Quality Assurance Project Plan for an Integrated Stormwater Management Approach for Promoting Urban Community Sustainability and Resilience QAPP, Revision 0

OCTOBER 31, 2018

PREPARED FOR:

US Environmental Protection Agency Region 1
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Mail Code OEP06-1
Boston, MA 02109-3912

CONTRACT NO: BPA-68HE0118A0001-0003
ORDER NUMBER: 68HE0118F0011

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This quality assurance project plan (QAPP) is consistent with EPA Requirements for Quality Assurance Project Plans (EPA QA/R5, 2001, EPA/240/B-01/003); EPA Guidance for Quality Assurance Project Plans for Modeling (EPA QA/G-5M, 2002, EPA/240/R-02/007) and EPA Guidance for Geospatial Data Quality Assurance Project Plans (EPA QA/G-5G, 2003, EPA/240/R-3/003). The Great Lakes Environmental Center (GLEC) and its subcontractors will conduct work in conformance with the quality assurance program described in this project QAPP. This QAPP is one of the contractor requirements and is used to communicate to all interested parties the QA/QC procedures that will be followed to ensure that the quality objectives for this project are achieved throughout the project. The QAPP is a commitment by GLEC that must be approved by USEPA Region 1.

APPROVALS

Quality Assurance Project Plan for an Integrated Stormwater Management Approach for Promoting Urban Community Sustainability and Resilience

CONTRACT NO: BPA-68HE0118A0001-0003
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R. Cody 11-15-18

Ray Cody — Date
Contracting Officer's Representative
USEPA Region 1

11/15/18

Robert Reinhart — Date
Quality Assurance Officer
USEPA Region 1

11-14-18

Mick DeGraeve — Date
Program Manager
GLEC

JA Hansen 11/14/18

Jennifer Hansen — Date
Quality Assurance Officer
GLEC

Khalid Alvi 11/13/18

Khalid Alvi — Date
Project Manager
Paradigm Environmental, Inc.

11/13/18

John Craig — Date
Quality Assurance Officer
Paradigm Environmental, Inc.

11/13/18

John Riverson — Date
Modeling QC Officer
Paradigm Environmental, Inc.

VERSION HISTORY

The following table outlines the revision history of this QAPP:

Documents	Revision No.	Date	Major Revisions
An Integrated Stormwater Management Approach for Promoting Urban Community Sustainability and Resilience	0	October 31, 2018	Submitted draft QAPP to EPA Region 1 for review.

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ACRONYMS AND ABBREVIATIONS

BMP	Best Management Practice
COR	Contract Officer Representative
CWA	Clean Water Act
DEM	Digital Elevation Model
DQO	Data Quality Objectives
EMC	Event-Mean Concentration
GI	Green Infrastructure
GIS	Geographic Information System
GLEC	Great Lakes Environmental Center, Inc.
IC	Impervious Cover
ICD	Impervious Cover Disconnection
LiDAR	Light Detecting and Ranging
MassGIS	Massachusetts Bureau of Geographic Information Systems
MS4	Municipal Separate Storm Sewer System
NCDC	National Climatic Data Center
NRCS	Natural Resources Conservation Service
PE	Professional Engineer
PM	Program Manager
PWS	Performance Work Statement
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCO	Quality Control Officer
SCM	Stormwater Control Measure
SOP	Standard Operating Procedure
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic Database
TO	Task Order
TOL	Task Order Leader
TSD	Technical Support Document
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

REFERENCE TO EPA QAPP ELEMENTS

To support EPA review of this document, we have developed Table 1 below that cross-references the *Guidance for Quality Assurance Project Plans* sections with the Sections of this QAPP.

EPA QAPP Element	R1 QAPP Section
Group A Project Management	
A1. Title and Approval Sheet	Cover Page, Page i
A2. Table of Contents	Page iii
A3. Distribution List	Section A.3
A4. Project/Task Organization	Section A.4
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A9. Documentation and Records	Section A.9
Group B: Measurement and Data Acquisition	
B1. Sampling Process Design	Section B.1
B2. Sampling Methods	Not applicable
B3. Sample Handling and Custody	Not Applicable
B4. Analytical Methods	Not Applicable
B5. Quality Control	Not Applicable
B6. Instrument/Equipment Testing, Inspection, and Maintenance	Not Applicable
B7. Model Calibration	Section B.7
B8. Instrument/Equipment Calibration and Frequency	Not applicable
B9. Data Acquisition (Non-direct Measurements)	Section B.9
B10. Data Management and Hardware/Software Configuration	Section B.10
Group C: Assessment and Oversight	
C1. Assessment and Response Actions	Section C.1
C2. Reports to Management	Section C.2
Group D: Data Validation and Usability	
D1. Departures from Validation Criteria	Section D.1
D2. Validation Methods	Not applicable
D3. Reconciliation with User Requirements	Section D.3

A. PROJECT MANAGEMENT

Certain Project Management elements have been provided in the preface of this document. Those elements include: Sections A.1 Title and Approval Sheet (page i), and A.2 Table of Contents and Document Control Format (page iii). The Project Management Group begins directly with Section A.3 Distribution List.

