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Quality Management Plan

Revision 1

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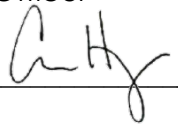
Signature  Date 11/23/2022

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LIST OF ACRYONYMS

CLP	Contract Laboratory Program
COC	Chain-of-custody
CQAP	Construction Quality Assurance Plan
DQA	Data Quality Assessment
DQO	Data Quality Objective
EDD	Electronic Data Deliverables
FSP	Field Sampling Plan
HASP	Health and Safety Plan
IFB	invitation for bid
OSHA	Occupational Safety and Health Administration
PMP	Project Management Plan
QA	quality assurance
QA/QC	quality assurance and quality control
QAC	Quality Assurance Coordinator
QAO	Quality Assurance Officer
QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan
QC	quality control
RFP	request for proposal
RFQ	request for quotation
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SOW	Scope of Work
U.S. EPA	United States Environmental Protection Agency

1.0 INTRODUCTION

The objective of this Quality Management Plan (QMP) is to ensure that all environmental data, findings, and associated documentation prepared for a work assignment in any Verdantas, LLC (Verdantas) office are scientifically valid, defensible, and of known and adequate precision and accuracy. Verdantas' quality management system has been developed for the following purposes:

- To demonstrate the ability of consistently providing products that meet client and applicable statutory and regulatory requirements, and
- To enhance client satisfaction through the effective application of the system, including processes for continual improvement and the assurance of conformity to client, applicable statutory and regulatory requirements.

The Verdantas quality management system uses an approach that emphasizes the importance of the following:

- Understanding and meeting requirements,
- The need to consider processes in terms of added value,
- Obtaining results of process performance and effectiveness, and
- Continual improvement of processes based on objective measurement.

With these purposes and approach as a foundation, Verdantas has developed a "multi-tiered" quality management program that uses corporate guidelines and protocol as an "umbrella" for defining project-specific components.

The QMP was prepared in accordance with U.S. EPA Requirements for Quality Management Plans (QA/R-2), (U.S. EPA/240/B-01/002, March 2001). Verdantas will also adhere to U.S. EPA principles when updating the Quality Assurance Project Plans (QAPPs), as stipulated in U.S. EPA Guidance for Quality Assurance Project Plans (QA/G-5, U.S. EPA 2002) and U.S. EPA Requirement for Quality Assurance Project Plans (QA/R-5, U.S. EPA 2001, reissued in May 2006).

This QMP addresses the application of quality assurance and quality control (QA/QC) procedures to all aspects of work processes, products, and services provided by Verdantas. This QMP presents Verdantas' structured and documented management system describing our:

- Quality assurance (QA) Policy,
- QA Program Organization,
- QA/QC Staff Authority and Responsibilities,

- QA Staff Background and Experience, and
- QA/QC Policies, Procedures, and Tools.

The QMP is organized into the following major sections (per EPA QA/R2):

- Management and Organization
- Quality System Description
- Personnel Qualifications and Training
- Procurement of Items and Services
- Documents and Records
- Computer Hardware and Software
- Planning
- Implementation of the Work Process
- Assessment and Response
- Quality Improvement

2.0 MANAGEMENT AND ORGANIZATION

This section documents the overall policy, scope, applicability, and management responsibilities of the Verdantas' quality management system, developed to:

- Demonstrate the ability of consistently providing products that meet client and applicable statutory and regulatory requirements; and
- Enhance client satisfaction through the effective application of the system, including processes for continual improvement and the assurance of conformity to client, applicable statutory and regulatory requirements.

The program depends on the performance of every employee and the oversight of several key staff. The QA Program for Verdantas is actively managed by key senior-level staff. This section of the QMP describes the management and organization of the QA Program.

2.1 Quality Assurance Policy Statement

Verdantas management is committed to the principles and practices of its QA Program at the highest level. Senior management recognizes and accepts its responsibility to identify the quality requirements that will meet client needs and expectations and create the business and professional environment where all employees take responsibility for the quality of their work. Verdantas' QA Program focuses on preventing quality problems.

Verdantas views QA as a management discipline that begins with effective work planning in close conjunction with the client and culminates with a carefully constructed set of checks and balances designed to ensure that uncertainty has been reduced to the lowest practicable level. Although it consists of requirements and procedures, Verdantas' QA is regarded as a discipline for which the end result is validated, verifiable, and well-documented information.

Verdantas is committed to delivering excellent services that exceed client expectations through quality work products, operational efficiency and accountability. Quality is a key element for Verdantas' success and is essential for creating a safe work environment, building a great internal and external reputation, gaining repeat business, attracting new clients, and managing business risks.

2.2 QA/QC Program Principles

Verdantas' QA/QC Program establishes minimum quality standards for performance and procedures for assuring that our clients receive quality service and requires the engagement of employees at every level. It encourages Project Managers and technical staff to take pride in their work and responsibility for ensuring that the work is

done correctly the first time. The program is designed to reduce the incidence of problems related to quality and result in implementation of corrective actions and modification of work procedures, where necessary, to reduce the incidence of future problems.

Through our experience in environmental consulting, data gathering, and monitoring activities, Verdantas is aware of the necessity to institute programs to ensure the integrity and defensibility of technical data. Consistent with the goals of the QA policies of U.S. EPA and other organizations, the goal of the QA Program is to ensure that all environmental data obtained for clients will be scientifically valid, defensible, and of known quality. This goal can be attained by including QA plans and resources as part of the initial planning for data collection or analysis tasks and incorporating specified QA procedures into the entire work process (from initial studies through data collection, evaluation, and application). Thus, the Verdantas QA Program includes the following objectives:

- Establish project and QA goals at the onset of work planning and implementation in close coordination with the client so that quality standards of the client and relevant regulatory agencies are met;
- Act as a "bridging document" between Verdantas' QA Program, procedures and guidelines, standard operating procedures (SOPs), and project quality control (QC) procedures;
- Develop and implement QA/QC activities at the onset of each work assignment effort;
- Implement QA/QC activities at pre-selected milestones throughout the life of the project;
- Ensure that technical work products generated for each work assignment are complete, accurate, and delivered on time; suitable for their intended purpose; and comply with all appropriate professional standards;
- Ensure that any analytical data generated over the course of a work assignment are of a quality and quantity suitable for sound statistical treatment and scientific analysis and can withstand close regulatory and legal scrutiny;
- Ensure that all appropriate technical and procedural standards are followed for calculations, drawings, or specifications for all preliminary, conceptual, or detailed design activities;
- Ensure that all QA/QC procedures are systematically re-evaluated over the course of a work assignment, so that deficiencies are identified and resolved in a timely manner; and
- Ensure that QA/QC review processes are well documented and distributed to appropriate internal parties so that QA "lessons learned" may be translated into future work assignments.

Verdantas' QA Program is continuous quality improvement, and advocates systematic planning, implementing, assessing, and correcting in an iterative process that results in a net long-term improvement. Continuous implementation of activities designed to achieve this principle results in higher value to our clients over time.

2.3 Quality Assurance Program Components

Verdantas' QA Program consists of the following related components:

- Assignment of Responsibilities - Designates personnel with the responsibility and authority to implement the QA Program. Roles and authorities are clearly defined. All staff levels have responsibilities under the program.
- Training and Development - Quality awareness seminars are part of the Verdantas employee training program. Topics covered include project planning, QC procedures, client relationships, liability issues, and loss prevention. In addition, training on the fundamentals of project management/loss prevention is available to Project Managers.
- Written Policies and Guidance - Maintains written guidance including procedures for many commonly performed work activities. These documents serve to assist Project Managers and staff to provide a quality of service that meets or exceeds the standard of practice.
- QC Review - Projects are assigned a QC reviewer responsible for assuring that project processes and documents have been properly reviewed by qualified professionals. Problems are communicated to the Project Manager and corrected.
- QA Audits - Projects are subject to unannounced audits to assure project procedures, including QC review, are followed at all times.
- Work Process Analysis - Where a need for improvement is identified, staff will analyze the problem and develop ways to improve management and project systems. Efforts to simplify work processes, while maintaining high quality standards, are ongoing.
- Change Management - Recommended quality improvement measures identified by work process analysis are communicated to the staff.

2.4 Quality Assurance Staff Organization and Responsibilities

Verdantas' QA Program consists both of dedicated quality system staff, as well as program and work assignment staff and functional groups that produce deliverables and generate data.

Verdantas' quality system stresses that quality is everyone's responsibility. Our dedicated quality system staff work alongside, although independently, of the program and project

staff. Verdantas recognizes the value of having its employees at all levels participate in the QA Program. Opportunities are continuously sought for encouraging employees to improve the quality of their work. Verdantas' Area Leaders encourage participative management by soliciting input from Project Managers and staff before issuing company policies and procedures.

2.4.1 Area Leader

The Area Leader is ultimately responsible for all quality-related functions. The Area Leader's QA responsibilities are to:

- Authorize the issuance of the QA Policy;
- Direct the implementation of QA objectives, plans, and policies;
- Approve the issuance of this QMP;
- Appoint the Quality Assurance Officer (QAO) who directs the QA Program; and
- Approve the QA implementation strategy.

2.4.2 Quality Assurance Officer (QAO)

The QAO manages the QA Program and is responsible for the technical quality of all work products Verdantas and the development and maintenance of a sufficient level of technical resources to support the company's quality objectives. The QAO has the training necessary to carry out the duties listed below. The QAO reports to the COO. The QAO's primary duties are to:

- Manages the overall performance of the quality program;
- Provide a central point of responsibility for assessing company-wide technical strengths, needs and direction in order to maintain a consistent company-wide quality of work that meets or exceeds the current standard of practice;
- Develop the QA Policy and QMP and subsequent revisions;
- Coordinate QA training;
- Provide guidance to the QC Reviewers in carrying out QC-related functions;
- Inform project personnel of QA policies, procedures, and other guidance documents;
- Schedule and/or conduct quality awareness seminars;
- Assist in preparation of QAPPs or review QAPPs as requested by Project Managers;

- Participates in performance evaluation studies;
- Audit selected projects and monitor general compliance with the QA Policy;
- Advise Project Managers of deficiencies based on peer reviews or audits and identify corrective action needs. Review the effectiveness of the QA Program with the Area Leader;
- Resolve disputes or inconsistencies that result from or are identified by audits/assessments;
- Maintain QA files, including any audit and QA Program progress reports; and
- Halt the transmittal of any work product that in his or her opinion is not consistent with Verdantas' quality or loss prevention standards.

2.4.3 Laboratory QA Manager

The Laboratory QA Manager is responsible for the chemical analytical laboratory QA. The Laboratory QA Manager will be responsible for assisting in day-to-day QA activities and coordination of subcontract laboratory analysis. The Laboratory QA Manager will be responsible for approving the corrective action measures taken in the event an activity is found to be deficient and ensuring that all appropriate data is evaluated.

The Laboratory QA Manager will work with the Project Manager who is responsible for uploading laboratory reports and Electronic Data Deliverables (EDD) for the laboratory to Verdantas' analytical database. The Project Manager is responsible for verifying the results reported in the laboratory report are the sample as those provided in the EDD prior to uploading the EDD to the database.

2.4.4 Project Manager

The Project Manager has overall responsibility for the project, including client liaison, planning document preparation, technical quality of work performed, data acquisition, report preparation, and presentations, as well as budget and schedule management. The Project Manager is also responsible for determining that staff assigned to the project understand and comply with the QC procedures that apply to their activities. The Project Manager's QA-related responsibilities are as follows:

- Review and approve project controlling documents, including QAPPs, Work Plans, Sampling Plans, SOPs, and contract documents;
- Select additional technical reviewers with the project QC Reviewer, if needed;
- Communicate project scope requirements to team members;

- Communicate with the client for feedback on service satisfaction;
- Ensure that project deliverables and activities are in accordance with project controlling documents;
- Respond to corrective action requests and assure that deficiencies are corrected in a timely manner; and
- Communicate with the project QC Reviewer on quality issues.

2.4.5 Task Manager

A Task Manager is a professional responsible for a particular project task. The Task Manager's responsibilities are to:

- Prepare project technical memoranda for the project task(s);
- Oversee data collection and analysis and determine that appropriate procedures are employed;
- Prepare reports or report sections related to the project task(s);
- Ensure that all task deliverables are in accordance with project controlling documents;
- Correct deficiencies and nonconformities identified for the project task(s);
- Participate in performance evaluation studies and audits;
- Keep the Project Manager and QC Reviewer informed of project requirements and changes in requirements; and
- Coordinate technical review requirements with the Project Manager and QC Reviewer.

2.4.6 QA/QC Staff

The QA/QC Staff consists of employees who are responsible for monitoring day-today implementation of the QA Program and are authorized to ensure that the requirements of the QA Program are implemented and maintained in accordance with project requirements and with Verdantas' corporate policies and procedures. The QA/QC Staff carry out the important functions of QC checks and QA audits. The staff includes, but is not limited to Technical Staff, QC Reviewers, and the QAO. The QA/QC Staff report up through the Area Leaders.

QA/QC Staff are selected and appointed by the QAO and the Project Manager, as needed, for work assignments involving such elements as field sampling, laboratory analysis, and data processing. The QA/QC staff have sufficient technical background to understand the tasks to be done, as described in the QAPP and SOPs, and to be able to reliably perform the checks required. Specific responsibilities include:

- Provide oversight and ensure that work is conducted according to plan, that measurements are taken properly, and that samples are analyzed, data are entered, calculations are performed, and software or models operate correctly;
- Participate in performance evaluation studies and audits; and
- Provide written and signed documentation that the work or information has been checked, as directed by the QAO.

The Project Manager or, in the case of large and/or multi-disciplinary projects, the appropriate Practice Leader, is responsible for coordinating QA/QC assignments. At a minimum, a QC Reviewer is assigned to each project. In lieu of a formal determination by the Project Manager, the Department Leader assumes the role of QC Reviewer. The QC Reviewer reports to the Project Manager, but also maintains a direct communication link and reporting relationship with the QAO on quality-related matters. QC Reviewers provide peer review oversight on the content of work products, usually after the work has been done. These reviews might include internal or outside peer reviews of document, validation of data, verification of the operation of software, final evaluation of documents and deliverables, or other verification of product quality. Specific responsibilities of QC Reviewers include the following:

- Ensure that material used in or provided for a product is correct, consistent, and complete and meets the objectives of the client;
- Participate in QC by checking the quality of the product or service against the predetermined standard for quality required by the client, including determining whether data are entered correctly, calculations have been performed correctly, software or models operate correctly, samples have been analyzed correctly, and that facts are correctly stated and issues discussed appropriately for the specific scientific, engineering, or policy topic under consideration;
- Participate in additional reviews and audits to ensure that the product or service meets or exceeds the client's specifications, including final evaluation of documents and deliverables to ensure that all revisions have been addressed or incorporated or to otherwise verify product quality; and
- Provide written and signed documentation that the information has been checked.

Project Management Assistants or Administrative Technical staff oversee production of written materials, particularly regarding format, correct usage, and style. They ensure that authors follow the project style guide and comply with client format requirements. They work closely with the Task Manager. Specific responsibilities include the following:

- Develop and implement procedures for the flow of work products through various phases of technical and editorial review;

- Ensure that various iterations of any deliverable submitted for editing are properly edited and that all editorial corrections are incorporated to improve readability and clarity; and
- Perform quality checks of deliverables to ensure that appropriate style and format guidelines are being followed consistently, that grammar and spelling are correct, and that consistency of products is maintained through checks of the written material against predetermined requirements for format, style, and usage.

2.4.7 Work Assignment Staff

All Work Assignment Staff are responsible for complying with the QMP, work plans, QAPPs, SOPs, and other guidance provided to produce quality materials for the work assignment. Specific responsibilities of the Work Assignment Staff include the following:

- Perform high-quality work, to the best of their abilities, and seeking additional help as needed to make sure that materials prepared are accurate and complete; and
- Maintain complete, legible, permanent, and defensible records documenting all work performed.

2.5 Subcontractor Management

Requirements to ensure adequate quality of subcontractor products or services are included or referenced in Verdantas' procurement documents; these include bid requests, purchase orders, and contracts. Changes to a procurement document are subject to the degree of control used in preparing the original document. Procurement documents state applicable requirements for technical performance, quality, acceptability, and documentation, as follows:

- General requirements (scope of work);
- Appropriate codes and standards; material composition, or physical/chemical requirements;
- Quantity and scheduling requirements;
- Work procedures;
- Testing and calibration requirements;
- Performance and accept/reject criteria; and
- Reporting requirements.

2.6 Quality System Activities

Two basic types of QA programs are developed and implemented by Verdantas:

- Project-specific QA programs required by contract and regulatory statues that are required to meet specific standards; and

- Project or Program-specific QA programs required by the client and developed based on accepted QA principles and practices, but not necessarily driven by formal standards (generally developed for major programs and projects).

In some cases, a combination of the above types of programs may be used to meet client needs. For example, a QA program may be developed using an institute or government standard plus client-specific QA requirements. Project-specific QA programs will be developed by project staff using institutional standards or programs developed specifically for the project. As determined by project management, the application of QA requirements and the degree with which they are applied will be tailored to each project or activity. In the planning stages of each project, project management, assisted by the QA staff, will perform a quality evaluation to establish potential risk and the necessary quality program required for all aspects of the project. Based on the evaluation, QA plans will be prepared, tailoring the applicable QA program requirements to that project.