A.3 Distribution List

This document will be distributed to the staff within the following organizations (Table A-1): U.S. Environmental Protection Agency Region 1 (USEPA), Great Lakes Environmental Center (GLEC), and Paradigm Environmental (Paradigm).

Table A-1. Project Distribution List

Name	Phone & email	Address
U.S. Environmental Protection Agency Region 1 (USEPA)		
Ray Cody Contract Officers Representative (COR)	617-918-1366 cody.ray@epa.gov	5 Post Office Square, Suite 100 Boston, MA 02109 Mail Code: OEP 06-4
Mark Voorhees Alternate COR	617-918-1537 voorhees.mark@epa.gov	5 Post Office Square, Suite 100 Boston, MA 02109 Mail Code: OEP 06-4
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A.4 Project/Task Organization

The United States Environmental Protection Agency (USEPA) has retained GLEC to enhance the capabilities of a municipality (Town of Tisbury, MA) to directly manage stormwater runoff and address multiple local water resource issues through incorporation of Green Infrastructure (GI) Stormwater Control Measures (SCM) and other stormwater related approaches. Through close collaboration, the GLEC Team will support the community in developing simple but effective strategies which incorporate innovative approaches for effectively disconnecting excessive runoff from impervious cover (i.e., IC disconnection) to minimize negative impacts (flooding and excessive pollutant loading) and support more beneficial uses (e.g., groundwater recharge and greening local environment).

The following organizational structure will facilitate project performance and adherence to Quality Control (QC) procedures and Quality Assurance (QA) requirements. The project team is composed of individuals from USEPA and the contractor project team. The contractor project team (GLEC Team) includes GLEC as the prime contractor and its subcontractor Paradigm Environmental (Paradigm). Key project roles are filled by the individuals who are leading the various technical phases of the project and the individuals who are ultimately responsible for approving and accepting final products and deliverables. The responsibilities of these persons are described below.

A.4.1 USEPA Region 1

USEPA Region 1 will be responsible for the coordination of QA aspects at the regional level and with local agencies to ensure technical quality throughout the project. USEPA will coordinate with contractors, reviewers, and others to ensure contract objectives are met. USEPA will also be responsible for ensuring that all technical tasks related to the project are fulfilled, and they will be responsible for final project decisions and direction.

Ray Cody will provide overall project/program oversight for this study as the USEPA Region 1 Contract Officer Representative (COR). Mr. Cody, along with Mark Voorhees (Alternate COR), will be responsible for coordinating with contractors, reviewers, and others to ensure technical quality throughout the project so that project objectives are met. Mr. Cody will provide oversight for project planning and design, data selection, coordination with the Town of Tisbury, model selection and application, and adherence to overall project objectives. Robert Reinhart, the USEPA Region 1 QA Officer, will be responsible for reviewing and approving the QAPP and ensuring that the QA/QC practices and requirements specific to Region 1 are achieved.

A.4.2 GLEC Team

The key personnel from the GLEC Team assigned to this project and their roles are summarized below. **Figure A-1** presents an organizational chart depicting the roles of key staff and the flow of communications across the project team and with EPA.

<u>**Mick DeGraeve**</u> is the GLEC Program Manager (PM) for this task order. He is responsible for directing and coordinating technical work and interaction with the USEPA COR. He will also track the budget, prepare monthly progress reports and invoices, track and ensure adherence with the schedule, and perform any other administrative functions.

<u>**Jennifer Hansen**</u> is the GLEC QA Officer (QAO) for this project. Ms. Hansen will work with the GLEC PM in cases that the quality of the data is questioned as it relates to the USEPA objectives defined

for the work. Ms. Hansen will review the QAPP on behalf of GLEC and will be responsible for maintaining the official QAPP at GLEC.

Khalid Alvi is the Paradigm Project Manager for this task order. He is responsible for executing the tasks and other requirements of the contract on time, within budget, and with the QA/QC requirements as defined by the contract and the QAPP. Mr. Alvi will communicate with the GLEC PM and the USEPA COR on technical matters; he will ensure that the quality of work, schedule, and budget meet task order requirements; he will provide technical direction to Paradigm staff and will manage the daily activities on the project; and he will obtain appropriate technical review of all deliverables and will ensure deliverables conform to EPA's technical review requirements.

John Craig is the QA Officer for Paradigm. His primary responsibility will be to provide support to the Paradigm PM in preparing and distributing this QAPP, reviewing and internally approving the QAPP, and monitoring QC activities to determine and document conformance.

John Riverson is the modeling QC Officer for Paradigm. He will be responsible for overseeing the data review and modeling activities and be responsible for QA/QC activities. Mr. Riverson will coordinate with the GLEC QAO to resolve any QA-related issues and he will notify the GLEC and Paradigm PMs of particular circumstances that may adversely affect the quality of the products provided by Paradigm. He will conduct the review of technical QA material and data related to the surface water model system design and analytical techniques and he implements, or ensures, implementation of corrective actions needed to resolve non-conformances noted during QA assessments.

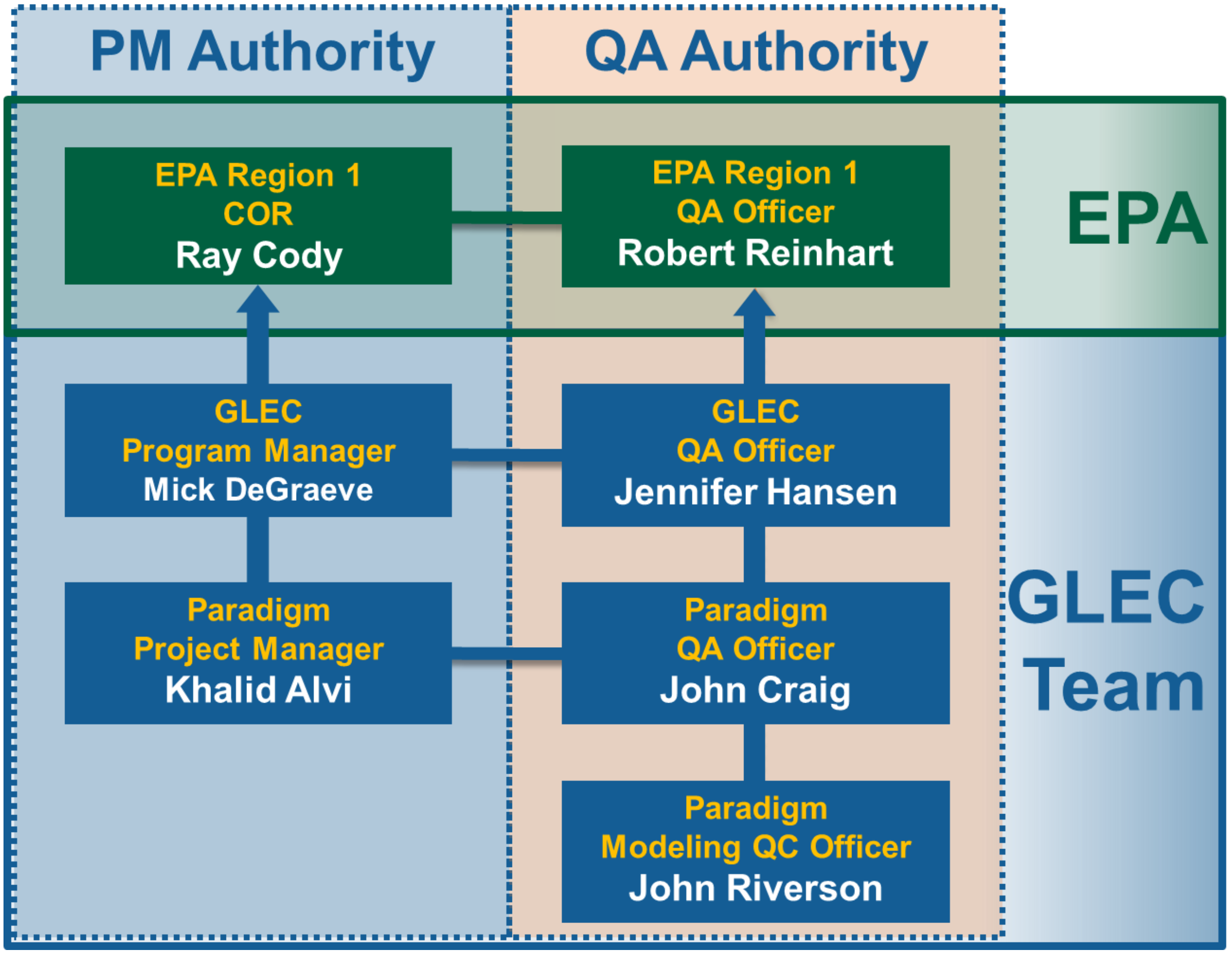


Figure A-1. Organizational diagram for both technical and QA lines of communication.