2.7 Assurance of Quality System Implementation

Senior and project management personnel will implement a system of planned and documented audits and/or assessment to verify whether quality activities comply with planned arrangements and to determine the effectiveness of the quality system. The level and extent of this audit and assessment program will be based on the complexity and risk of the system, activity, or project involved. In addition:

- The audit and assessment program will be scheduled on the basis of the status and importance of the activity.
- Audits and follow-up actions will be carried out in accordance with documented procedures.
- The results of audits and assessments will be documented and brought to the attention of personnel having responsibility in the area audited.
- Responsible management personnel will take timely corrective action to noted deficiencies and/or adverse quality conditions.

Verdantas senior and project management personnel will also periodically review the company and project quality systems at appropriate intervals to ensure their continuing suitability and effectiveness.

3.0 QUALITY SYSTEM COMPONENTS

The purpose of this section is to document how Verdantas manages its quality system and defines the primary responsibilities for managing and implementing each component of the system. A quality system is a management system that specifies the level of quality to be achieved; personnel responsibilities; and the procedures, activities, and tools needed to plan, implement, and assess the quality of products prepared and services provided by an organization to ensure that this level of quality is attained. The QAO prepares the design of the overall quality system to cover work performed under the project, oversees the preparation of the QMP that explains that system, and updates the QMP when reviews of the system indicate that changes are necessary. This section provides a brief overview of the quality system and the protocols. Additional details are given in later sections of the QMP, as indicated.

3.1 Quality System Description

3.1.1 Quality Management Plan

The QMP describes the overall QA policies and procedures that Verdantas follows. Following approval by the Area Leader and the QAO, the QMP is distributed to work assignment staff and subcontractors. The QMP will not be revised simply to reflect changes in QA personnel, but it may be revised as a result of any of the following circumstances:

- Changes suggested following management system review;
- Changes in the procedures as a result of the implementation of corrective actions; and
- Feedback received from client and regulators regarding the quality of any aspect of Verdantas' performance.

Verdantas solicits feedback from the client and regulators regarding responsiveness, presentation of deliverables, and general level of satisfaction with our performance. Verdantas responds to this feedback by implementing quality improvements and incorporating changes, as necessary, into the QMP. Verdantas considers the QMP to be a "living" document that will be continually improved to ensure the highest quality performance.

3.1.2 Project Management Plan (PMP)

A PMP is written to clarify the objective(s), task(s), schedule, staffing requirements, and to inform the staff of the requirements for the project. The PMP also addresses administrative procedures, format and content of the deliverable(s), resources and contacts, and, if subcontractors are involved, their roles and responsibilities. The PMP incorporates by reference the current QMP, as well as any additional QA/QC procedures and instructions specific to the project. Site-specific QA procedures are included as part of the PMP. Additional information regarding the PMP is presented in Section 8.1.1.

3.1.3 Data Quality Objectives (DQO) Process

For those work assignments that require the collection and analysis of monitoring data, an important part of the QA effort is the establishment of DQOs. DQOs are specific, integrated statements and goals developed for each data or information collection activity to ensure that the data, once collected, are of the required type, quality, and quantity and that they meet the intended uses for a particular work assignment. DQOs are discussed in detail in Section 8.1.2. They are also incorporated into the project specific QAPP.

3.1.4 Quality Assurance Project Plan

A QAPP is a written document that describes specific procedures and responsibilities needed to accomplish the data collection goals of the work assignment. A QAPP is developed and approved for each work assignment that requires collection of field or other data or analyses of environmental monitoring samples or data, when specified by the U.S. EPA. The QAPP is implemented to ensure that data collected and analytical data generated are complete, accurate, and suitable for the intended purpose. The associated Sampling and Analysis Plan (SAP) describes specific samples to be collected, sampling procedures, shipping requirements, and analyses to be conducted. A separate health and safety plan (HASP) ensures that collection of field samples by Verdantas complies with all applicable Occupational Safety and Health Administration (OSHA) standards and the Verdantas health and safety policies.

3.1.5 Standard Operating Procedure

An SOP is a written document that explains how particular activities must be conducted; for example, field or laboratory data collection operations, operation and maintenance of equipment, calibration of instruments, analysis of environmental samples, analysis of data, tracking of samples, record keeping, and other activities. The document describes the step-by-step procedure for the activity so that it can be repeated consistently through time, thus minimizing problems. Routine SOPs are referenced in the QAPP.

3.2 Quality System Implementation Tools

3.2.1 Formal Peer Review

Formal Peer Review is to be incorporated into the planning process for all major scientific or technical work products. Formal Peer Review involves in-depth assessment of the assumptions, calculations, interpretations, methodology, acceptances criteria and conclusions pertaining to the major scientific or technical work product and its supporting documentation. Verdantas' Senior Review Policy provides an overview of the peer review program including who has senior review privileges, their responsibilities, and further guidance on the review process.

3.2.2 Technical Editorial Review

A technical review is a documented critical review of a work product that is performed by a technically qualified QC Reviewer. It is conducted to provide technical verification, validation, or confirmation of the information or results presented in the work product. Work assignment deliverables are reviewed to ensure that the products meet or exceed professional technical standards and the client's expectations. A QC Reviewer is not expected to review the work of all scientific and engineering disciplines but is responsible for certifying that the proper technical reviews have been performed. Appropriate registrations should be held by individuals signing reports or stamping/sealing drawings. Deliverables produced by subcontractors receive comparable levels of review by the Project Manager. The review process and QC procedures are detailed in Section 10.4.1.

All Verdantas work products are required to undergo QC review. Each QC review should address:

- Project scope and objectives;
- Report outline;
- Data collection rationale;
- Data collection methods;
- Factual conclusions/findings;
- Opinions and recommendations;
- Technical reviews and professional registrations;
- Standard of practice; and
- The client's perspective.

Although these review elements were developed for report review, many also apply to other Verdantas work products. A Quality Control Review Checklist is designed to facilitate the QC review process. QC reviews of design engineering documents should follow the general approach described in Section 4.

3.2.3 Data Quality Assessment (DQA)

A DQA is a scientific and statistical evaluation of data to determine whether the data obtained from environmental data operations are of the right type, quality, and quantity to support the intended use of data, as specified during the planning phase using the DQO process. This process can be an iterative one. The assessment includes the validation and verification of data to ensure that sampling and analysis protocols described in the QAPP were followed, that measurement systems were performed in accordance with the criteria specified in the QAPP, and that quality of data is satisfactory for its intended use.

3.2.4 Audit

An audit is an evaluation of the implementation process in relation to the planning of that process. For example, a technical system audit is a qualitative assessment of a data collection activity or measurement system, or process to confirm that it is occurring as specified in the QAPP. A performance audit is a qualitative evaluation of the procedures by which work plans, QAPPs, or deliverables are prepared, reviewed, and approved for submittal as specified in the QMP to verify that the appropriate plans have been prepared, reviewed, and approved by responsible personnel, and that the work products have been reviewed and approved as required. An audit is conducted to identify and document problems affecting quality and to propose recommendations for quality improvement, as needed. An audit may be a self-assessment (performed by someone in Verdantas' offices) or an independent assessment (performed by someone outside Verdantas' offices).

Audits may be performed by the QAO or senior technical staff designee with training in performing project audits. Typical steps in an audit include:

- Notify the Project Manager of the intent to perform an audit as well as the objective and scope of the audit;
- Audit work processes;
- Review project files and deliverables;
- Interview the Project Manager and other key technical staff;
- Prepare a draft audit report for the Project Manager;
- Debrief the Project Manager and Area Leader; and

- Finalize the audit report with input from the Project Manager and Area Leader.

3.3 Quality Management Plan Development

The QAO has overall responsibility for coordinating QA-related services within Verdantas to assure QA resources are adequate for specific programs and projects.

QAO, senior and technical staff, and specialists develop quality systems and procedures for integration into project QA, management, or execution plans. These systems are assigned for review and approval in accordance with the staff roles and responsibilities described in Section 2.4. Once these systems and procedures are approved, QA personnel maintain the system by performing QA functions. These include verifying and attesting to the adequacy of design, engineering, procurement, and construction for conformance with requirements, including maintaining construction project QA/QC plans and procedures.

4.0 PERSONNEL QUALIFICATIONS AND TRAINING

The purpose of this section is to document the procedures for assuring that all personnel performing work for an organization have the necessary skills to effectively accomplish their work. Verdantas selects and utilizes the services of appropriately qualified technical personnel to ensure that the highest standards of quality control are maintained for each work assignment, and that technical problems are adequately identified and resolved. The Project Manager is ultimately responsible for selecting staff with the qualifications to meet the diverse needs of the organization's clients.

4.1 Personnel Qualifications

Appropriately qualified personnel from within Verdantas or subcontractors or consultants are used to ensure high-quality products for each work assignment. For each project, the Project Manager works closely with staff supervisors and/or management to ensure that personnel are qualified and have the skills to perform their job functions and that they meet the professional standards of their disciplines.

If project requirements, regulations, or Verdantas policies require specific certifications and special training for certain types of work, the Project Manager and/or Task Managers are responsible for identifying such requirements for each work assignment.

4.2 Training Policy and Programs

Comprehensive and diverse training improves technical performance and client satisfaction, as well as assisting an employee's professional growth and career development and increasing overall employee satisfaction. A variety of training programs and educational opportunities are available within Verdantas to strengthen technical expertise, to enable employees to better manage their current responsibilities, and to prepare employees to assume additional responsibilities.

Verdantas Department and Area Leaders are responsible for evaluating positions, determining the need for training or certification, and ensuring that staff performing work are trained and qualified based on project-specific requirements prior to the start of the work or activity. In addition to maintaining accurate staff training records, managers document suggested or required minimum training needs by creating a separate document recording such information. Each Practice Area implements training specific to the practice and coordinates requests for training. Cross-training is encouraged between Practice Areas. Records of internal and external training are maintained by the Practice Area Leader (in a central location on the company intranet).

Quality awareness training is conducted every two years, or as needed, and the training is required for all staff who manage environmental data. Other staff are encouraged to attend the training as well. The QAO maintains and tracks (in a central location on the company intranet), a list of individuals who have attended training. Staff training is also documented within each individual personnel file. Staff that are responsible for developing, implementing, and using quality systems documents are identified by the QAO. Training may be conducted by the QAO or designee or obtained from external sources. The effectiveness of training is assessed initially through evaluations completed after training is conducted. Comments are evaluated and discussed for further action on the part of the quality systems team at the department level. If training programs are deemed incomplete or unacceptable, additional program specific training may be developed and implemented. Annual system audits may be conducted that also allow for identification of program weaknesses and strengths in QA.

Effectiveness of training for the individual employee is assessed during the performance evaluation process by the employee's supervisor. Each employee is evaluated through an annual performance evaluation and during normal one-to-one discussions. Additional training or retraining may be identified during the evaluation process. Each department maintains documentation of its employees' training. Personnel are also encouraged to seek out training opportunities offered from outside sources.

4.2.1 Internal Programs

- Quality Awareness Seminars: Seminars and informal presentations on the scope and implementation of Verdantas' QA Program and other quality management topics.
- Health and Safety Training: Training required to meet federal statutes for employees performing work under specific conditions.
- Project Management Training: Training workshops, focused seminars, and continuing education for Verdantas' Project Managers.
- Loss Prevention Training: Seminars and training workshops for all Verdantas staff.
- Technical Training: On-the-job training for specific job responsibilities, seminars on specific technical subjects, workshops focused on specific service areas, training on standard operating procedures.
- Supervisor Training: Training workshops and continuing education for all Verdantas' managers.

Internal training sessions are performed by designated qualified personnel and subject matter experts.

4.2.2 External Programs

- Continuing Education: Funding of college level course work.
- Seminars/Short Courses: Selectively funded by Verdantas for individuals requiring or desiring specific technical training through a non-degreed program.
- Publications: Verdantas encourages its staff to publish articles in peer-reviewed journals and trade magazines and to prepare and present technical papers at technical conferences.
- Membership in Professional Societies/Organizations: Verdantas encourages membership in relevant professional societies and provides professional fees for membership.
- Professional Licenses: Verdantas pays for professional licenses for individuals based on the requirements of our clients, projects, or the states within which we operate.
- Vector Solutions: External training and learning management system with a curated library available for employee development.

The Project Manager is responsible for ensuring that personnel on the project have appropriate training and coaching, as needed, to meet the requirements for the preparation of high-quality materials for every work assignment. Training sessions specific to the project and its requirements are provided to personnel involved in the project to familiarize them with project and work assignment requirements, procedures for preparation, and review and approval of work plans, QAPPs, and SOPs. This applies as well to any other documents needed for work assignments and QA/QC procedures required prior to commencement of work.

4.3 Certifications

Verdantas encourages staff to obtain certifications and actively seeks to hire certified individuals for specific job duties. In addition to professional certification, all personnel involved in projects that require data collection and data assessment are trained and familiar with the QAPP and SOPs. All employees must pass the minimum requirements to perform QA procedures and know how to use all instrumentation needed to collect and analyze data. Verdantas retains a variety of certified professional staff including, but not limited to: Licensed Environmental Professionals, Professional Engineers, Registered Geologists, and Registered Land Surveyors.

Regulatory mandates and the standards of professional associations may dictate specific certifications for employees.

5.0 PROCUREMENT OF ITEMS AND SERVICES

The purpose of this section is to document the procedures for purchased items and services that directly affect the quality of environmental programs.

5.1 Procurement of Equipment, Supplies, and Services

All items and services procured by Verdantas that are used in the generation of environmental data must meet the requirements of this QMP. To accomplish this goal, the Project Manager and other designated personnel shall ensure that:

- Technical specifications for the procurement of an item or service includes specifications that ensure acceptable quality in the item or service;
- The process of selecting a supplier includes an assessment of the supplier's quality system and the supplier's ability to supply items or services that meet quality specifications;
- Items and services provided by a supplier may be evaluated to determine compliance with quality specifications prior to use by the department's programs; and
- Programs may conduct appropriate audits of the supplier's quality systems as part of project implementation and work with that supplier to correct identified problems as soon as possible.

5.2 Specifications for Items and Services

Requirements to ensure adequate quality of subcontractor products or services are included or referenced in Verdantas' procurement documents; these include bid requests, purchase orders, and contracts. Changes to a procurement document are subject to the degree of control used in preparing the original document. Procurement documents should state applicable requirements for technical performance, quality, acceptability, and documentation, as follows:

- Technical Performance;
- General requirements (scope of work);
- Appropriate codes and standards; material composition, or physical/chemical requirements;
- Quantity and scheduling requirements;
- Work procedures;
- Testing and calibration requirements;
- Performance and accept/reject criteria; and
- Reporting requirements.

Quality. Quality requirements that a subcontractor must satisfy depend on the purpose of the procurement, the degree of contractor independence, and client requirements. The right to stop work for significant quality problems should be clearly stated in all contract documents. The control of purchased items and services will include procurement source evaluation and selection and subcontractor performance control, including inspections and audits where appropriate.

Acceptability. Purchased items or services are controlled by invoking appropriate quality-related requirements and elements of this QMP. To verify acceptability, the procurement documents will provide for Verdantas access to subcontractor facilities, work areas, and records.

Documentation. The contract should specify Verdantas rights and procedures the subcontractor must follow for preparation, control, and retention of documentation. Subcontractor submittals of nonconformance, work progress, and results will be specified in the procurement documents.

Purchasing and subcontracting decisions are made by the Project Manager, Area Leader, or other designated personnel, in accordance with the Project Authority Matrix. All purchases and subcontracts are entered into on a competitive basis to the maximum extent possible. Under some programs, services may be procured directly by the client and Verdantas provides interface for conducting the work. Control over the procurement of purchased items and services shall be consistent with the subcontractor procurement procedures described below.

For each acquisition requirement identified, the Project Manager or designee selects the proper and most expedient solicitation vehicle to request bids or proposals from prospective subcontractors using a request for quotation (RFQ), a request for proposal (RFP), or an invitation for bid (IFB). The Project Manager and Task Manager define the specifications of each component to be subcontracted. The specifications, along with other task criteria, make up a Scope of Work (SOW) that addresses subcontractor performance objectives and deliverable requirements. A standard procurement package is prepared to establish the methodology and requirements of the solicitation, as well as the provisions of the resultant subcontract. The package contains a solicitation instrument (RFQ, RFP, or IFB), the SOW, general and special subcontract provisions and prime project flow-down requirements, instructions for proposal preparation, evaluation criteria, pricing/cost tables, and requirements for certifications and representations. If the supplier provides services or items that directly affect the quality of results or products from technical programs (e.g., environmental data operations, deliverable preparation),

the supplier is also required to submit evidence of a quality system consistent with Verdantas' requirements.

Once bids or proposals are received, the bid data is tabulated and then an evaluation is conducted by the Project Manager, Task Manager, and/or technical staff to assess technical content, price reasonableness, overall management capability, safety, and the quality management plan against criteria set forth in the solicitation. The goals of evaluation criteria are objectivity, equitable treatment of bidders, and ease of evaluation. By applying the specified evaluation criteria, evaluators make recommendations to ensure that the award of the subcontract is made to the bidder whose proposed price and goods or services are deemed most beneficial to Verdantas and the client.

After selection, negotiation, and award of a suitable subcontract, the Project Manager or Task Manager is responsible for overseeing the subcontractor's performance, ensuring compliance with the SOW, and performing QC reviews of delivered goods and services.