A.5 Problem Definition/Background

The goal of this project is to identify and quantifiably-assess and quantify opportunities for the disconnection of IC within a geographically-constrained urbanized New England community located near the southern New England coastline. The community, the Town of Tisbury, MA, has requested assistance from the United States Environmental Protection Agency (USEPA) to address chronic (even acute) flooding and the generally poor transmission of stormwater runoff related to and resulting from IC. An equally important project goal is building an understanding and capacity for integrating green infrastructure (GI) and other stormwater control measures (SCM) into municipal land use decision making. This collaborative project will achieve innovative and cost-effective management of stormwater for a broad range of management objectives (e.g., volumetric control (flooding); reuse, resilience and sustainability; control of pollutants and protection of sensitive surface waters).

The following provides important background information for the Town of Tisbury:

- Tisbury recently completed a Drainage Master Plan, entitled "Drainage Master Plan – Final Report," and appendices dated January 2018 (hereafter, DMP) (Environmental Partners, 2018). The DMP included a Mapping and Assessment Program and a Prioritization Plan for addressing multiple drainage problems that cause or contribute to flooding in and around Tisbury, including:

  - Five Corners, where “frequent flooding in intersection and on commercial properties especially in high intensity storms and high tides” attributable in part to “large areas of impervious cover, including commercial buildings and parking lots”;
  - Union Street / Main Street, where “overland flow occurs in Union Street” in part due to “runoff that misses catch basins in the downtown area” and “large impervious areas that cause severe peak flow” such that there is “potential risk from flowing water in Union Street”; and
  - Delano Road / Causeway Road, where in part because “no drainage infrastructure exists upstream of Delano Rd and Villa Dr intersection,” the runoff “overtops structures” eventually discharging into Lagoon Pond which is nitrogen limited (i.e., the Lagoon Pond is at its upper limit for nitrogen assimilation capacity).
- The areas described refer generally to the Village of Tisbury (i.e., Vineyard Haven) which is denoted as R-10 on the Zoning Map. R-10 is a high-density residential area comprised of lots having minimum areas of about 10,000 ft^2, although the corresponding minimum dimensions for frontage (80 ft.) and lot depth (80 ft.) would equate to lot sizes of about 6,400 ft^2. The R-10 area slopes steeply to the northeast down towards the business district denoted as B-1 on the Zoning Map and Lagoon Pond, an estuary listed as impaired (high nitrogen). The area generally described here is more specifically described in the ‘base map’ provided in DMP Appendices A and B as the approximate ‘rectangle’ formed by Assessors Maps 15, 16, 19, 20, 21, 22, 23, 24 and 36. The rectangular area formed by these maps would appear to be approximately 4,800 ft. x 3,200 ft. (15.4 million ft^2).
- The soils of Tisbury are generally characterized as “outwash sand and gravel over sandy glacial till” and the soils of Martha’s Vineyard more generally characterized as “outwash plain (Qmvo) and eastern moraine (Qmvo/Qmv)”.
- Precipitation falling on impervious or semi-impervious cover in the Village causes or contributes to the flooding. Because the Village slopes quite severely (actual slope unknown) to the northeast and district B-1, it is likely that runoff from upgradient areas of the Village lack time and area to infiltrate, and run downhill and oversaturate the B-1 district (located adjacent to coastal estuaries), where hydrologically, discharge of flood waters lacks the hydraulic head and perhaps also the permeability for ready soil transmission (likely also tidally influenced) to the sea. In general, the capacity for the more inland / upgradient R-10 soils to infiltrate depends on the capacity (static depth and infiltration rate) of the R-10 soils to infiltrate runoff.
- Promoting infiltration by impervious cover disconnection (ICD) must consider the impact of infiltration on water quality, perhaps particularly for Martha’s Vineyard where drinking water supplies are uniquely constrained.

A.6 Project/Task Description and Schedule

The Town of Tisbury, MA, has requested assistance from the USEPA to address chronic (even acute) flooding and the generally poor transmission of stormwater runoff related to and resulting from IC. This collaborative project will achieve innovative and cost-effective management of stormwater for a broad range of management objectives (e.g., volumetric control to mitigate flooding; water reuse, resilience and sustainability; control of pollutants and protection of sensitive surface waters). The overall data quality objectives (DQOs) and criteria for data usage and documentation are presented in **Section A.7**.

The project includes the following specific tasks and deliverables:

- Prepare a Work Plan, Budget, and Schedule (see Table A-2);
- Prepare a Quality Assurance Project Plan (QAPP);

- Participate in a project kick-off meeting, monthly conference calls, and a post-project webinar;
- Conduct one (1) municipal coordination meeting with the City of Tisbury and USEPA;
- Developed a watershed characterization(s) by performing Geographic Information System (GIS) spatial data analyses;
- Conduct an Opti-Tool analyses for quantifying stormwater runoff volume, high-flow rates and pollutant loadings from watershed source areas;
- Develop High Runoff Flow Rate Metric(s) to Evaluate Source Area Contributions and SCM Reduction Benefits;
- Develop Planning Level SCM Performance Curves for Estimating Cumulative Reductions in SW-Related Indicator Bacteria;
- Identify Green Infrastructure Stormwater Control Opportunities and Potential Management Strategies for the Community;
- Conduct Field Investigations to Further Evaluate Community SCM Opportunities and Strategies;
- Develop SCM Conceptual Designs;
- Quantify Benefits for Municipal Long-Term SCMs Implementation Strategies;
- Develop Streamlined Technical Support Document to Quantify Benefits of SCMs for IC Disconnection;
- Final Project Meeting and Final Project Report; and
- Develop Streamlined Technical Support Document for Developing Long-Term Community SCM IC Disconnection Strategies.

This project will rely on a set of analytic tools, including spreadsheet tools, GIS, and the Opti-Tool. The model development process can be a good platform for gaining valuable information and insight about a natural system. If well-designed, the model development process is an iterative and adaptive cycle that improves understanding of the natural system over time as better information becomes available. Ultimately a model can inform future data acquisition efforts and management decisions by highlighting factors that have the most impact on the behavior of a natural system. A well-designed model development cycle is conceptually circular allowing for feedback loops at key points.

The tasks to be implemented under this QAPP are described in the following sub-sections. This project will include identifying, compiling, evaluating, and analyzing existing data (i.e., secondary data); conducting screening-level field reconnaissance of possible sites for SCMs; and developing a model to support SCM planning. Existing data for the purposes of this project will primarily be readily-available GIS and stormwater-related timeseries data.

A.6.1 Watershed Characterization & Data Analysis

Under this task, all available data will be reviewed and evaluated for possible use in characterizing the watershed characteristics, including drainage patterns, existing SCMs, problem areas for flooding or water quality, pollutants sources, setting model initial conditions, and performing modeling calibration. A preliminary list of data (e.g., GIS, precipitation timeseries) that will be part of this analysis are described further in **Section B.9**.

A.6.2 Opti–Tool Modeling

EPA Region 1 has developed the spreadsheet-based Opti-Tool, a stormwater best management practices optimization tool with two different design levels for use by municipal stormwater managers and consultants. The tool supports development of technically sound, robust, and optimized cost-effective stormwater management plans, which can demonstrate accountable progress and compliance with stormwater Municipal Separate Storm Sewer System (MS4) permit requirements.

The Opti-Tool provides the ability to evaluate options for determining the best mix of structural BMPs to achieve quantitative water resource goals specific to the New England Region. The tool incorporates long-term Hydrologic Response Unit (HRU) runoff and pollutant load timeseries for regional climate conditions that are calibrated to regionally representative stormwater data and annual average load export rates from nine (9) major land uses. Opti-Tool also incorporates regionally representative BMP cost functions and regionally calibrated BMP performance parameters for our pollutants, including total phosphorus (TP) and total nitrogen (TN), to calculate long-term cumulative load reductions for a variety of structural controls (USEPA 2016).

Setup of the Opti-Tool model will divide the City of Tisbury into discrete subwatersheds based on existing hydrologic criteria (i.e., existing drainage area boundaries, stormwater catchments, etc.). HRUs will be developed using available soils, slope, land cover, and land use datasets consistent with HRU categories provided in the Opti-Tool. The HRU distribution by subwatersheds, along with a representative historical precipitation timeseries, will be used to simulate stormwater runoff and pollutant load from the study area.

Upon approval of the QAPP, the GLEC Team will further analyze exisitng water quality datasets and identify any missing gaps or alternative information that is needed for analysis. Once complete, the Opti-Tool will be setup and applied as described above and in **Section B.7**. Application of the Opti-Tool is conducted entirely using secondary data. This process will involve gathering, evaluation and analysis of existing data. Evaluation of secondary data will be conducted based on USEPA guidance documents USEPA QA/G-9R and USEPA QA/G-9S (USEPA 2006a and b).