5.3 Maintenance of Equipment and Supplies

Verdantas is responsible for inventory and maintenance of all equipment and supplies provided, either directly or indirectly. Inventories of supplies and disposable equipment provided or purchased for a specific project are maintained and replenished as needed to ensure that field and laboratory equipment are maintained according to the specific procedures provided by the manufacturer so that the required sensitivity, accuracy, completeness, representativeness, comparability, and precision are achieved.

For projects involving field and/or laboratory work, preventive maintenance procedures and schedules for laboratory and/or field equipment should be described in the QAPP. If maintenance procedures are simply referenced in the QAPP, the complete procedure should be readily available to the field or laboratory staff using the equipment.

Verdantas' IT Department is responsible for maintenance activities of computer resources and programs and associated repairs. All computer users have been instructed on the importance of routinely archiving work assignment data files from hard drive to backup storage devices. Verdantas relies on cloud storage, which is continually backed up. Screening for viruses on electronic files loaded on microcomputers or the network is standard company policy. Automated screening systems are placed on our computer systems to ensure that viruses are identified and destroyed promptly.

5.4 Laboratory Services

Verdantas procedures for procuring chemical analytical laboratory services that might be needed under a particular project follow the basic requirements of the purchasing system, as outlined above. Requirements for field and laboratory investigations, evaluations, and analyses are described in detail in the project QAPP.

The Project Manager and/or Task Manager determine the best method for procuring the necessary analytical services, depending on the amount of lead time available. For some projects, the laboratory may be preselected during the proposal stage or may be procured directly by the client. The formal subcontract agreement with the laboratory specifies technical requirements, including QC measures, schedules for deliverables and reporting frequency, appropriate cost limitations, and appropriate formats for submitting analytical results. The laboratory is expected to conform to this QMP with respect to procedures for QA /QC, health and safety, and documentation. The laboratory revises any QA/QC procedures or documentation and SOPs that the Laboratory QA Manager deems inadequate. The laboratory designates a Technical Contact who is responsible for reporting any problems, anticipated delays, or overruns to the Project Manager and/or the Task Manager as soon as the potential concern is recognized.

The laboratory provides appropriate sampling containers and shipping materials. Verdantas or other staff collect the samples as specified in the QAPP, contact the laboratory, and ship the samples to the laboratory for analysis. Upon receipt of the samples, the laboratory handles, stores, and analyzes the samples. Data reports are not considered acceptable, and invoices are not approved for payment until the Project Manager and/or Task Manager have received and reviewed the final results for completeness and technical quality. The data package is sent to the Project Manager, Task Manager, and the Laboratory QA Manager. After appropriate data review/validation, as stated in the project QAPP, the data is distributed as specified in the work plan and/or the QAPP.

6.0 DOCUMENTS AND RECORDS

The purpose of this section is to document appropriate controls for quality-related documents and records determined to be important to the mission of the organization. Verdantas maintains a system and procedures for preparation, review, approval, and management of quality system and technical guidance documents. In addition, if needed, an information tracking system is used to organize documents and data obtained from various sources that might be used in the preparation of specific work assignments. The QAO is responsible for developing and maintaining quality system documents and works with the Project Manager to ensure that pertinent documentation and records are prepared and maintained for each work assignment. Also, the QAO ensures that QA/QC documentation and records for each work assignment and the project are prepared and filed appropriately.

6.1 Document Identification and Control

Documents and records that might require special handling are those pertaining to the quality system and those obtained or generated to support work assignments. Examples of such documents include, but are not limited to, QMPs, work plans, QAPPs, SOPs, technical guidance memoranda, and technical reports. Examples of such records include, but are not limited to, review forms, audit reports, and corrective action requests. The QAO maintains files for all quality system documents for the Project. Document control responsibilities of the QAO include the following:

- Distributing quality system documents and record forms to the Project Manager, Task Manager, and other designated staff;
- Maintaining a list of personnel who receive controlled documents, so that distribution of updated documents or portions thereof can be quickly accomplished;
- Notifying all project staff of changes or updates in these documents, ensuring that the latest version of the document is used; and
- Maintaining files for all quality system records under the project to prevent damage and deterioration, while providing access by authorized personnel.

The Project Manager and/or Task Manager is responsible for incorporating record-keeping practices as part of the work assignment. The Task Manager working with the Project Manager maintains a filing system for all incoming documentation, which includes all documents and deliverables generated as part of the work assignment (e.g., work plans, records of work assignment activities and staff meetings, completion reports, monthly reports, technical reports, and all correspondence). The Task Manager is also

responsible for collecting and compiling reference documents and other literature and materials that might be used in the preparation of a deliverable.

6.2 Work Process Control

Quality system documents and records are prepared and reviewed as specified in the QMP or according to appropriate SOPs or other guidance to ensure consistency in type, format, and content. The QAO is responsible for ensuring that these materials are prepared and revised according to specifications. They are reviewed and approved by authorized personnel, including the Project Manager and QAO, and submitted for approval by the client as required by the project. The QAO prepares and revises the QMP, as appropriate, which is reviewed and approved by the Area Leader and Project Manager. The Project Manager and Task Managers prepare and revise, as needed, work plans, QAPPs, and SOPs. These documents are reviewed and approved by the QAO. The Laboratory QA Manager also reviews the QAPP. The QAO ensures that quality system documents are approved by the appropriate personnel before they are used and that completed record forms have been signed and dated by authorized personnel before they are filed.

6.3 Documentation

Verdantas senior and project management personnel will establish and implement a system to control the preparation, review, approval, issuance, use, and revision of documents. The documents involved are those that establish policies, prescribe work, specify requirements, or establish design (e.g., drawings, specifications, calculations, computer codes, procurement documents, vendor supplied documents, procedures, plans, and instructions). All project data are organized using a consistent directory structure that is job specific. The directory structure is standardized and set up on the network by the Administrative Team. All electronic correspondence, reports, spreadsheets, and drawings are identified and catalogued using a standardized File Naming Structure.

Revisions to controlled documents will be reviewed and approved by the group that originally reviewed and approved them. Controlled documents will be distributed to and used by personnel performing work. New or revised controlled documents will be reviewed, approved, and distributed in a timely manner consistent with the project schedule.

Control of superseded and canceled documents will include measures to ensure that only correct documents are in use. Hard copies of record copies should be marked as superseded, canceled or void and kept for a specified retention period. Electronic copies of superseded documents should be moved into folders identifying the revision

number or moved to a folder that identifies the documents in the folder as having been superseded, cancelled, or void.

A document is considered a completed record when it has finished full processing and is logged into the project document log. Completed project records should be maintained in a secure location to facilitate retrievability and provide protection from deterioration. Documents to be controlled include those documents and/or computer-generated records that specify project requirements such as:

- Proposals;
- Contracts and subcontracts;
- Purchase orders;
- Cost estimates;
- Work plans, instructions and procedures;
- Calculations;
- Data quality standards;
- Technical reports;
- Drawings and specifications;
- Inspection and test reports;
- Correspondence; and
- Invoices and related backup.

The Project Manager and Task Manager are responsible for project document control. This responsibility includes establishing a records management system to control both printed paper copies and documents and data stored in electronic media. The records management system should address procedures and responsibilities for the preparation, review and approval, collection, custody and control, indexing, fling, distribution, safe storage, maintenance, retrieval, and retention/destruction of company and project records. Written records management and document control procedures should also be furnished by Verdantas subconsultants, subcontractors, and vendors.

6.4 Document and Record Retention

All quality system documents and records are maintained for the life of the project either electronically or by paper copy. Quality system records are filed according to guidance provided by the Project Manager and QAO. Disposition of quality system documents and records is determined in accordance with Verdantas' records policy which also

incorporates all project requirements which should be detailed in the work plan and/or the QAPP.

To streamline audits under the project, the Project Manager, Task Manager, or QAO maintains quality control records either electronically or by paper copy. A signed review form or email providing review comments will be maintained to show that documents have been reviewed where review is required by the QMP.

The monthly progress report for the project will make reference to the review status of each deliverable. Task Managers are responsible for providing the information for this part of the monthly progress report to the Project Manager, as well as ensuring that subcontractors have submitted appropriate documentation of any reviews performed by subcontractors. Periodic assessments will be made to determine that appropriate forms have been completed and filed as indicated in the monthly progress report.

Disposition of quality system documents and records is determined in accordance with the Verdantas' records policy and client-specific project requirements. Disposition of library compilations or other controlled document collections is in accordance with requirements specified.

6.5 Chain of Custody (COC) Procedures

Chain-of-custody (COC) documentation is described in any SOP, work plan, and/or QAPP that is developed that involves sampling and data collection. This COC process is followed throughout the life of the data and/or sample, according to the quality document parameters. If the COC cycle is broken or improperly maintained, the samples may be discarded and/or flagged as compromised. Project-level personnel and Project Managers are responsible for following COC procedures and maintaining custody records that meet appropriate requirements. COC records are maintained in either print or electronic copies, stored in project files or electronic files. Laboratories verify COCs upon receipt and COCs are returned to Verdantas when samples are completely analyzed.

Verdantas' project management personnel will establish and implement processes to identify, control, and maintain items (such as consumables, items with limited shelf life, equipment, field samples, groundwater samples, and soil samples) to prevent the use of incorrect or defective items and to control samples.

7.0 COMPUTER HARDWARE AND SOFTWARE

The purpose of this section is to document how the organization will ensure that computer hardware and software satisfies the organization's requirements. Verdantas acquires and maintains state-of-the-art computer equipment to meet its internal needs, as well as those of its clients. We follow specific information management procedures for selecting or developing appropriate hardware and software for work assignments involving information management, traditional data and geospatial analysis, database management, mathematical modeling, literature search, graphic presentation, and document publishing. Verdantas' IT management and QAO are responsible for ensuring that specific requirements for quality of these products are met and that pertinent documentation for these items is maintained by appropriate staff, as needed, for the particular work assignment or project.

Verdantas maintains a variety of computing and communications systems to meet the client's needs for efficient and accurate data processing. These include comprehensive libraries of statistical analysis, graphics, database management, and data processing software applications for the personal computer and local/area wide networks as well as other applications including word processing, desktop publishing, spreadsheets, communications, and programming. Qualified staff have expertise in information management, statistics, systems development, and data transport and file transfers.

Our technical staff has extensive experience in the application, testing, and development of a wide variety of computer models pertinent to environmental problems and can access software available through the Internet. These capabilities ensure that the most appropriate software is used for the task at hand and that more options are available for final application of software and use of data. Software should be validated, verified, and documented considering its intended use. Where possible, Verdantas technical staff should use public domain software that has been qualified, peer-reviewed, validated, and verified. Documentation for the software used will be current. Where software that is not considered public domain is used, the source of the software will be specified and documented. Verdantas project personnel will validate and verify the software before its use on projects. Where Verdantas project personnel develop project-specific software, the code will be independently benchmarked, validated, and verified prior to use. In addition, documentation of the code will be available and maintained with the project file.

Verdantas adheres to the following general criteria regarding selection of computer-based tools:

- Performance must be adequate for both company and client needs.
- Software and hardware must be considered presently suitable and reliable by the computer industry, as well as the business community.
- Future product support and enhancements must be anticipated and accurately projected.
- Software and hardware must be compatible with our clients' practices and requirements.

7.1 Use of Computer Hardware and Software

Verdantas maintains the latest versions of Microsoft Office including Word, Excel, Outlook, PowerPoint, Teams, OneNote, and OneDrive. Our personnel are equipped with laptop computers and/or mobile devices to support remote work from anywhere in the field or from their home office via a secure VPN connection.

Modifications to software will be controlled, documented, and assessed to assure that performance is not unacceptably altered. Verdantas ensures that all software purchased for a specific work assignment or used to manipulate data to be delivered to the client in electronic format complies with client- specific policies and standards. This is accomplished by testing the software, reviewing the output, and verifying that the configuration is compatible with client requirements specified in the project and for each work assignment.

Our offices are equipped with all the essentials to maintain a successful engineering and consulting business. To meet our high standards for security, data availability, and business continuity, we use modern cloud platforms like Office 365 and Microsoft Azure. Our data is replicated off-site and stored across multiple data centers for redundancy.

Verdantas has a state-of-the-art communications network that allows for the efficient use of internal resources and provides the capability to transfer electronic data with clients as requested. Verdantas maintains a cloud based wide-area network with dedicated data lines between all offices. The communications network is protected by a firewall and dedicated virus scanning software for all incoming and outgoing email, and Internet traffic. All file and print servers, as well as email servers, have redundant architecture such as RAID 5 hot-swappable hard drives and power supplies and all data is backed up daily for disaster recovery. Verdantas maintains a SharePoint site as well as an external web site at www.Verdantas.com. If document files are too large for emails, a secure SharePoint site or One-Drive site is established to transfer documents.

Verdantas uses state-of-the-art software for engineering planning and design. Large-format black-line and color plotting and scanning capabilities are available. By utilizing this communications network, Verdantas maintains efficient use of internal resources as well as providing the capability to transfer electronic data with clients as requested.

8.0 PLANNING

The purpose of this section is to document how individual data operations and remedial design will be planned within the organization to ensure that data or information collected are of the needed and expected quality for their desired use. Detailed plans (e.g. planning, sampling, engineering design, construction) and effective communications of those plans, are included as part of the QA Program. Every project and work assignment undertaken in a Verdantas office begins with the identification of specific objectives and requirements for the project, as well as development of one or more documents that describe the tasks to be performed, the QA/QC procedures and activities to be conducted, and to ensure the quality of products and services provided for the work assignment. The Project Manager and/or designee is responsible for preparing these planning documents and distributing them to the work assignment team to ensure that all goals and expectations are effectively communicated to all involved personnel.

8.1 Planning Process

Verdantas projects are planned, implemented, and monitored following procedures described in this QMP.

8.1.1 Project Management Plan (PMP)

Upon receipt of authorization to proceed with the project or a specific assignment as part of the project, the Project Manager may contact the client to ensure clear, mutual understanding of the goals and objectives of the assignment, the desired work products, and the type and level (and location) of expertise required to meet the objectives, schedule, and budget.

In many cases for add-on work, the scope of work is similar to the scopes of work of other work assignments conducted by one or more of the staff members. Such experience can be invaluable in helping the Project Manager select the Task Manager for the work assignment, as well as anticipating and avoiding potential technical problems. The Task Manager reviews available background information and data, including the PMP, work plans and reports from similar work assignments, to assist in designing the work plan and determining the tasks that must be performed to complete the work assignment.

Each PMP modification is internally reviewed by the Project Manager prior to distribution to project personnel. This document is prepared for internal use and is not intended to be submitted to the client or regulators. The Task Manager implements the approved PMP, including obtaining any required permits for conducting field investigations.

8.1.2 Data Quality Objectives (DQO)

Project planning is conducted using established project management procedures and, where applicable, the DQO process as defined by U.S. EPA and interpreted by the Project Manager. The DQO process includes preparing a clear statement of the problem, identifying the decision(s) to be made using the data, identifying the information needed to make the decision(s) (e.g., previously collected data or new environmental measurements), defining the spatial and temporal boundaries of the study, developing a decision rule that will describe a logical basis for choosing an appropriate action based on study results, specifying the limits on decision errors, and optimizing the design for obtaining data.

The DQO process consists of the seven basic steps described below.

Step 1: State the Problem

The scope, objectives, requirements, and activities associated with a program or task are defined. A statement of the specific problem to be addressed or the question to be answered is typically required. Additional scope definition activities include identifying members of the scoping team and specifying resources available to address the problem.

Step 2: Identify the Decision

The key decisions to be made that require the collection of data are identified. The key decision for a particular phase or stage of a project is defined, as well as alternative actions that may be taken based on the results of the investigation. Any relationships between the key decision and other associated or subsequent decisions are identified.

Step 3: Identify the Inputs to the Decision

The data needed to make or support decisions are identified. The sources of all data are identified. Methods used to assess or manipulate collected data to arrive at project decisions are described.

Step 4: Define the Study Boundaries

The spatial and temporal boundaries of the data acquisition activity are defined. These boundaries ensure that the approach incorporates the time periods in which the data should be acquired, areas that should be sampled, and the time period to which the results should apply. This step includes defining the geographic areas for field investigations, the population of interest, the scale of decision-making, the time frame for the decision, the timing of sample collection, and any constraints on sampling or analysis.

Step 5: Develop a Decision Rule
A logical decision rule is formulated that defines conditions that would cause the decision-maker to choose among alternative actions. First, the statistical parameter that specifies the characteristic or attribute that the decision-maker needs to know about the population or problem is defined. Next, the action level for the decision is defined.

Step 6: Specify Tolerable Limits on Decision Errors
The decision-maker's acceptable limits on decision errors are specified in order to establish appropriate limits for uncertainty in the data. Activities include the following:

- Establishing a possible range for each parameter of interest by estimating its upper and lower bounds;
- Defining types of decision errors and identifying the potential consequences of each;
- Defining a range of possible parameter values where the consequences of decision errors are relatively minor; and
- Assigning probability values to points above and below an action level that define the acceptable probability for the occurrence of decision errors.

Step 7: Optimize the Design
Evaluate information or data obtained from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.