A.6.3 Field Reconnaissance for SCMs

The GLEC Team will also be conducting up to ten (10) field reconnaissance trips within the City of Tisbury to conduct observational field investigations to further explore SCM retrofit project opportunities and prioritize opportunities for further evaluation. The purpose of the investigations is to conduct cursory evaluations of project opportunities and to further evaluate the general feasibility of applying generic types of SCMs (e.g., rooftop disconnection, rain garden programs, IC removal, infiltration/filtration systems public right of ways, etc.) as part of a long term municipal SCM strategy. Information collected (notes and photographs) during the field investigations will be used to inform the development of conceptual designs of specific potential projects and conceptual designs of generic SCMs that may be adapted at suitable locations within the municipality. The feasibility of implementing the identified SCMs for conceptual designs will be based on the field notes and other readily available information (e.g., maps of topography and utilities, etc.)—no data collection (e.g., infiltration measurements or calculations) will take place as part of this project.

For these trips, our team will adhere to relevant components of EPA Region 1's Standard Operating Procedures (SOP) for Field Documentation & Records Management (USEPA 2017) and will document all field activities using dedicated bound logbooks. Logbook entries will be objective, factual, and free of personal feelings or other terminology that might prove inappropriate. All pertinent field activity information will be recorded contemporaneously when observed or collected to prevent a loss of information. No data produced during these field reconnaissance trips will be used without QA documentation, cross-referencing with readily-available datasets (e.g., GIS, construction drawings, utility surveys when available, etc.), and further review by staff outside of the field reconnaissance team. An effort will be made to investigate and verify the accuracy of all information obtained during these reconnaissance trips through independent examination by two (2) or more Team members while in the field. Other assumptions will be made throughout the study and we will document each with the rationale and justification for the assumption. Additional information on the types of information to be collected is presented in Section B.2.

A.6.4 Electronic Data and Administrative Record

Our team will maintain an ongoing, updated inventory of all data compiled (and how/if it is being used), all studies reviewed, all GIS data collected, all derived GIS products, all model input and output files (including calibration and validation calculations), all draft and final products, log books/field notes (electronic and hard copies), and project communications. All materials will be delivered to USEPA at the project close per the schedule in **Table A-2**.

A.6.5 Schedule

Table A-2. Project Schedule.

Project Elements/Sub-Tasks	Delivery Dates											
	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
Task 0: Work Plan, Budget, and Schedule												
Draft work plan, budget, and schedule	12-Oct											
Final work plan, budget, and schedule	•											
Task 1: Prepare Quality Assurance Project Plan												
Prepare draft QAPP	12-Oct											
Final QAPP	•											
Task 2: Project Management and Administration												
Kickoff call	4-Oct											
Kickoff meeting and summary	24-Oct											
Monthly progress calls and summaries												
Develop and present post-project webinar												15-Sep*
Task 3: Municipal Coordination Meeting												
Prepare meeting material, including the agenda		21-Nov*										
Participate in municipal coordination meeting, including preparation of materials		29-Nov*										
Prepare meeting notes			6-Dec*									
Task 4												
4A: Watershed Characterizations through GIS												
Draft technical approach memo		1-Nov										
Final technical approach memo		•										
GIS analysis results		28-Nov*										
4B: Opti-Tool Analysis for SW Volume, High Flow Rates, and Pollutant Loading												
Draft technical memo			15-Dec									
Final technical memo and Opti-Tool analysis results in Excel			•									
4C: High Runoff Flow Rate Metrics												
Draft technical memo					1-Feb							
Final technical memo					•							
4D: Develop Planning Level SCM Performance Curves												
Draft technical memo			15-Dec									
Final technical memo			•									
SCM performance curves in electronic format					15-Feb							
4E: Identify GI SW Control Opportunities and Management Strategies												
Develop meeing materials						1-Mar						
Attend and participate in meeting						7-Mar*						
List of SCM opportunities and strategies identified in meeting						15-Mar*						
4F: Conduct Field Investigations												
Draft informational brochure							15-Apr*					
Final informational brochure							29-Apr*					
Conduct and complete field investigations									1-Jun			
Draft technical memo									15-Jun			
Final technical memo									•			
4G: Develop SCM Conceptual Designs												
Draft conceptual designs in electronic format										15-Jul		
Final conceptual designs in electronic format										•		
4H: Quantify Benefits for Long-Term SCM Implementation Strategies												
Draft technical memo											15-Aug	
Final technical memo											•	
4I: Develop Streamlined Technical Support Document (TSD)												
Draft TSD											15-Aug	
Final TSD											•	
4J: Final Project Meeing and Final Report												
Participate in final project meeting											30-Aug*	
Submit draft final project report												15-Sep
Submit final project report												27-Sep
Task 5: Develop Streamlined TSD for Developing Long-Term SCM IC Disconnection Strategies												
Draft TSD												15-Sep
Final TSD												27-Sep

•=within 1 week of receiving comments from EPA
*=tentative, to be finalized in consultation with EPA
As needed, 1 call each month

A.7 Quality Objectives and Criteria for Measuring Data

This QAPP is intended to ensure that any collected information is of the quality necessary to support USEPA in the tasks described above. This support may include review of existing data; collection and review of additional data; performing data analyses in spreadsheets, databases, and models; and project deliverable review. The data quality criteria and/or quality control for each of these activities is outlined in the following subsections.

A.7.1 Data Compilation and Information Collection

In support of this project, the GLEC team will perform review of existing data and collection/review of new data (e.g., readily-available GIS datasets, site reconnaissance, etc.). We will review local and regional governmental and non-governmental sources for available land-use, flow gauging, and hydrologic data. GLEC will not perform sampling as part of this task order; however, we will conduct field visits to evaluate specific project opportunities and to further evaluate the general feasibility of applying typical generic types of SCMs identified during this project. Details of the field investigations will be presented to EPA in a technical memo. Factors that the GLEC Team will consider in reviewing gathered information for use in calibration and development of the models are described in **Table A-3**.

Table A-3. Factors considered when reviewing gathered information for model development

Quality Criterion	Description/Definition
Accuracy	All (100 percent) data will be proof read to ensure accurate data entry into any data tables, spreadsheets, or databases.
Completeness	All data collected or received into any data tables, spreadsheets, or databases will be checked to ensure presentation of results are complete.
Comparability	Data from different locations or within a single field site will be compared by checking methods used to collect the data and that the units of reporting are standardized.
Relevance	Data sources specific to the topic being investigated will be considered for use. Sources that most closely represent the topic/data of interest are the most relevant.
Reliability	The information/data source is reliable. For example, this criterion includes at least one of the following acceptance specifications: • The information or data are from a peer-reviewed, government, or industry-specific source. • The source is published. • The author is engaged in a relevant field such that competent knowledge is expected (i.e., the author writes for an industry trade association publication versus a general newspaper). • The information was presented in a technical conference where it is subject to review by other industry experts.
Representativeness/Content	The information/data source is representative in its content. Examples of source content can include extent of data (e.g., what geographical area does it cover, over what period) and level of documentation describing the generation of the data.

A.7.2 Opti–Tool and Other Analytical Tools

All Opti-Tool and other analytical spreadsheets will undergo review by technical/project staff other than the original spreadsheet developer. The responsibilities of the technical reviewer are to verify that the technical approach and procedures used in the spreadsheet are reasonable and logical, verify that the spreadsheet documentation is complete and clear, and verify that calculations and results are accurate by manually verifying equation cells. Project staff will document technical review of spreadsheets. As deemed necessary, the technical reviewer will provide a written summary of the data checked, errors or problems found, and recommendations for revisions. This summary may be provided separately or included in a QA worksheet in the spreadsheet workbook. Additional discussion of model calibration and proposed DQOs specific to Opti-Tool inputs and outputs are presented in **Section B.7**.

A.7.3 Deliverable Review

GLEC has an established internal QC review procedure for all deliverables (memoranda, spreadsheets, etc.). **Table A-4** shows the levels of review that GLEC requires for various types of deliverables. At the direction of the USEPA COR, GLEC will deviate from these levels of review to accommodate situations where there is limited time and/or budget.

Table A-4. Summary of required review levels by type of deliverable

Work Product	Degree of QC Reviewer Involvement			
	Team Member / Technical Reviewer	Project / Modeling QA Manager	Technical Editor	Senior Manager
Internal project documentation, including modeling and GIS products	●	--	--	●
Methodology development	●	--	●	●
Papers, reports, technical memos, and all project deliverables	●	●	●	●
QA Project Plan (QAPP)	●	●	--	●

GLEC conducts technical tasks and prepares deliverables using in-progress/interim deliverable reviews and final product reviews. The quality of intermediate products and draft and deliverables are evaluated as these work products evolve. Progress reviews include a check on calculations and data, and reviews of draft documents. Draft and final deliverables are reviewed by an independent senior manager and a technical editor prior to delivery to USEPA.