This process might require several iterations to specify the DQOs for a work assignment. If all seven steps of the DQO process are not applicable to an environmental data collection activity (e.g., specific decisions cannot be identified or the study is exploratory in nature), the applicable steps will be used to help plan the data collection effort.
The final DQOs are approved by the Project Manager, client, and any other pertinent personnel. To ensure that the data or information collected are of the type and quality needed to satisfy the DQOs, a QAPP is developed for collecting the data consistent with available resources and data quality requirements and specific activities are documented in the project QAPP. Since DQOs are continually reviewed during data collection activities, any needed corrective action can be planned and executed to minimize problems before they become significant.

A Project Planning and Scoping Checklist is provided to assist the Project Manager, QC Reviewer, Task Manager, and/or QAO to assure that a comprehensive planning and scoping effort has been performed.

8.3 Data Collection Systems Design

Once project objectives or DQOs have been established, the project data collection system can be designed. The data collection system is designed to identify the most effective and efficient approach to sampling and analysis that will satisfy project DQOs. The data collection design process includes identification of the following:

- Personnel requirements and qualifications;
- Specifications for field sampling events;
- Health and safety considerations;
- Sample handling and custody;
- Selection of analytical methods;
- Analytical instrumentation requirements;
- Specification of calibration and performance evaluation samples for analytical methods;
- Data reduction, validation, and verification methods;
- Specification of methods for evaluating data and assessing limitations on data use
- Specification of statistical methods;
- Data reporting requirements; and
- Required QC activities and oversight needs.

By following the data collection design process, data can be traced to sampling and analytical procedures, performance standards, and measuring equipment.

8.4 Planning Documents

The data collection system design and other project criteria and parameters are specified in project planning documents. These documents are reviewed and approved by the Project Manager and, as appropriate, Task Managers, as well as designated QC Reviewers. The QC Reviewer shall be an appointed individual who was not involved in the design of the data collection system. Any design or procedure changes are subject to the same review and approval process as the original documents.

Different clients will have different requirements for planning documents. The general intent of the planning documents is to communicate the scope and procedures for intended activities so that these procedures can be reviewed and validated. The

following sections describe planning documents generally required for environmental projects performed under U.S. EPA procedures (e.g., CERCLA, RCRA). Variations of this set of documents will be required where different services are provided or where clients have unique requirements.

8.4.1 Quality Assurance Project Plan

For work assignments involving environmental data operations, including the acquisition, analysis, and evaluation of environmental data as part of the SOW, a QAPP specific to the needs of those work assignments will be developed to ensure that the work is performed by fully trained and qualified technical staff and supported by sufficient resources to achieve the planned DQOs. The need for a QAPP is identified during the development of the work plan. The QAO or the subcontractor Quality Assurance Coordinator (QAC), depending on the firm conducting the work, is responsible for ensuring that the project QAPP is implemented throughout the duration of the work assignment. The final responsibility resides with the Verdantas Project Manager.

The QAPP defines the DQOs for a work assignment and the roles and responsibilities of work assignment staff, identifies the critical measurements to be performed and the procedures for doing so, and discusses the various QC/QA activities to be conducted during the measurement portion of the work. Unless otherwise specified by U.S. EPA, QAPPs for work assignments conducted by Verdantas are prepared in accordance with the specifications for format and content in U.S. EPA Requirements for Guidance for Quality Assurance Project Plans for Environmental Data Operations (EPA QA-R-5, EPA/240/B-01/003, 2001, reissued in 2006). A separate HASP is prepared to ensure that collection of field samples by Verdantas personnel complies with all company health and safety policies and applicable OSHA standards.

8.4.2 Standard Operating Procedures (SOPs)

An SOP presents in detail the method for a given operation, analysis, or action in sequential steps. It describes specific facilities, equipment, materials and methods along with QA/QC procedures and other factors required to perform the operation, analysis, or action. SOPs are developed in accordance with guidance presented in US EPA QA/G-6 - *Guidance for Preparing Standard Operating Procedures (SOPs)* dated April 2007.

SOP Preparation

SOPs are developed as needed by Subject Matter Experts (SMEs) to cover specific operations and to standardize new activities. SOPs are referenced in or attached to the QAPP, if they are work assignment specific. All Practice Areas managing environmental data prepare written SOPs for sampling, testing, gathering information on field conditions,

checking and validating this information, and reviewing their own data quality systems. An SOP is prepared for those activities that need to be performed the same way every time, i.e., it is standardized.

The Practice Area Leader determines what procedures or processes need to be documented specific to their Practice Area. SOPs are written by SMEs who are experts in or routinely perform the work or use the process being detailed. In some cases, the SME designates a team approach to development of the SOP for multi-tasked processes where the experiences of several individuals are critical. These individuals are required to have appropriate training and experience with the process/procedure.

SOPs are written with sufficient detail so that someone with limited experience or knowledge of the process or procedure, but with a basic understanding, can successfully reproduce the process or procedure when unsupervised. The experience requirement for performing an activity is noted in the section that outlines personnel qualifications. The Project Manager is responsible for ensuring the project team is competent and knowledgeable in the activity they are conducting. SOPs are used as a part of Verdantas staff training, as they provide detailed work instructions.

SOP Review & Approval

SOPs are reviewed by one or more individuals with appropriate training and experience with the process/procedure. In most cases, SOPs are tested by staff other than the original writer and modified as needed before the SOPs are finalized.

The finalized SOPs are reviewed, verified, and approved by the senior management and the QAO. Electronic signature approval indicates that an SOP has been both reviewed and approved by appropriate senior management staff and the QAO.

SOP Revisions

Whenever procedures are changed, when new equipment is used, when comments by personnel indicate that the directions are not clear, and/or when a problem occurs SOPs are updated and re-approved. In general, only the pertinent section of the SOP is updated, and the change date/revision number for that section is indicated in the document control notation.

SOPs are also systematically reviewed on a periodic basis, e.g. every 1-2 years, to ensure that the policies and procedures remain current and appropriate, or to determine whether the SOPs are still needed. The review date is added to each SOP that has been reviewed. If an SOP describes a process that is no longer followed, it is withdrawn from

the current file and archived. Outdated versions are archived to prevent their continued use. If SOPs require modification for a work assignment, the modifications are discussed in the QAPP.

New and revised SOPs are reviewed and approved by the QAO, QA Manager or subcontractor QAC, as appropriate, before implementation. The QA Manager or QAC, as appropriate, will ensure that obsolete documents are removed and that the revised SOPs are used in subsequent tasks. Practice Area Leaders are responsible ensuring that SOPs are current and are available to all staff on a centralized location on the company intranet. Electronic access is limited to read-only format to prevent unauthorized changes to the documents.

The QAO (or designee) is responsible for maintaining a master list of SOPs. This database indicates the SOP number, version number, date of issuance, title, author, status, Practice Area, and any historical information regarding past versions.

8.4.3 Work Plan

A Work Plan presents the structural design for a project and the strategy to be followed for completing the project. In a stepwise fashion, duties are identified and described, and milestones for their accomplishment are established. The resources to be used in the course of work are elaborated upon.

Project personnel, including the Project Manager and QC Reviewer, are identified, along with their respective responsibilities and anticipated levels of effort. Lines of interaction between the staff are outlined. In addition, the plan specifies material resources to be used, including laboratory and field equipment and computer software and hardware systems (e.g., programs, information databases, communication network).

8.4.4 Field Sampling Plan (FSP)

Under current U.S. EPA guidelines, data collection projects require a SAP, which consists of an FSP and a QAPP. The FSP:

- Describes sampling objectives including the phase of the sampling and the ultimate use of the data;
- Identifies procedures for field activities and sampling protocols and procedures;
- Specifies the types, locations, and frequency of samples to be taken;
- Identifies procedures for sample analyses; and
- Identifies responsible individuals.

The FSP may also include pertinent instruction guides, SOPs, and operating manuals.

8.4.5 Health and Safety Plan

Verdantas administers a health and safety program for its employees in compliance with OSHA regulations in 29 CFR Part 1910. Site-specific HASPs are generated for each project and provide detailed health and safety information and guidelines for a project. A Site Safety Officer is assigned for each sampling operation and is responsible for implementing the HASP.

8.4.6 Construction Quality Assurance Plan (CQAP)

Project construction phase activities should be planned during the preconstruction stage with regard for quality and safety and to avoid project implementation problems while the project is still in design. A project Construction Quality Assurance Plan (CQAP) serves to establish project quality objectives (e.g. calibration, field testing, controls, field documentation, reporting) and procedures for loss prevention, quality control, and general coordination between Verdantas and the construction contractor. The CQAP includes the specific QC requirements of the contract documents, applicable regulatory codes and requirements, Verdantas corporate and professional standards, and loss prevention considerations.

8.5 Data Evaluation

Information sources that might be used to obtain data for work assignments include the U.S. EPA or other federal, state, and local agency personnel and files, along with contractors, published and unpublished documents, and direct measurement or observation. Regardless of the source, sufficient documentation is required to ensure an independent evaluation of the data, including its validity and proper representation.

When appropriate, the original published sources are consulted and data entry and submission forms are developed to check for minimum data requirements. Appropriate qualifiers are assigned to the data. Data gaps are identified and any data inconsistencies noted. Edit checks are conducted to evaluate completeness of the data, conformance of the data to the proper format, and whether data are acceptable based on requirements for allowable (permitted) values or are within the specified range.

8.6 Acceptance Criteria

The acceptance criteria for data collected for a project is discussed in the DQOs. All reports and other documents prepared for a project will be submitted to the client for their review and acceptance prior to finalization and submittal to any reviewing authority (if required). The acceptance criteria is meeting the contract requirements while providing a document satisfactory to the client.

9.0 IMPLEMENTATION OF THE WORK PROCESS

The purpose of this section is to document how work processes will be implemented within the organization to ensure that data or information collected are of the needed and expected quality for their desired use. Specific procedures described earlier in this QMP are followed to ensure that work is performed as required under each work assignment. These procedures apply to all work assignments that Verdantas conducts unless otherwise specified in writing for the project or work assignment. The Project Manager, Task Manager and/or QAO are responsible for implementing these procedures.

9.1 Procedures to Ensure that Work is Performed According to Plan

Verdantas uses the following tools to ensure that work is performed as planned:

- A PMP addressing the tasks to be completed for the work assignment, proposed technical approach, deliverable(s) to be prepared, and work assignment-specific QA/QC procedures to be executed during the work.
- A QAPP for any work assignment requiring collection of environmental samples (including specific SOPs needed for the work assignment).
- A project CQAP.
- Regular audits – minimum of annual - (e.g., technical system audits, technical reviews of draft and final deliverables, data quality assessments, performance audits, safety audits, and management system reviews).
- Corrective actions based on audit results to ensure continuous quality improvement responsive to the needs of the client throughout the term of the project.

Quality assurance metrics are gathered and reported annually by the QAO to senior management. In addition, quality assurance metrics are part of the annual performance evaluation for the QAO.

The Project Manager and/or Task Manager informs staff members of the purpose and goals of the work assignment; the schedule; their responsibilities; and the individual(s) to whom they are accountable for their performance. This information is included in the work plan and QAPP, if needed, for each work assignment. Staff use the PMP, work plan, QAPP and CQAP, if applicable, to guide the work. The Task Manager is responsible for ensuring that staff are provided with the latest versions of these documents and that previous versions are disposed of properly.

The Task Manager oversees the day-to-day operations of the work assignment and communicates frequently with staff as a work product is developed. The Task Manager also continuously monitors technical progress and budgetary performance. This approach provides early identification of problems so they can be quickly resolved. Frequent communication between the Task Manager and the Project Manager is also essential to determine progress. Any technical or schedule difficulties are immediately addressed.

Work assignment staff meetings are held as necessary to review work assignment status, report on activities, and describe planned activities. Newly available information is distributed so that technical personnel are informed of all new developments. Significant events, decisions, and issues that affect the work assignment are documented and distributed to the team members as the work assignment proceeds.

Throughout the work assignment, the work scope detailed in the Work Plan is the focal point for all technical reviews. The work assignment is judged at all stages against the objectives and goals set forth in the SOW, work plan, QAPP and/or CQAP, if appropriate. Any specified QC procedures are implemented during the work assignment by the Task Manager, who informs the Project Manager of any deviations and the need for revision of any procedures during the course of the work. Laboratory analyses are conducted according to the specifications of the QAPP and the project. As a final step to ensure that technical QC of work products is achieved and any problems are adequately addressed, the Task Manager ensures that appropriate reviews have been conducted on final deliverables prepared for a work assignment and that all revisions have been made before the deliverables are submitted to the client.

Construction phase QC consists of preparatory and follow-up actions that involve review of construction specifications. Specifications must clearly describe to bidders the scope of construction work and define the standards for technical performance and quality acceptance. These standards become the basis for onsite construction QC activities such as construction observation, inspection, and acceptance testing. Depending on contract agreements, construction QC is performed by Verdantas either as the owner's representative or as the construction manager. Verification of the design intent and communication of the contractor's understanding of the contract requirements and response by the engineer are made through the submittal review and field clarification order process.

9.2 Identification of Operations Needing Procedures

Verdantas senior and project management personnel will plan and ensure that procedures or instructions are in place for all work processes that affect quality. The

purpose of process control is to ensure that both standard and special work processes are accomplished under controlled conditions.

Standard work processes and special processes include, but are not limited to, engineering, design, procurement, supplier (source) inspection, welding, heat treating, nondestructive testing, data management, media sampling, data validation, constituent analysis, and laboratory services. Work-process-related procedures, instructions, and other forms of direction will be developed, reviewed, and approved by technically qualified personnel. They will also include provisions to ensure that:

- Work is planned, authorized, and accomplished under controlled conditions using technical standards, instructions, procedures, or other appropriate means of detail commensurate with the complexity and risk of the work.
- Work processes and equipment are reviewed and approved by authorized personnel.
- Personnel performing work are responsible for the quality of their work.
- Work processes are monitored to ensure that the desired quality is being achieved and to identify areas needing improvement.

9.3 Policies for Changing Procedures

The personnel responsible for establishing the procedures will also be responsible for authorizing changes to the procedures.

9.4 Level of Management Oversight and Inspections to be Provided

Verdantas provides the level of management oversight and inspections appropriate to the work being performed under a particular work assignment. The Project Manager, in consultation with the QAO, will determine an appropriate level of management oversight and inspections for each work assignment, in accordance with budgetary constraints and anticipated difficulties that might be encountered. However, the routine management activities described in Section 9.1 will be implemented without exception.

9.5 Quality Process Approach

Verdantas promotes the adoption of process driven approaches when developing, implementing, and improving the effectiveness of its quality management system, thereby enhancing client satisfaction by meeting client requirements.

10.0 ASSESSMENT AND RESPONSE

The purpose of this section is to document how the organization will determine the suitability and effectiveness of the implemented quality system and the quality performance of the environmental programs to which the quality system applies.

Verdantas conducts annual self-assessments and independent assessments as described in this section to ensure the technical quality of all work products and proper operation of all quality systems. Senior management personnel identified for each type of assessment have authority to suspend or stop work in progress if any condition that could adversely affect the quality of results or the health and safety of personnel is detected. Corrective actions are performed by staff and monitored by the QAO to ensure that problems have been resolved.

10.1 Quality System Audits

Verdantas conducts quality system audit reviews no less than annually on select projects, to ensure the quality management system performs as planned and is effectively implemented and maintained. The purpose of these assessments is to provide management and clients with an ongoing evaluation of the quality of the results produced by Verdantas' data collection activities and to indicate how well the objectives for a given project are being met.

Quality system audits are initiated by the QAO. The QAO or QAO designee may periodically conduct impromptu audits of various elements of the project to ensure compliance with the quality system established for the project. Any deficiencies noted during the review are subject to management review, as coordinated by the Project Manager.

10.2 Planning, Implementing and Documenting Assessments

Audits are typically used to assess the overall quality of data collected during a measurement program. Audits are also useful in evaluating the procedures used in collecting and analyzing samples, how data are handled, and how a program or work assignment is managed. An audit often detects problems that might otherwise have gone undetected until the end of the activity.

Verdantas recognizes that technical system audits should be reserved for specific projects where their relative importance, risk potential, schedule constraints, and resource limitations allow. Impromptu audits will be carried out as needed. Impromptu audits may be conducted by the QAO, subcontractor QAC, or authorized designee, as

appropriate, throughout the duration of a project. Subcontractor audits may be conducted by the QAO or other designated auditor/senior staff as needed. The QAO selects the auditor and audit team, if needed, based on the activities to be audited and their complexity. Designated QA audit personnel must be experienced and knowledgeable about the activities which they are auditing and completely independent of these specific activities audited. The auditor's responsibilities include preparation of the audit plan, coordination of the audit process, communication with the work assignment team or subcontractor being audited, participation in the audit, coordination of the preparation and issuance of audit reports, and evaluation of the audit process. These unannounced audits serve at least three purposes:

- To ensure that performance is responsive to the client's needs and objectives, and that appropriate information is available to meet the deadlines of the work assignment;
- To verify that the QMP, work plan, and QAPPs are being executed and that SOPs are being followed; and
- To detect and define problems so that corrective action can begin as soon as possible.

Several different types of audits can be conducted: management audits, laboratory audits, field audits, and performance evaluation audits.

- **Management audits** are designed to evaluate whether quality management functions and responsibilities related to data acquisition and assessment are being performed in accordance with the QAPP and Verdantas QA policy. These audits are conducted annually.
- **Laboratory audits** are performed to verify continuity of personnel, instrumentation, and quality control requirements. A laboratory audit typically consists of random data audits and review of laboratory quality control data. The laboratory documentation normally examined during an audit includes sample receiving, sample log-in, sample storage, COC, sample preparation and analysis records, instrument operating records, and any other documentation related to the generation of analytical data by the laboratory. Laboratory audits are conducted on a project-by-project basis, generally for multiple projects each year.
- **Field audits** are performed to evaluate procedures for sample identification, sample control, chain-of-custody, field documentation, sampling operations, sample preservation, packaging, and shipping. Field audits are conducted at multiple times throughout the year.
- **Safety audits** are performed to ensure that staff are able to identify, evaluate, and control potential hazards, to evaluate the effectiveness of the project HASP, and to evaluate compliance of on-site personnel to Verdantas' safety expectations. Safety audits are conducted at multiple times throughout the year, both by the

Project Manager and by the Health & Safety Officer.

- **Performance evaluation** audits are performed annually to determine the bias of a total measurement system. These audits typically consist of a performance evaluation sample that is submitted to and analyzed by the audited laboratory. In some cases, the laboratory is made aware of the submittal of samples. At other times, the samples are submitted to the laboratory in such a way that the laboratory is necessarily unaware it is being audited.
- **Construction Audits** are performed to verify that subcontractor construction activities are being conducted in accordance with approved design specifications. These audits are conducted on a project-by-project basis, no less than annually.

The audits might not cover all tasks and activities performed by Verdantas under all work assignments but will involve sufficient activities to allow an evaluation of the quality of the work and compliance with the QMP, work plan, QAPP and/or CQAP, as appropriate. Specific areas that might be examined include, but are not limited to, the following:

- Qualifications of technical and management staff;
- Quality of performance of administrative and technical personnel, including subcontractors;
- Sample collection procedures, chain-of-custody records, and the document control system;
- Technical specifications are being followed;
- HASP is completed and addresses site-specific and task-specific hazards;
- Field staff are complying with Verdantas safety protocols;
- Procedures for analysis, documentation of data sources, and storage and retrieval of data;
- Validation of analytical data, calibration procedures, and detection limits of test equipment;
- Identification and reporting of nonconformance;
- Completion of corrective actions;
- Procedures for document review and resolution and incorporation of review comments; and
- Documentation of technical/editorial reviews and data quality assessments.

Following the completion of an audit, the auditor will submit a report to the Project Manager and QAO (as long as the QAO was not directly involved in the audit) and the Task Manager, as appropriate. The assessment report will include:

1. A determination of whether tasks were performed in accordance with established criteria (SOP & directives);
2. An identification of non-conformances from approved procedures;
3. Proposed corrective actions for resolving quality problems; and
4. An evaluation of whether the process produces an outcome that is consistent with quality system objectives.

The Project Manager will review the report and forward it to the Department and/or Area Leader, as appropriate. Management is responsible for reviewing the report with the appropriate staff. The QAO, following consultation with the Project Manager, has authority to suspend the performance of any activities determined to be deviating from the established QMP, work plan, or QAPP until appropriate corrective actions can be instituted. The QAO has final authority in resolving any disputes or inconsistencies that result from or are identified by the assessment within each Area. The implementation of corrective actions identified during program assessments will be tracked by the QAO. Written response to the assessment and audit findings will be prepared. The Quality Systems team, consisting of the QAO and Area Leaders, meets monthly, or as needed, to discuss all procedures related to audits or assessments conducted. The QAO may issue periodic audit reports to the Project Manager and Task Manager to provide an overview of performance of QA activities, including the status of action items for resolving nonconformance and recommendations for improvements.

10.3 Corrective Actions

The general approach for defining corrective action requirements should involve:

- Identifying corrective action needs and causes;
- Establishing appropriate corrective action responses; and
- Verifying the timely implementation and effectiveness of the corrective action taken.

If processes are discovered that contradict or fall outside of the quality processes, they shall be identified and addressed at the lowest management level, if possible, in consultation with the QAO. If there are disputes regarding resolution of processes, the QAO has final authority for dispute resolution.

Corrective action reviews are part of the QAPP narrative. Templates for corrective action

are readily available on the company intranet. The templates document corrective action procedures and provide for action taken during such reviews. Management then examines results from corrective action reviews and provides input and decisions on next steps in the process.

The project corrective action program ensures prompt and effective corrective actions are implemented to prevent the recurrence of failures or nonconformance. A project log is used for capturing and tracking non-conformities from identification to resolution. The log is used in tracking problems, driving root-cause analysis and corrective action, and measuring the effectiveness of solutions. Client concerns or complaints are addressed through this mechanism. The QAO and Project Managers are responsible for ensuring the corrective action program operates correctly during the entire project life cycle.

The QAO and Project Manager will review all project documentation prior to submission for approval. Types of project documentation include, but are not limited to:

- Scope of Work
- Project Schedule
- Work Breakdown Structure
- QMP
- Risk Management Plan
- QAPP
- SAP
- SOPs
- Training logs

The resulting project documentation should address all possible causes of the nonconformance and will be used to determine the root cause of the problem. A corrective action plan will be developed based on results of the analysis.

Corrective action may require additional data collection activities. In the field, corrective action is initiated by the Project Manager and/or Task Manager. All problems should be identified and reported. Although corrective action for deviations from standardized field procedures may not always be required, all deviations from project planning documents should be noted in the field logbooks along with the field team leader's justification and rationale for the changes. Corrective actions should be always implemented when SOPs are not met, when non-representative conditions are indicated, and/or when specific tasks have not been performed. Formal corrective action is documented, tracked and verified at the project level.

The Project Manager will review suggested corrective actions for each identified process or work product nonconformity and will work with the QAO and Department Leader to ensure a corrective action has been established that will address the identified process nonconformities. The Project Manager will inform the project team of the corrective actions, personnel responsible for each task, any additional training, and expected completion dates. Depending on the number of participants and time needed to execute the corrective actions, the project manager will determine if the recommended corrective actions should be placed on the schedule. Progress made against any corrective actions and corrective action priority are placed on the schedule and reported via regular project status meetings.

If a client identifies a problem or the QA team needs the client to assist in resolving a problem, then the client is involved through the resolution. The client will also be consulted and involved if the problem affects scope and schedule.

The implementation and completion of the corrective action will be verified, and completion will be documented. A comprehensive evaluation should be done to ensure the root cause of the problem has been solved; any resulting secondary issues have been corrected; proper controls have been established; adequate monitoring is in place; and any adverse effects of the actions taken are resolved. This investigation and its results will be documented in the project files and available to the project team. Data gathered from performance evaluations and audits are used to evaluate quality.

10.4 Quality Control for Deliverables and Data

Clearly defined QC procedures are implemented for data collection and work assignment deliverables. Draft and final work products are prepared and reviewed by qualified reviewers. Reviews focus on the extent to which work products meet or exceed professional technical standards. The Project Manager is responsible for the quality of deliverables submitted to the client. At the initiation of work on each work assignment, the QAO reviews the SOW and draft work plan and advises, if needed on the type, number, and level of reviews that should be performed. Reviews may be internal, conducted by Verdantas QC Reviewers, subcontractors, or they may be external, conducted by persons outside Verdantas, such as the client, or expert/peer reviewers associated with the client or Verdantas. The following policies apply to reviews of materials produced for work assignments:

- No internal reviews are needed for most notes, memoranda, letters, and first drafts prepared for internal distribution or submitted to the client.
- First drafts of documents to be submitted to the Agencies will have an internal technical review, editorial review, and be subject to computerized spell checking

prior to being submitted to the client for review.

- Internal reviews (QC checks) of data collection, data entry, data analysis, and database or software development (including modeling) are performed by at least one person other than the person who performed the task initially. These QC checks help ensure that entries are correct and complete, that formulas are correct, and calculations have been performed correctly, and that models operate correctly.
- Drafts of deliverables that might be distributed to others are usually reviewed by one qualified senior-level person other than the person who prepared the deliverable. However, if the client is conducting external peer reviews or quick response is required, such internal scrutiny might not be necessary as long as the client is informed that such internal review has not been conducted.
- Final versions of a deliverable that is to be published or widely distributed and transmittal letters must be reviewed by one qualified senior-level person, other than the person who prepared the deliverable as well as the technical editor to ensure that it is complete, accurate, and meets the client's requirements for content and format.
- The final authority for releasing deliverables rests with the Project Manager. The Task Manager consults with the Project Manager to ensure that any deliverable is consistent with overall project goals and requirements and does not contain information that could expose either Verdantas or the client to liability.

The Project Manager, in coordination with the client, will develop an appropriate format for the deliverable and to ensure that the content meets the client's requirements. The QAO will identify qualified senior staff who can assist in conducting internal reviews as needed. Multiple reviewers might be needed to ensure that complex deliverables are adequately reviewed.

10.4.1 Technical and Editorial Review

The QC Reviewer should confirm that the technical aspects of the project have been checked or reviewed by technical personnel qualified in the appropriate disciplines. A QC Reviewer is not expected to review the work of all scientific and engineering disciplines but is responsible for certifying that the proper technical reviews have been performed. Appropriate registrations should be held by individuals signing reports or stamping/sealing drawings. Verdantas' Senior Review Policy provides an overview of the peer review program including who has senior review privileges, their responsibilities, and further guidance on the review process

Data collection and interpretive techniques should conform with the standard of practice and applicable regulatory requirements. It is important to recognize that the standard of practice is the ordinary skill and competence exercised by members of a

profession in good standing in the community at the time the work is undertaken. This is not to be confused with the state of the art or an individual's perception of "excellence." Necessary deviations from the standard of practice should be explained.

The QAO is responsible for seeing that technical reviews are conducted by the appropriate personnel. The Project Manager is responsible for setting up a Document Review Checklist at the start of the project. This document should be kept in the project folder and completed each time a review is performed to document the QA/QC process. For internal reviews, a review form can be attached to the copy of the document or other deliverable (e.g., database entries, data tables, graphics, text, model runs, evaluations). This form identifies the reviewer(s), the date the review is to be completed, and any special instructions for the reviewer(s). Separate copies of the deliverable may be given to each reviewer, or one copy of the deliverable may be passed from one reviewer to another. If more than one reviewer examines a single copy, each reviewer ensures it is possible to identify individual comments. When documents are reviewed electronically, changes and comments are to be made using red-line format, so it can be determined what changes are proposed or where comments made requiring clarification or change. A copy of an email with comments or indicating review is completed should be copied over as a text file for documentation of the review.

The technical reviewers identify and document all problems that affect quality and make recommendations for improving the deliverables. All technical work is carefully checked to ensure that analytical approaches and methodologies are consistent and that all analyses, information, databases, and assumptions are properly applied and yield supportable, accurate results. The content, format, and style of the document or other deliverable is also evaluated. The reviewers may use prepared checklists, other editorial or technical guidelines, along with their personal knowledge and experience to thoroughly review the deliverable. In particular, text must agree with tables and tables must be internally accurate and consistent with other tables. Graphics must also agree with text, be of good quality, and be clear and concise in their representations. Deliverables must be written in accordance with the SOW.

Review of reports involving calculations includes rechecking the computations, reviewing the assumptions used and the selection of input data, and checking the input data against the original sources to be sure that transcription errors have not occurred. Calculations may be rounded in a manner consistent with the accuracy of the data used in the calculations. When calculations are checked, the following are documented, as appropriate: the basis for the calculation (i.e., why the calculation is being performed); the assumptions made or inherent in the calculation; a reference (including page, where applicable) for each piece of input data (e.g., standard handbook, technical paper);

the method used for the calculation; and the results. After completing the check, the reviewer may check off each number reviewed (physical check mark if reviewing hard copy or highlighting checked calculations when reviewed electronically) and will initial each page reviewed, and sign and date the review form. Both the originator and the reviewer are responsible for the correctness of the calculations.

The reviews help to identify sections of the deliverable that might not be clearly written, areas where more detailed explanation or substantiation is needed, and data and calculations requiring revision. The technical reviewers mark all corrections and suggested revisions on the document or attach additional pages (e.g., a specific quality control checklist), then sign and date the review form and return the form, marked-up document (typically electronically in redline format), and any additional pages to the Project Manager. When internal technical reviews are complete, the Task Manager submits the deliverable to a qualified technical editor for editorial review to ensure that the writing is clear and concise, that it conforms to predetermined requirements for format, style, and usage, and that it includes consistent terminology, reference designating, and formatting. The technical editor signs and dates the technical/editorial review form and returns it with the marked-up document (typically electronically in redline format) to the Task Manager.

The original form(s) signed by the internal technical and editorial reviewers filed with the marked-up page(s) in the project file or if electronic, in the online files in a separate folder for review documents.

When external reviews are conducted by either Verdantas or the client, an external review form is used to track receipt of external reviewers' comments and to document how the reviewers' comments are addressed when the deliverable is revised. Comments received are attached to the form and filed in the project file or scanned and stored in the online files.

The Task Manager compiles the comments received from internal or external technical reviewers and editors. The Project Manager and/or Task Manager is responsible for ensuring that all comments, corrections, additions, deletions, or other revisions have been incorporated into the final deliverable. If conflicts exist in the quality improvements indicated by two or more reviewers, the Task Manager should seek additional professional guidance and document how the situation was resolved. Once all of the revisions and corrective actions have been made the work product will be submitted to the client. The Task Manager or designee will include a signed letter of transmittal indicating that the deliverable has been reviewed and approved when the deliverable is submitted to the client.

10.4.2 Data Quality Assessments

Measurement data used in deliverables might include previously collected data extracted from databases and data generated as the result of field investigations and laboratory analyses. The level of data quality required depends on the intended use of the data and the decisions to be made based on the data. The type, quantity, and quality of data required will be specified in the QAPP. Data might also be obtained from other sources and analyzed to support work assignments. A DQA involves scientific and statistical evaluation to determine if the data obtained from an environmental data activity are of the right type, quality, and quantity to support their intended use. The DQA involves validation and verification of data to ensure that data obtained from various sources have been appropriately reviewed and that entry into databases has been performed correctly, as well as to ensure that sampling and analysis protocols described in the QAPP were followed and that measurements were performed in accordance with the criteria specified in the QAPP. The validated data set is then used to determine whether the quality of the data is satisfactory for its intended use.

DQA activities are conducted by qualified senior-level technical staff and are documented by using the review form and by marking corrections on printed copies of the data or preparing written reports and checklists, as appropriate, for the type of DQA performed.

10.4.2.1 Assessments of Processed Data

Processing data provides statistical or modeling results or an evaluation of options. Processed data must be carefully reviewed, stored, and analyzed to protect their integrity and quality. QC procedures are implemented during data processing activities and technical reviews of processed data are conducted by qualified personnel.

Data transfers include copying raw data from a notebook onto a data form for computer data entry or directly to computer data entry, copying from computer servers to flash drives, and electronic transfers. Data transfer steps are minimized and data form design evaluated. All data transfers, from raw data through final interpretation, are documented by work assignment staff. Final data reports can be transmitted on electronic media as specified for the particular work assignment.

Data reduction includes all processes that change either the values or numbers of data items and the original data set from which reduced data are generated cannot be recovered. This process is distinct from data transfer in that it entails a

reduction in the size of the data set and an associated loss of information. Validation of the data reduction process is addressed in a manner appropriate to the level of effort involved. For manual calculations, actual raw data are transformed to the reduced data. When a computer is used to process large quantities of data, references to the specific program and database documentation are provided.

Reduction of field measurement data and laboratory measurement data will be performed in accordance with project data validation procedures that specify the required documentation and technical criteria necessary to produce valid data. Laboratory data must be:

- Quantitative and statistically significant in relation to the standard analytical methods or procedures employed; and
- Satisfactory for custody and document control.

Field measurement data must meet criteria for:

- Complete documentation of sampling location, time, and personnel;
- Satisfactory documentation of field activities; and
- Correct sampling methods.

Data analysis can involve graphical, statistical, or deterministic methods. Data analyzed using statistical techniques should be graphed, whenever possible, since graphical methods can be useful in identifying data points that could exert undue influence on statistical conclusions. Before using statistical techniques for data analysis or when reviewing a report where statistics have been used, the assumptions required by the methods are evaluated. In some cases, relaxation of the assumptions may have a minimal effect on the results while, in other cases, the results may be rendered invalid.

10.4.2.2 Assessment of Field Investigation Data

Field measurement data present a special case where statistical indicators of data quality are used in the assessment. Data collected or generated for a particular work assignment under a project are assessed for precision, accuracy, or bias, as well as the qualities of representativeness, comparability, and completeness, where practical. Data are also assessed to ensure that DQOs are satisfied.

The QA Manager, subcontractor QAC, or an authorized designee (e.g., a

professional data validator for analytical chemistry data) is responsible for conducting the DQA. The DQA determines whether and to what extent the DQOs were met and specifies any restrictions on the use of the data resulting from the review. Analytical data obtained by Verdantas usually are internally validated by the laboratory that did the analysis, with copies of the data package sent to the Laboratory QA Manager and/or Project Manager. Additional data validation may be performed by Verdantas according to procedures and criteria delineated in the QAPP.

10.4.2.3 Analytical Data Validation Procedures

For projects involving field sampling and analysis, Verdantas will have the laboratory provide the data according to the U.S. EPA Contract Laboratory Program (CLP) guidance. In those instances when definitive performance criteria have been established, the CLP guidance may take the form of SOPs. These criteria are concerned with specifications that are not sample dependent; they specify performance requirements that should fully be under a laboratory's control. These specific areas include blanks, calibration standards performance evaluation standard materials, and instrument performance checks.