A.8 Special Training Requirements/Certifications

Work processes performed under this TO may require experience, advanced training, or academic degrees in such topics as environmental science, computer science, data management, GIS, statistics, engineering and SCM principles, and watershed management. The requirements will vary depending on the portion of the project that a staff member is assigned. Although no special certifications will be required for the planned analyses, the field investigations and conceptual plans will be developed under the direction of a professional engineer. All staff proposed to work on this project are trained and have a professional proficiency with the following skills that will be utilized in this project:

- Database management, basic database skills using such packages as Microsoft Excel or Microsoft Access and basic GIS skills;
- Experience in developing and reviewing datasets for model development;

- Experience with application and development of the Opti-Tool;
- High-level geospatial analysis using a variety of GIS software; and
- Strong science background and knowledge of major USEPA programs, including the Clean Water Act (CWA), and other major natural resource and water quality laws.

The GLEC Team PMs will be responsible for ensuring the qualifications of their respective staffs. All staff participating in this project will be qualified and have previous experience with the skills required for the assigned task. The GLEC Team does not expect to collect or review any confidential business information (CBI) under this task order; however, all project staff will strictly adhere to all USEPA procedures when handling industry information and will coordinate with the USEPA COR to ensure that CBI is not used or disclosed.

A.9 Documents and Records

Thorough documentation of all project activities will be a priority for the GLEC Team. We understand the need for document control for review, version control, and the development of an accurate electronic library and administrative record. Our team retains and stores all project documents and communications, including modeling input and output files that will be necessary for review of the study results.

Data and assumptions used to develop project models will be recorded and documented in the draft and final reports and memos as well as internal approach and preliminary results documents. We will document and save the results of technical reviews, model tests, assessments of output data and audits, actual input and databases used, and our responses to comments in model development.

The GLEC Team will deliver the project files that will contain copies of project documents and data, including model input and output datasets. GLEC will deliver those files to USEPA at the end of the project as part of final deliverables outlined in the PWS. GLEC will maintain files, as appropriate, as repositories for information and data used in models and for the preparation of any reports and documents during the project. GLEC will distribute the approved QAPP and any updates to the approved QAPP to project staff on the distribution list (**Section A.3**).

The following outlines the kinds of information and data that will be included in the hard copy or electronic project files in the administrative record:

- Reports and documents prepared, including the draft and approved QAPP;
- Electronic copies of model input/output;
- Electronic data files, including physical measurements, land use data, and any watershed data;
- Electronic copies of all GIS data, including derived products (some of this will likely be delivered via external hard drive or other electronic media based on the size of the files);
- Maps, photographs, and drawings;
- Results of internal technical reviews, model tests, data quality assessments of output data, and audits;
- Studies, reports, documents, and newspaper articles pertaining to the project (hard copy and electronic—hard copy documents may be scanned depending on size); and
- Contract and project information.

The GLEC Team will also prepare monthly progress reports that will address task and subtask milestones, deliverables, adherence to schedule, and financial progression at the end of each full month while the TO for this project is open.

The modeling software to be used on this project consists primarily of the USEPA developed Opti-Tool. The code and executables to be used are publicly available from USEPA. Any other post-processed model outputs (primarily Microsoft Excel-based) will be included with final electronic deliverables.

B. MEASUREMENT AND DATA ACQUISITION

Only sections B.1, B.2, B.7, B.9, and B.10 are included with this QAPP. The remaining sections are not relevant to this QAPP.

B.1 Sampling Process Design (Experimental Design)

As part of this project, the GLEC team will conduct reconnaissance-level field investigations to further explore SCM retrofit project opportunities and prioritize opportunities for further evaluation. The purpose of the investigations would be to evaluate specific project opportunities and to further evaluate the general feasibility of applying typical generic types of SCMs (e.g., rooftop disconnection, rain garden programs, IC removal, infiltration/filtration systems public right of ways, etc.) as part of a long term municipal SCM strategy.

The GLEC team will conduct up to ten (10) days of field investigations. These investigations will consist of field visits carried out collaboratively with Town of Tisbury municipal staff that have the responsibility and authority to implement, operate and maintain stormwater management infrastructure to ensure that GI SCM retrofits are compatible with end user maintenance culture.

Information collected during the field investigations shall be used to develop conceptual designs of specific potential projects and conceptual designs of generic SCMs that may be adapted at suitable locations within the municipality. The feasibility of implementing the SCMs identified for conceptual designs, or a variation thereof, shall be determined based on field investigations and other readily available information (e.g., maps of topography and utilities, etc.). To the extent practicable, efforts will be made to evaluate opportunities that include the most promising SCM types (applied in varying and typical settings) determined to be acceptable to the municipality and that also serve as examples/templates for future municipal work.

No collection of data will occur during this project and all information obtained will be qualitative in nature and will be used to inform the development of conceptual plans.