For some projects, data will be evaluated internally and also validation by a third-party to determine if the data is usable. The QAPP will identify if the type of data collected warrants further data validation. Data validation typically identities two distinct types of problems - those associated with poor laboratory performance and those associated with factors outside the control of the laboratory, including problems related to the sample matrix itself or the sample collection and shipping processes. Whatever the source of the problem, the goal of data validation is to obtain data that meet the quality required for the specific project and to identify when that goal has not been met.

When the results of data validation efforts identify problems with project laboratory performance, several forms of corrective action may apply. For example, Verdantas may require the laboratory to reanalyze individual samples associated with performance problems, at no additional cost to our client. For problems that indicate a more pervasive failure of the laboratory's quality system, it may be appropriate for Verdantas to negotiate a more systematic solution to the problem, including changes in the laboratory's internal quality system. In rare instances, it may be necessary for Verdantas to take formal project action against the laboratory. In this latter instance, the response may not change that quality of the data already generated for specific samples or the project, rather, our actions

may prevent future data quality problems.

10.5 Assessor Training Requirements

The lead auditor will organize and direct the quality audits and will report audit findings and evaluate the corrective actions. The lead auditor will have good communication skills and have experience in conducting audits. Other auditors participating in the quality audits will be given appropriate training or orientation to develop their competence in performing the audits.

10.6 Assessor Authority

The QAO and other designated QA personnel have the authority and the organizational freedom to identify quality problems, stop work when safety or quality is compromised, and provide interpretation of the QA program.

10.7 Review and Response to Findings

Deviations identified from the project QAPP or other project QA requirements identified during a QA audit will be noted. Deviations will be discussed with the Project Manager and QAO. Results of each audit will be available for general review. The Project Manager is required is address the deficiencies and mitigate them as appropriate.

Major deficiencies and repeated deficiencies will be discussed with the Project Manager and with the Area Leader, as necessary, to mitigate the deficiencies. Major deficiencies could include, but are not limited to:

- Lack of QAPP for project; and
- Inappropriate deliverables that do not meet client requests and/or requirements.

10.8 Corrective Actions

Corrective actions may include the following:

- Reemphasizing to work assignment staff and their supervisors the work assignment directives, the limitations in scope, the need to adhere to the agreed-upon schedule, and the need to document QC/QA procedures;
- Securing additional commitment of staff time to devote to the work assignment;
- Retaining outside consultants to review problems in specialized technical areas; and
- Changing procedures.

The Project Manager may exercise his authority to replace a Task Manager or staff member if it is in the best interest of the work assignment to do so. If the work assignment

is being performed by a subcontractor, such replacement would take place only after discussion with the subcontractor QAC and management.

10.9 Dispute Resolution

Disputes over audit findings or review comments will go up the chain of command from Project Management to Area Leader. If the issues fail to be resolved at these lower levels, the QAO will resolve all disagreements and disputes regarding implementation of the quality management system for the projects.

11.0 QUALITY IMPROVEMENT

The purpose of this section is to document how the organization will improve the organization's quality system. The QA Program includes procedures for identifying and implementing quality improvements. Despite careful planning of work assignments and the use of highly qualified staff, technical problems can occur. Such problems might be identified by the work assignment staff or be revealed during a formal audit. The QAO and Project Manager are responsible for resolving QA issues and determining whether corrective actions are needed.

Generally, disputes between quality staff and program/project staff are resolved, if at all possible, through consultation with the next highest level of management within the organization.

11.1 Quality Improvement to Prevent Adverse Conditions

11.1.1 Identification of Situations Requiring Corrective Actions

Many technical problems can be solved on the spot by the staff members involved. For example, technical staff can modify the technical approach, repair instrumentation that is not working properly, or correct errors or deficiencies in documentation. Problems that cannot be solved in this way are brought to the immediate attention of the Task Manager and the QAO or the subcontractor QAC. The QAO works with the Project Manager to determine whether major corrective actions are needed.

Results from the following QA activities may initiate a corrective action: technical and editorial reviews, data quality assessments, audits, and management system reviews. In particular, failure to adhere to the QMP, work plan, QAPP, and/or SOPs, as well as identification of a nonconformance (not meeting predetermined specifications), requires that corrective action be taken. In addition, the Project Manager questions and surveys the client regarding any concerns about deliverable quality. Long-term corrective actions are focused on building quality into procedures, rather than relying on QC reviews and audits to identify and correct errors and deficiencies on a case-by-case basis.

11.1.2 Implementation and Verification

If major corrective action is required, the QAO or an auditor documents the problem on a Corrective Action Request and Response form. If more than one problem is involved, each is documented on a separate Corrective Action Request and Response form.

Copies of the form are given to the Area Leader, QAO, Project Manager, Task Manager, and subcontractor QAC, as appropriate, who discuss each problem jointly to determine

when the problem arose, to assign responsibility for investigating the problem, to identify the root cause of the problem, and to determine what specific corrective action is needed to address the problem. In addition, a time schedule is set and the responsibility for implementation of the required corrective action is assigned. The Project Manager also determine whether notification of the client is required.

The QAO is responsible for verifying and documenting that the corrective action has eliminated the problem within the agreed-upon time frame. The QAO and Project Manager, as appropriate, sign and date the form, verifying that the corrective action has been implemented. The QAO monitors the status of all corrective actions to ensure that problems remain corrected and reports to the Project Manager, as needed. The QAO continually work with the Project Manager to resolve all QA issues arising under the project.

11.1.3 Identification of Quality Improvement Opportunities

The QA Program advocates systematic planning, implementing, assessing, and correcting in an incremental process that results in a net long-term improvement. Continuous implementation of activities designed to achieve this principle results in higher value to our clients over time.

12.0 REFERENCES

ANSI/ASQC E4-2014, Quality Systems for Environmental Information and Technology Programs – Requirements for Guidance, American National Standard, February 4, 2014.

EPA Directive 2100 (1999), Information Resources Management Policy Manual, U.S. Environmental Protection Agency, Washington. DC.

EPA Order 1900 (February 1998), Contracts Management Manual, U.S. Environmental Protection Agency, Washington. DC.

EPA Order 2160 (July 1984). Records Management Manual, U.S. Environmental Protection Agency, Washington, DC.

EPA Order 5360 A1 (May 2000), EPA Quality Manual for Environmental Programs, U.S. Environmental Protection Agency, Washington, DC.

EPA Order 5360.1 A2 (May 2000), Policy and Program Requirements for the Mandatory Quality Assurance Program, U.S. Environmental Protection Agency, Washington. DC.

U.S. Environmental Protection Agency. 2001. EPA Requirements for Quality Assurance Project Plans (QA/R-5), EP A/240/13-01/003, Office of Environmental Information.

U.S. Environmental Protection Agency, 2000, Guidance for the Data Quality Objectives Process (QA/G-4), EPA/600/R-96/055, Office of Environmental Information.

U.S. Environmental Protection Agency, 1980, Interim Guidelines and Specifications for Preparing Quality Assurance Program Plans, QAMS-004/80, Office of Research and Development.

Table

QUALITY MANAGEMENT PLAN
REVIEW CHECKLIST

ORGANIZATION: Verdantas, LLC

This checklist will be used to review the Quality Management Plans (QMPs) that are submitted to the Office of Mission Support, Office of Enterprise Information Programs, Enterprise Quality Management Division (EQMD) for Agency review under CIO 2105.1. Items from this checklist are discussed in detail in Section 6 of CIO 2105-P-01.1 and in *EPA Requirements for Quality Management Plans (QA/R-2)*. Consult these resources for more information on the items below.

All items below are required to be included or addressed in the QMP. If an item is not relevant, please provide an explanation about why this is not relevant in the Comments column. Also note, that a process may either be described or referenced in the QMP; however, all references should be available within the organization and provided to the EQMD with the QMP.

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
Management and Organization [Reference CIO 2105-P-01.1 §6A, 6B, 7; EPA QA/R-2 §3.2]			
1) QMP Approved by senior manager (signed if hard copy or approved by separate cover memo if electronic QMP copy)?*	Approvals, Page i		
2) Signed and dated by senior line management (for subordinate offices) as applicable (signed if hard copy or approved by separate cover memo if electronic QMP copy)?*	Approvals, Page i		
3) Signed and dated by QA manager (signed if hard copy or approved by separate cover memo if electronic QMP copy)?*	Approvals, Page i		
4) Includes statement of the organization's QA policy?	Section 2.1, Page 3		
a) QA policy statement includes general objectives/goals?	Section 2.2, Page 3		

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
b) QA policy includes general discussion of management and staff responsibilities?	Section 2.3, Page 5		
5) Includes organizational chart?	Figure 1		
a) Organizational chart identifies all components of organization?	Section 2.4, Pages 5 -10		
b) Organizational Chart identifies position of QA manager?	Section 2.4, Pages 5 -10		
c) Organizational Chart identifies lines of reporting of the QA manager?	Section 2.4, Pages 5 - 10		
d) Organization Chart identifies any other QA staff?	Section 2.4, Pages 5 -10		
6) Includes discussion of roles, responsibilities, and authorities of the QA manager and QA staff (QA Officers, Coordinators, etc.), as applicable?	Section 2.4, Pages 5 -10		
7) Documents the organizational independence of the QA manager?	Section 2.4, Pages 5 -10		
8) Describes procedures to ensure QA staff has access to appropriate levels of management?	Section 2.4, Pages 5-10		
9) Discusses technical activities or programs that require application of quality management practices?	Section 2.6, Pages 10-11		
10) Discusses where oversight of delegated (i.e., States, Tribes) and/or extramural programs is needed?	NA		
11) Identifies where internal coordination of QA and QC activities among organizations (e.g., divisions, offices,	Section 2.4, Pages 8-10		

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
branches) is needed?			
12) Discusses how management assures understanding and implementation of quality practices in all programs and activities?	Section 2.7, Page 11		
13) Describes process for resolving disputes relating to quality issues?	Section 10.9, Page 56		
Quality Program Components [Reference CIO 2105-P-01.1 §6, 7; EPA QA/R-2 §3.3]			
14) Includes description of the quality program as it pertains to the organization's mission?	Section 3.0, Page 12		
15) Addresses and describes principal quality program components and tools developed by the organization, including how they are implemented and by whom? (Note: list specific tools, such as SOPs, guidance, training, etc., in Column 3.)	Section 3.2, Pages 14-15		
a) Planning work	Section 8, P. 31		
b) Implementing work.	Section 9, P. 40		
c) Assessing work performed.	Section 10, P. 43		
16) Identifies internal organizations (e.g., subordinate offices, divisions) that develop QMPs?	Section 3.3, Page 16		
17) Identifies review and approval procedures for these internal QMPs?	Section 3.3, Page 16		
18) Includes assurance that QA responsibility is incorporated into performance standards for QA Managers/Directors of Quality Assurance?	Section 9.1, Pages 40-41		
Personnel Qualifications and Training [Reference CIO 2105-P-01.1 §6A, 6G, 6N, 7; EPA QA/R-2 §3.4]			

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
19) States policy regarding QA training for management and staff?	Section 4.2, Pages 17-18		
20) Describes minimum training for personnel necessary to implement the QMP?	Section 4.2, Pages 17-18		
21) Describes process for identifying, ensuring, and documenting that personnel have necessary quality-related competencies?	Section 4.1, Pages 17		
22) Describes process for ensuring personnel maintain quality-related competencies, including continuing education or refresher training?	Section 4.2.2, Page 19		
23) Describes roles, responsibilities, and authorities managers and staff relative to training planning and implementation?	Section 4.1, Pages 17		
Procurement of Items and Services [Reference CIO 2105-P-01.1 §6K; EPA QA/R-2 §3.5]			
24) Describes process for reviewing and approving all extramural agreements (grants, cooperative agreements and contracts), including use of the QA Review Form[a]?	Section 5.2, Pages 20-21		
a) Review process ensures documents are complete and accurate?	Section 5.2, Pages 20-21		
b) Review process ensures agreement clearly describes the item or service needed?	Section 5.2, Pages 20-21		
c) Review process ensures agreement describes the associated technical and quality	Section 5.2, Pages 20-21		

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
requirements?			
d) Review process ensures agreement describes the quality program elements for which the supplier is responsible?	Section 5.2, Pages 20-21		
e) Review process ensures that the supplier's conformance to requirements will be verified?	Section 5.2, Pages 20-21		
25) Describes process for reviewing and approving applicable responses to solicitations and requests to ensure that they satisfy all technical and quality requirements?	Section 5.2, Pages 20-21		
a) Review process includes the review of evidence of the supplier's capability to satisfy EPA quality requirements?	Section 5.2, Pages 20-21		
b) Review process provides for ensuring that procured items and services are acceptable?	Section 5.2, Pages 20-21		
26) Describes process for review and approval of suppliers' quality-related documentation (e.g., QA Project Plans and QMPs)?	Section 5.3, Page 22		
27) Includes discussion of any policy and criteria for delegations of review of QA Project Plans and QMPs?			
28) Describes process to ensure EPA extramural agreement policies, including quality, are satisfied?			
29) Describes roles, responsibilities, and authorities managers and staff relative			

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
to extramural agreement planning and implementation?			
Documents and Records [Reference CIO 2105-P-01.1 §6E, 6F, 7; EPA QA/R-2 §3.6]			
30) Describes process for identifying quality-related documents and records (including electronic) requiring control (e.g., guidance, SOPs)?	Section 6.1, Pages 24		
31) Describes process for preparing, reviewing, approving, issuing, using, authenticating, and revising documents and records?	Section 6.2, Page 24		
32) Describes process for ensuring that records and documents accurately reflect completed work?	Section 6.3, Pages 25-26		
33) Describes process for maintaining documents and records including transmittal, distribution, retention, access, preservation, traceability, retrieval, removal of obsolete documentation, and disposition?	Section 6.4, Pages 26-27		
34) Describes process for establishing and implementing appropriate chain of custody and confidentiality procedures for evidentiary records?	Section 6.5, Page 27		
35) Records on environmental data and information comply with applicable EPA policies (e.g., locational data for samples, Agency records management)?	Section 6.4, Pages 26-27		
36) Describes roles, responsibilities, and authorities managers and staff relative to documents and records?	Section 6.3, Pages 25-26		
Computer Hardware and Software [Reference CIO 2105-P-01.1 §6F; EPA QA/R-2 §3.7][b]			
37) Describes process for developing,			

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
installing, testing, using, maintaining, controlling, and documenting computer hardware (e.g., computers, servers) and software, including software products like models, data bases, and programs?	Section 7.0, Pages 28-29		
38) Describes process for assessing and documenting the impact of changes to user requirements and/or the hardware and software on performance?	Section 7.1, Pages 29-30		
39) Describes process for evaluating purchased hardware and software?	Section 7.1, Pages 29-30		
40) Describes process for ensuring that data and information produced from or collected by computers meet applicable EPA Orders, requirements, and standards?	Section 7.1, Pages 29-30		
41) Describes roles, responsibilities, and managers and staff relative to computer hardware, software, and information management?	Section 2.4, Pages 5 -10		
Planning [Reference CIO 2105-P-01.1 §6D, 6E, 6J; EPA QA/R-2 §3.8]			
42) Includes a description of the systematic planning process for environmental information/data acquisition (e.g., direct measurement, compilation from other sources) and use?	Section 8.3, Pages 33-34		
a) Does this process include identification and involvement of relevant customers and suppliers?	Section 8.3, Page 34		
b) Does this process include description of the project goal, objectives, and questions and	Section 8.4, Pages 34 - 35		

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
issues to be addressed?			
c) Does this process include identification of project schedule, resources, milestones, and any applicable requirements?	Section 8.1.1, Pages 31-32		
d) Does this process include identification of the type and quantity of information/data needed and how the data will be used to support the project's objectives?	Section 8.1.2, Pages 32-34		
e) Does this process include specification of performance criteria for measuring quality?	Section 8.1.2, Pages 32-34		
f) Does this process include specification of needed QA and QC activities to assess the quality performance criteria?	Section 8.1.2, Pages 32-34		
g) Does this process include description of how, when, and where the data will be obtained (including existing data) and identification of any constraints on data collection?	Section 8.1.2, Pages 32-34		
h) Does this process include description of how the acquired data will be analyzed, evaluated, and assessed against its intended use and the quality performance criteria?	Section 8.1.2, Pages 32-34		
43) Describes process for developing, reviewing, approving, implementing, and revising QA Project Plans?	Section 8.4.1, Page 35		

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
44) Describes process for evaluating and qualifying information acquired from other sources (e.g., States, other Federal Agencies)?	Section 8.5, Page 38		
45) Describes roles, responsibilities, and managers and staff relative to planning?	Section 2.4, Pages 5 -10		
Implementation of Work Processes [Reference CIO 2105-P-01.1 §6F, 7; EPA QA/R-2 §3.9]			
46) Describes process for ensuring that work is performed according to planning and technical documents (e.g., SOPs, approved methods and protocols)?	Section 9.1, Pages 40-41		
47) Describes process for identifying operations needing procedures (e.g., SOPs)?	Section 9.2, Pages 41-42		
48) Describes process for preparation, review, approval, revision, and withdrawal of these procedures?	Section 9.1, Pages 40-41		
49) Describes policy for use of these procedures?	Section 9.3, Page 42		
50) Describes process for controlling and documenting the release, change, and use of planned procedures?	Section 9.1, Pages 40-41		
a) Process includes description of necessary approvals?	Section 9.1, Pages 40-41		
b) Process includes removal of obsolete documentation from work areas?	Section 9.1, Pages 40-41		
c) Process includes verification that the changes are made as prescribed?	Section 9.1, Pages 40-41		

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
51) Describes roles, responsibilities, and authorities managers and staff relative to implementing work processes.	Section 9.1, Pages 40-41		
Assessment and Response [Reference CIO 2105-P-01.1 §6G, 7; EPA QA/R-2 §3.10]			
52) Describes the process for assessing the adequacy of the quality management system at least annually?	Section 10.1, Page 43		
53) Describes the process for planning assessments?	Section 10.2, Pages 43-46		
a) Process includes selecting an assessment tool, the expected frequency, and the roles and responsibilities of assessors?	Section 10.2, Pages 43-46		
b) Process includes determining the competence of assessment personnel?	Section 10.2, Pages 43-46		
c) Process includes ensuring that personnel have no real or perceived conflict of interest, and have no direct involvement or responsibility for the work being assessed?	Section 10.2, Pages 43-46		
d) Process includes ensuring that personnel conducting assessments have sufficient authority, access to programs and managers, access to documents and records, and organizational freedom?	Section 10.2, Pages 43-46		
54) Describes the process for implementing and documenting assessments and reporting results to management?	Section 10.2, Pages 43-46		
a) Describes the process for			

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
completing assessment reports in a timely manner, including appropriate levels of review and approval?	Section 10.2, Pages 43-46		
55) Describes process for management's review of, and response to, findings?	Section 10.4, Pages 48-54		
56) Describes process for identifying how and when corrective actions are to be taken in response to the findings of the assessment?	Section 10.8, Pages 55-56		
a) Process includes ensuring corrective actions are made promptly?	Section 10.8, Pages 55-56		
b) Process includes confirming the implementation and effectiveness of any corrective action?	Section 10.8, Pages 55-56		
c) Process includes documenting effectiveness of the corrective actions implemented?	Section 10.8, Pages 55-56		
57) Describes process for addressing disputes encountered as a result of assessments?	Section 10.9, Page 56		
58) Describes roles, responsibilities, and managers and staff relative to planning and implementing assessments and responses to assessments?	Section 10.2, Pages 43-46		
Quality Improvement [Reference CIO 2105-P-01.1 §6, 7; EPA QA/R-2 §3.11]			
59) Describes process for ensuring that conditions adverse to quality are prevented, identified promptly, corrected promptly and that actions are taken toward prevention, documented and actions tracked to	Section 11.1, Pages 57-58		

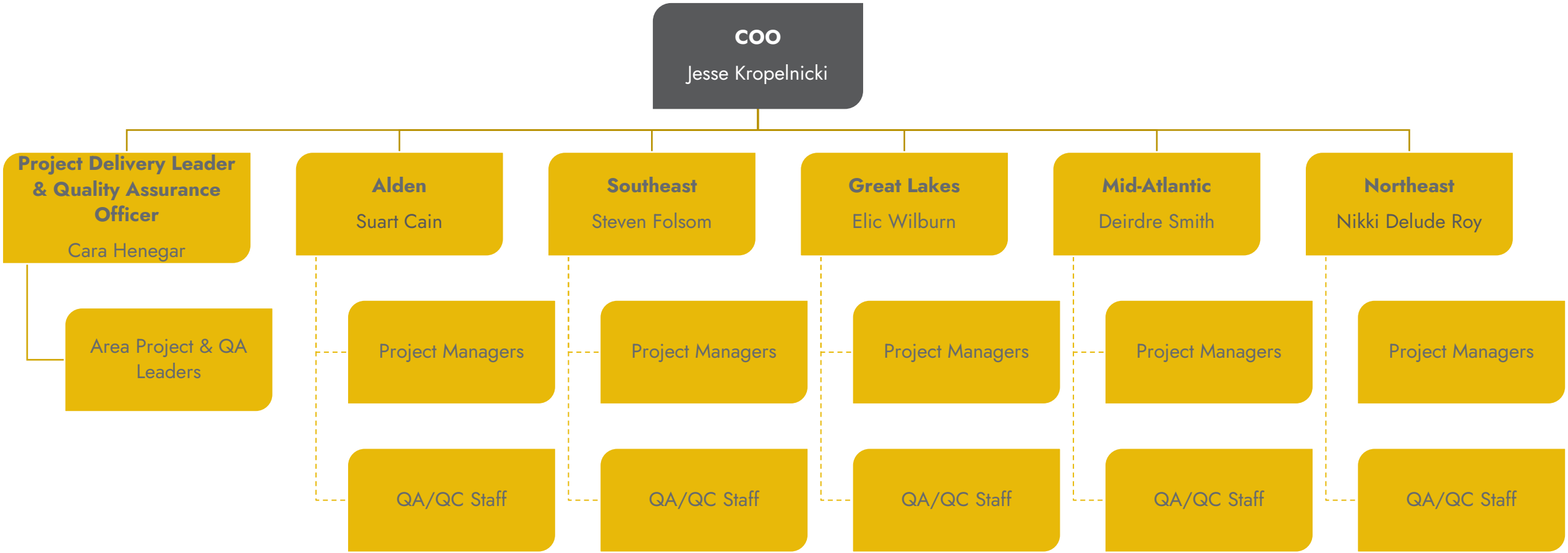
Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
closure?			
60) Describes process for encouraging staff to establish communications between customers and suppliers, identify process improvement opportunities, and identify and propose solutions for problems?	Section 11.1.3, Page 58		
61) Describes roles, responsibilities, and managers and staff relative to quality improvement?	Section 11.1, Pages 57-58		
Other Review Criteria [Reference CIO 2105-P-01.1 §6I]			
62) Are regulatory or other citations in the QMP current and accurate?			
63) Are there any inconsistencies in the text?			
64) Is the writing clear?			
65) Are organizational units identified consistent with the most recent reorganization?			
66) Are activities described in the QMP consistent with QA Annual Report and Work Plans?[c]			
67) Are tasks proposed for other organizations not covered solely by this QMP documented elsewhere (e.g., in another organization's QMP)?			
Information Quality Guidelines[d] [Reference CIO 2105-P-01.1 §6J]			
68) Does the QMP identify criteria for information products that are subject to Information Quality Guidelines?			
69) Is the process for pre-dissemination review discussed?			
70) Does the pre-dissemination process			

Element	Section & Pages(s)	Comments (this column completed by QAM/DQA)	Recommended Change (this column completed by EQMD)
description include protocols for clearance review, requirements for clear disclaimer language; identify roles and responsibilities of management and staff?			

[a] Quality Assurance Review Form (QA Review Form) is required for EPA Organizations.
[b] This may be a statement of compliance with Agency standards and practices if no specialized hardware or software are purchased or used by the organization.
[c] Quality Assurance Annual Report and Work Plans are for EPA Organizations.
[d] Information Quality Guidelines apply to EPA Organizations.

Figure

verdantas
PEOPLE FOCUSED FUTURE



Appendix A

Forms, Checklists, Plans, Policies, and Guidelines

INTRODUCTION

Verdantas, LLC (Verdantas) was founded on the principle of providing high quality, technical, regulatory, and strategic consulting services to our clients. A primary focus of our business plan is to develop the reputation for providing superior consulting services when compared to our competitors.

In addition to being recognized by our clients and the regulatory community as providing high quality consulting services, we consistently receive comments regarding the excellent quality of our reports/documents/letters and written communications. Clients and reviewers are impressed by how organized, clear, readable, and understandable our documents are. This factor is critical to our success because, other than verbal communications, written communications and reports are the primary product that we sell. Our documents/work product also serve as valuable marketing tools (i.e., putting our best foot forward within our business community). Maintaining a rigorous, thorough, and consistent review process is an important element along with data/information collection and interpretation, good technical writing skills, and strong technical quality and regulatory knowledge in maintaining this success.

The objective of this memorandum is to provide an overview of the senior review program and general guidance regarding the review mechanics.

SENIOR REVIEW PRIVILEGES

As part of the senior review process, three layers of review should be completed:

Technical: A technical review to check that the submittal meets project objective and adheres to local codes/regulations.

Risk Management: Check for contract implications, ensure assumptions are well defined, red-flag words are removed, and an appropriate contract is included with proposals. Navigate the negotiated contract terms, insurance, risk profile, etc.

Financial: Review proposals for financial indicators in accordance with the Authorities Matrix.

These reviews can be completed by a single person if they meet the separate qualifications defined below, or up to three separate reviewers may be required. Assignment of Senior Review privileges on a company-wide basis is the responsibility of and coordinated by the Area Manager (who may also delegate this responsibility to an appropriate Senior Manager). **Assignment of Senior Review privileges is on a case-by-case basis and is based primarily upon a staff member's demonstrated competency in applying these guidelines consistently.** The authorization of Senior Review privileges will be reviewed and assessed by the Area Manager on an on-going basis. Senior Review privileges may be suspended or revoked for cause.

OVERVIEW

The primary objectives of Verdantas' senior review program include:

- promoting and maintaining the quality of our reports/work product;
- ensuring the accuracy and correctness of our technical computations, evaluations, conclusions, and recommendations;

- ensuring the accuracy and correctness of our regulatory evaluations, citations, interpretations, opinions, and recommendations;
- maintaining a focus on project/client strategic legal and business objectives;
- ensuring concise, readable, and well-organized reports/work product; and
- managing and limiting company exposure to potential liabilities.

The Senior Reviewer must incorporate each of these objectives into the review process.

Each project is assigned a Senior-in-Charge (SIC), the SIC must meet the qualifications for at least one of the senior review categories and ideally all categories on smaller projects. The SIC is responsible for completing the final senior review of Verdantas work product. SIC responsibilities will not be assigned to Senior Staff until they have demonstrated competency and consistency in implementing Verdantas' review program as outlined in this memorandum. Work product will not be finalized and submitted to the client/regulatory agency until reviewed and approved by a qualified SIC. The Project SIC has sole authority to delegate project final review responsibilities to other qualified SICs.

The Project Manager is responsible for delivering a complete work product to the SIC for review. Although not responsible for final review, the Project Manager is responsible for ensuring all senior review steps are completed. To the extent of his/her/their capability, the Project Manager's review should be completed consistent with the provisions of this guidance, and, at a minimum, should focus upon technical/regulatory and format/styles components of the process. Consistent performance on this aspect of the Project Manager's responsibility is an important element in demonstrating fitness for review responsibilities. Upon delivery to the SIC, the work product should be complete, and the operating assumption should be that it is the Project Manager's opinion that the work product is ready to go to the client/regulatory agency. If agreeable to the SIC, the Project Manager can deliver the work product with components that are not final, subject to eventual final senior review of those components. However, the SIC retains the discretion to defer final review of the report/work product until the missing/draft components are finalized.

The SICs should be provided advance notice (at least several days) regarding anticipated receipt of documents/work product for review. Generally, Project Managers/project staff should anticipate several days to several weeks (for larger reports/deliverables) to accommodate in-house review process. **Clients should not be promised draft or final reports unless the schedule has been reviewed and approved by the SIC.**

The general senior review methodology outlined in this memorandum also serves as a guide for developing SIC senior review privileges. The guidance can be used by project staff and Project Managers to progressively develop senior review privileges as they gain additional project and company experience and responsibilities. The general guidance can be applied by any staff member with regard to delivery of company work product to the "next in line."

COMPLEMENTARY PRINCIPLES

There are several management principles that complement the senior review program. While not a formal component of the senior review program, these principles are implemented to maintain

top quality work product and provide secondary support to the objectives of the senior review program. These complementary principles include:

- to the extent practicable, maintaining the same staff on projects from proposal to project completion, thus maximizing continuity and consistency;
- application of a company-wide report style guide for grammar, spelling, conventions, and format;
- use of a company-wide drafting styles guide for conventions, format, and symbols;
- independent checking of all calculations, estimations, technical equations, etc. (coordinated by the project staff and completed prior to incorporation into company work product and prior to document senior review by the Project Manager); and
- the implicit understanding that no document is handed-off to the next in line unless the author/reviewer is of the opinion that the document is ready to go to the client.

SECOND SET OF EYES POLICY

To ensure the consistency and high quality of Verdantas' work product and correspondence, we employ a second set of eyes policy for all documents, emails, letters, and correspondence that fall outside the standard senior review policy (i.e., communications that **do not present opinions, conclusions, or recommendations**).

The second set of eyes policy requires review by someone other than the primary author before the document is finalized and sent (even if the primary author is a SIC). The staff member does not have to be a senior reviewer.

The purpose of the second set of eyes policy is to provide an objective, unbiased review of the document and identify common errors/mistakes in format and grammar. The review is also focused upon ensuring that the written communication is clear and easily understandable.

Types of documents that are included under the second set of eyes policy includes but is not limited to:

- transmittal cover sheets;
- facsimile cover sheets;
- simple request letters;
- factual data transmittal letters;
- e-mail communications; and
- miscellaneous communications.

When in doubt, employ the second set of eyes policy or seek guidance from Senior Managers and SICs.

THE REVIEW PROCESS

Verdantas' work product senior review program includes three primary components. The senior reviewer must afford each component equal weight and a thorough, comprehensive review. These components include:

Technical

Reviewer Qualifications: 10+ years of progressive experience in the field of review, approved by Area Manager.

Separate technical reviewers should be utilized when a project spans multiple disciplines.

Styles and Format:
This review component focuses upon maintaining consistent presentation and style of documents, figures, tables, and appendices/attachments. This review is based upon evaluating work product consistency with Verdantas' style guide and drafting conventions. Each document should be internally consistent in style and format. To the extent possible, each document/deliverable should also be consistent with applicable company standards, styles, and conventions (including drafting).

Technical/Regulatory Content:
This review component focuses upon ensuring the technical and regulatory accuracy and completeness of work product content. Technical/regulatory content review has two main components: review of methods and data (and associated calculations), and review of technical approach and conclusions drawn from collected data. This review is based upon evaluating the accuracy of methods, observations, information, and data presented in the work product, and the accompanying calculations, evaluations, interpretations, and conclusions/recommendations based upon the data/information (technical and regulatory). The reviewer should assume the role of editor and fact checker.

Technical review should also include a review of any subcontractor work product associated with the project (e.g., geophysical survey reports, analytical laboratory reports, treatability study reports, tank testing reports, boring/well completion logs, etc.).

Risk Management

Reviewer Qualifications: 10+ years of progressive project management experience, appropriate Loss Prevention training, approved by Area Manager.

This review component focuses upon evaluating and minimizing company exposure and liability related to the work product. This review is based upon evaluating the scope of the project and the resulting conclusions and recommendations. Pertinent considerations include:

- Are the findings/conclusions/recommendations fully supported by the scope of the project/investigation activities?
- Do the findings/conclusions/recommendations have limitations or are they based upon assumptions, and if so, are these limitations/assumptions clearly stated?
- Was the project completed by staff with the appropriate training and expertise?

- Were there components of the project that required specialized technical or regulatory knowledge/skills and were appropriate staff used to complete these tasks?
- Evaluate, identify, discuss, and if appropriate, eliminate information/findings/conclusions/recommendations that are not technically supported or are based upon undocumented or technically inappropriate suppositions/assumptions, and/or weak data.
- Have we made opinions/conclusions/recommendations in areas that were not fully investigated or for which we did not have the necessary expertise?
- Evaluate the work product for statements that suggest or imply an inappropriate level of certainty; legal "no-no" words, such as determined, inspection, etc. (see styles sheet for complete listing).
- Evaluate the work product and eliminate to the extent practicable blanket and overly broad statements.
- Identify and evaluate the appropriateness of statements that specifically discuss and/or indicate compliance with.
- Evaluate work product for presence/inclusion of appropriate and/or necessary limitations section; clarifications of scope (such as for ASTM Phase I ESA's), and clarifications regarding the bases for estimates (e.g., remedial cost estimates).

Financial (for proposals)

Reviewer Qualifications: Review to be completed in accordance with the Authorities Matrix.

This review component focuses on evaluating financial health of the project by reviewing indicators for the project including client risk profile, past performance, overall project multiplier, and net revenue.

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DOCUMENT QA/QC CHECKLIST

Project Name: _____ **Project Number:** _____

Document Title: _____ **Document Status:** ☐ Draft ☐ Final

Server link to files: _____

Date: _____ **Prepared by:** _____

Due Date -Draft: _____ **Project Manager:** _____

Due Date -Final: _____ **Hours budgeted for review:** **Peer:** _____ **SR:** _____

Text Review	Date Requested	Date Reviewed	Comments	Edits completed by /Date
Author Review				
Peer Review				
Senior Review				

Review	Date		Reviewer	Comments
	Requested	Reviewed		
Tables				
Figures				
Attachments				
Lab Reports				
Models/Calculations				
Project Profile for marketing				

Please confirm that the following requirements have been met:		
1. The deliverable meets the applicable project scope of work.	☐ Yes	☐ No
2. The deliverable is being submitted within the time frame agreed upon with the client.	☐ Yes	☐ No
3. Appropriate standards, regulatory requirements, and assessment criteria have been referenced and verified to be current.	☐ Yes	☐ No
4. Calculations/models were reviewed and accepted as correct.	☐ Yes	☐ No
5. For final documents, a copy has been saved in the project file.	☐ Yes	☐ No
6. Project profile has been submitted to marketing.		
If "No" to any of the above, explain why: _____		

Project Manager:
approval for submittal _____ **Date:** _____

DOCUMENT QA/QC CHECKLIST

DOCUMENT REVIEW GUIDANCE

Final document review should be thorough and complete. For most Verdantas report deliverables, the process should take at least one to several hours to be performed correctly. For PMs with which a SIC has not yet established an adequate senior review relationship, the review process should be completed making no assumptions. Every component should be independently checked and verified. Once a SIC-PM senior review relationship is developed, the SIC can modify the scope of the review process accordingly (i.e., for example, with a new PM, the SIC should independently verify the accuracy of analytical summary tables to the laboratory data sheets for a relatively large percentage of samples; as a relationship is developed such that the PM demonstrates attention to detail for analytical summary tables, the review can be scaled back to checking a percentage of the data sheets rather than every sample data sheet).

The review should generally be initiated by confirming that all the necessary document components are present. That way, if components are missing, the PM can be alerted regarding the need to provide or generate necessary deliverable components, and the SIC can evaluate whether to proceed with the review or wait for all necessary components to be assembled. This review of document components should include an evaluation of ancillary components that may be required or necessary (such as cover letters, public notice letters, compliance fees, necessary forms, etc.), and a discussion with the PM and project staff regarding the need for and status of these components.

The actual review of the document can be completed based upon personal preference. However, it is often easiest to begin with a review and check of document format and, if applicable, Table of Contents. After the format check is completed, the document can be reviewed for content. Lastly, based upon a review of content and understanding of project tasks and evaluations, the document can be evaluated for limitations and liabilities.

Examples of representative questions/issues associated with document/deliverable review are provided in the sections that follow. These sections are not intended to be a comprehensive list; rather, they provide a list of the more frequent and general types of considerations that should be included in the review process.

Table of Contents

- numbering in Sequence, no missed or out of order numbers/sections;
- no "single" sub-sections, must be at least two for a given section;
- consistent with Styles Sheet;
- formatting/spacing consistent; and
- list of Tables/Figures/Appendices – titles exact and in order.

Text

- title Page; is the information accurate; Title should be worded exactly the same on Title Page and Heading for Report Section 1. Is the client information correct?
- check format, font, spacings, and margins;
- check footers for correct date, project number, and format; do we need to include special footer information, such as "DRAFT" or "Attorney Work Product, Privileged and Confidential?"
- confirm all regulatory citations;
- confirm all dates;
- check to make sure Section number references (to other sections of the report/document) match;
- confirm report/document/letter titles and dates;
- confirm regulatory agency site reference names/numbers;
- confirm all regulatory standards/categories (both that appropriate standard categories were identified and numerical standards used);
- reference section included (where applicable)?

- While reading, make sure Table, Figure, and Appendix references are correct and in sequence (Tables, Figures, and Appendices should be numbered in the order that they are in the text).
- check features discussed in the text versus figures; most site-pertinent features that are discussed in the text should be represented on figures, and they should be discussed/designated/labeled consistently ("UST grave" in the text should not be shown as "UST Excavation" on the figure);
- check distances referenced in the text; and
- check compass directions referenced in the text.

Tables

- headings/footers should be consistent and in order.
- tables should be consistent with Styles Guide. Same font for all components.
- is information in tables consistent with information presented in the text (such as dates for USTs/removals; dates of sampling; etc.)?
- check NOTES; are all necessary NOTES included (all abbreviations in tables should be defined in NOTES)? Are standard NOTES consistent with other Tables/Styles Sheet?
- check units?
- check calculations (e.g., water elevations based on TOC and depth to water measurements; emission estimates; etc.);
- check laboratory summary tables against laboratory reports (listed detections and detection limits);
- check sample depth and locations against information included on figures; all locations should be depicted on an accompanying figure or explained in the report text; and
- check regulatory standards and references included in analytical summary tables.

Figures

- are the figures in sequence?
- are the scales accurate (scale bar should be on all to-scale figures); consistent from figure to figure?
- north arrow present and consistent figure to figure?
- check longitude/latitude and UTM measurements for Site Locus; check contour interval;
- review drafting conventions/symbols for completeness and consistency?
- engineering drawings/specifications reviewed by appropriate staff?
- check spellings;
- correct/consistent client reference and project name;
- are appropriate base maps/references included?
- are features/designations consistent from figure to figure?
- are the figures clear, concise, and easily interpreted; should "crowded" figures be separated into two figures or simplified; does the figure convey the information in the best/simplest way? and
- review technical data included in figures, such as
    - check ground water contour maps for accurate transcription of water elevations; -confirm representative section of contours;
    - check cross sections for accurate transcriptions of depths, soils, etc.; and
    - check for accurate transcriptions of laboratory data.

Appendices

- title pages included and accurate?
- PDF copies legible?
- photographs clear; photograph labels accurate? and
- review QA/QC type-issues for laboratory reports (i.e., holding times, surrogate recoveries, etc.)

PROPOSALS

Special considerations for proposals include:

- review associated detailed cost estimates/break-out;
- verify reimbursable costs, subcontractor costs, man-day estimates, etc.;
- confirm (i.e., add-up) cost estimates;
- does the proposal include appropriate drafting and PM time?
- are associated direct expense fees included, or will they be paid directly by client? Are they discussed in the proposal;
- have we anticipated possible permitting/license needs, costs?
- does the proposal include information that clarifies the general information that was used to develop the work scope, and any associated limitations?
- did we develop the work scope, or have we responded to a specific request/scope developed by the client? If developed by the client, or limited by the client, make sure proposal indicates as such and is consistent w/clients expectations.
- does the proposal list key assumptions?
- does the proposal include a schedule? Is the schedule reasonable; might it depend upon subcontractor availability?
- does the proposal include the appropriate billing and contract information?
- consider appropriate billing terms. Is a lump sum or retainer appropriate? Should the client be billed by subcontractors directly?
- is the proposal valid for a particular time period?
- consider whether the scope of the project is such that the client should be consulted regarding the need for contracting through an attorney to assure confidentiality; and
- were changes made to contract terms at the request of the client?

REVISIONS/EDITS

The revisions/edit process should follow the following guidelines:

- SIC edits and revision should be checked by the PM when completed (whether the edits/revisions are completed by technical staff or support staff).
- All new (as opposed to revised) report sections, tables, figures, or analyses that are completed as a result of the first SIC review should be reviewed by the SIC before the report is finalized.
- For each document reviewed, the SIC should evaluate whether the revisions to the document are of a sufficient magnitude and scope to require a second review by the SIC.
- The SIC should be given an opportunity to complete a "final check" before the final report/document goes "out the door." This review generally focuses upon format and presentation issues. Verdantas support staff are authorized to review and as necessary, revise document format to be consistent with Verdantas styles sheets. Major changes/revisions to format should be discussed with the project manager, and, as appropriate, the project SIC, particularly if an extensive effort will be required.

It is sometimes expected for Verdantas to provide a DRAFT version of a project deliverable to a client (or a client's attorney/representative) for review and comment. The person responsible for completing the final review of a project deliverable is also responsible for reviewing and approving client requests for work product edits, revisions, and changes. It is the project manager's responsibility to make sure the project SIC is aware of such client requests.

E-MAIL COMMUNICATIONS

Electronic communications should be treated as any other company work product. It is especially important to be vigilant regarding electronic communications because of the tendency to "let your guard down" and assume an informal tone. It is also difficult to maintain proper context for electronic communications because of the general tendency to use these methods to communicate brief, summary, or time critical information. It is also important to understand that these types of

communications can take on a life of their own, are easily transmitted to others for whom the original information was not intended (and who might not have the same context and general familiarity with the information discussed) and are equally "discoverable" as written documentation in court and litigation matters (and are subject to the same treatment and provisions as our written work product under our corporate insurance policies).

Consequently, electronic communications that present company work product, or provide opinions, interpretations, and/or recommendations require SIC review prior to transmittal.

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QUALITY CONTROL REVIEW CHECKLIST

Project Name: _____ Project Number: _____

Project Location: _____

Project Manager: _____ Reviewer: _____

Date: _____

	Yes	No	Not Reviewed	Not Applicable
Objectives & Scope				
Are the objectives of the project clearly defined?				
Is the overall technical approach commensurate with the objectives?				
Are the limitations of the proposed scope of work adequately described?				
Is there conformance to the contracted scope of work?				
Data Collection Rationale				
Is the rationale for data collection adequately described?				
Methods and Procedures				
Are the methods and procedures used technically sound and adequately explained?				
Were data collection procedures followed?				
Conclusions				
Is the data interpretation process logical, and can it be followed?				
Are conclusions clearly stated?				
Are conclusions adequately supported by facts?				
Opinions and Recommendations				
Are opinions supported by data and conclusions?				
Do recommendations and opinions reflect reasonable professional judgment?				
Are recommendations clearly separated from conclusions?				
Professional Registrations				
Have documents been reviewed and signed by registered professionals where appropriate?				

Reviewer: _____ **Date:** _____

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PROJECT MANAGEMENT PLAN

Prepared by:		Date:	
Project Name:		Project Number:	
Project Address:			
Client:		Client Phone No.:	
Client Contact:		Email:	
Client Manager:			
Type of Contract:		Budget:	

Project Description (attach SOW)

Project Objectives

Deliverables, Milestones, & Schedule

No	Deliverable/Milestone	Date	Remarks

Subcontractors

Company Name:			
Contact Name:		Contact Phone No.:	
Contact Email:			
Budget:		Type of Contract:	

Scope of Work/Schedule

Subcontractors

Company Name: _____

Contact Name: _____ Contact Phone No.: _____

Contact Email: _____

Budget: _____ Type of Contract: _____

Scope of Work/Schedule

Company Name: _____

Contact Name: _____ Contact Phone No.: _____

Contact Email: _____

Budget: _____ Type of Contract: _____

Scope of Work/Schedule

Standards, Procedures, & Project Documents

No.	Title	Document No.	Remarks

Project Team (Attach org chart)

Role	Project Phase/Task	Name	Contact Info.

Project Meetings			
Number	Type	Frequency	Attendees

Signature Authority		
Document	**Authority Name/Title**	**Remarks**
Letters		
Emails		
Internal communications		
Draft documents		
Final documents		
Progress reports		

Recipients of Project Management Plan		
Name	**Title**	**Remarks**

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PLANNING & SCOPING CHECKLIST

Project Name: _____ Project Number: _____

Project Location: _____

Project Manager: _____ Reviewer: _____

Date: _____

	Yes	No	Not Reviewed	Not Applicable
Objectives & Scope				
Signed Contract				
Are the objectives of the project clearly defined				
Is the overall technical approach commensurate with the objectives?				
Are the limitations of the proposed scope of work well understood and conveyed to the client?				
Is there conformance to the contracted scope of work?				
Are the project members appropriately assigned and briefed?				
Methods and Procedures				
Are the proposed methods and procedures technically sound and adequately defined?				
Have competent subcontractors been identified?				
Have the permit issues been adequately considered?				
Are the QC requirements adequately identified?				
Is there a change order procedure documented?				
Deliverables				
Have the client and the project manager agreed on the number and scope of deliverables?				
Budget and Schedule				
Have detailed cost estimates been prepared?				
Are cost estimates correct?				
Has detailed project schedule been prepared and discussed with the client?				
Is the schedule reasonable?				

Project Manager: _____ **Date:** _____

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FIELD AUDIT CHECKLIST

Project Name: _____ Project Number: _____

Project Location: _____

Project Manager: _____ Completed By: _____

Date: _____ Field Personnel: _____

Subcontractors on-site? ☐ Yes ☐ No

Subcontractor Name: _____

Subcontractor Name: _____

Audit Item Assessed	**In Compliance?**		
HEALTH & SAFETY	Yes	No	NA
Approved health and safety plan (HASP) on site or available			
Job safety analysis (JSA) conducted and documented			
Names of on-site personnel recorded in field logbook or daily log			
HASP compliance agreement form signed by all on-site personnel			
Daily tailgate safety meetings conducted and documented			
Site personnel meet medical exams, fit test training requirements (including subs)			
Documentation of training, medical exams, and fit tests available from employer			
Compliance with specified safe work practices			
PPE	Yes	No	NA
Safety Glasses or Goggles			
Face Shield			
Task-appropriate Gloves			
Safety Boots			
Hard Hat			
Coveralls			
Hearing Protection			
Safety Vest			
Dust Mask			

FIELD AUDIT CHECKLIST

Audit Item Assessed	In Compliance?		
TRAFFIC CONTROL & SAFETY EQUIPMENT	Yes	No	NA
First Aid Kit			
Poison Ivy Ointment/ Sunscreen/ Insect Repellent			
Traffic Control Equipment			
Fire Extinguisher			
Spill Clean-up Supplies			
INSTRUMENTATION/MONITORING	Yes	No	NA
PID/OVA/FID (specify)			
Combustible Gas (LEL) / O2 Meter			
Colorimetric Tubes (specify)			
4-Gas Meter			
Radiation Meter			
Personal Monitors (list)			
Other (describe):			
Monitoring equipment specified in HASP available and in working order			
Monitoring equipment calibrated and calibration records available			
Environmental and personnel monitoring performed as specified in HASP and documented			
ADHERANCE TO FSP/SOPs	Yes	No	NA
Approved field sampling plan (FSP) on site or available			
Field personnel trained for tasks being performed			
Tasks are being performed according to SOPs			
Field sampling records are completed			
Field equipment in use is functioning properly			
Field instruments calibrated and calibration records available			
Decontamination area is properly set up and functioning according to the SOP			
Proper laboratory containers and proper preservatives are being utilized			
Laboratory sample containers are properly labeled and stored			
Application of sample identifications follows the specified protocol			
Laboratory COC is filled out properly and completely			

FIELD AUDIT CHECKLIST

Comments:
Corrective Action Taken During Audit:
Corrective Action Still Needed:

Auditor's Signature: _____ Date: _____

Field Personnel Signature: _____ Date: _____

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QUALITY MANAGEMENT PROJECT AUDIT CHECKLIST

Project Name _____

Project Number: _____

Project Manager _____

Audit Team Leader _____

Date _____

Audit Activities Conducted

Project personnel interviewed
- ☐ QA/QC Manager
- ☐ Project Manager
- ☐ Supervisor
- ☐ Support staff
- ☐ Other, specify

Contract documents reviewed
- ☐ Contract
- ☐ Project deliverables
- ☐ Drawings/Specifications
- ☐ Other, specify

Records reviewed
- ☐ Letters
- ☐ Emails
- ☐ Plans/drawings
- ☐ Reports
- ☐ Status reports
- ☐ Invoices
- ☐ Other, specify

Corrective Action Plan needed? ☐ Yes ☐ No

QUALITY MANAGEMENT PROJECT AUDIT CHECKLIST

Project Name _____

Project Number: _____

Project Manager _____

Audit Team Leader _____

Date _____

	Yes	No	Not Reviewed	Not Applicable
Objectives & Scope				
Did proposal define work performed?				
Did work plan define work performed?				
Did project meet objectives?				
Budget and Schedule				
Were all scope items budgeted?				
Were all equipment and support labor budgeted?				
Were cost estimates correct?				
Was the project completed within budget?				
Was the project completed on schedule?				
Field Investigation				
Were field procedures audited?				
Were field notes reviewed?				
Were boring logs/construction diagrams edited?				
Chemical Analysis				
Were data quality objectives established?				
Were QC samples collected?				
Were QC data reviewed?				
Calculations				
Was methodology correct?				
Was math correct?				
Design				
Was design in conformance with Project Procedures Memorandum?				
Was design review completed?				

QUALITY MANAGEMENT PROJECT AUDIT CHECKLIST

QA/QC Plan				
Were separate QA/QC plans required?				
Did QC procedures conform to company policy?				
Report				
Was a technical edit performed?				
Were graphics correct?				
Was draft report reviewed?				
Were signatures correct?				
Contractual Procedures				
Was there a signed contract?				
Did SOW, budget, and schedule comply with contractual obligations?				
Are change orders properly documented for scope, budget, and schedule changes?				
Are subcontracts in accordance with company policy?				

Reviewer: _____ **Date:** _____

QUALITY MANAGEMENT PROJECT AUDIT REPORT

Project Name: _____

Project Number: _____

Report Name: _____

Audit Team Leader: _____

Audit Type: _____ Audit Date: _____

Audit Summary:
Audit Objective:
Audit Participants
Documentation/Work Products/Activity Examined
Description of substandard issues
Impact of issues identified: ☐ Serious ☐ Critical ☐ Major ☐ Moderate ☐ Minor ☐ NA
Audit Status ☐ Substandard issues found ☐ Resolution, Without Any Changes ☐ Corrective Action Plan is needed ☐ Escalation to Senior Management needed ☐ No issues found
Audit Recommendations
☐ Acceptable Process/Procedures ☐ Process/Procedures conditionally acceptable subject to addressing action items below ☐ Unacceptable Process/Procedures
Findings/Corrective Actions/Action Items

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CORRECTIVE ACTION REQUEST & RESPONSE FORM

Project Name: _____

Project Number: _____

Report Name: _____

Audit Team Leader: _____

Audit Type: _____ Audit Date: _____

Describe the substandard issue(s) found:
Identify the corrective action to be taken: Estimated completion date: Person responsible:
Identify the root cause of the substandard issue(s) found:
Identify preventative action to ensure that the issue does not recur: Estimated completion date: Person responsible:
Corrective Action Plan Approved/comments: Project Manager signature: Date:
Corrective Action Closed/comments: QAO signature: Date: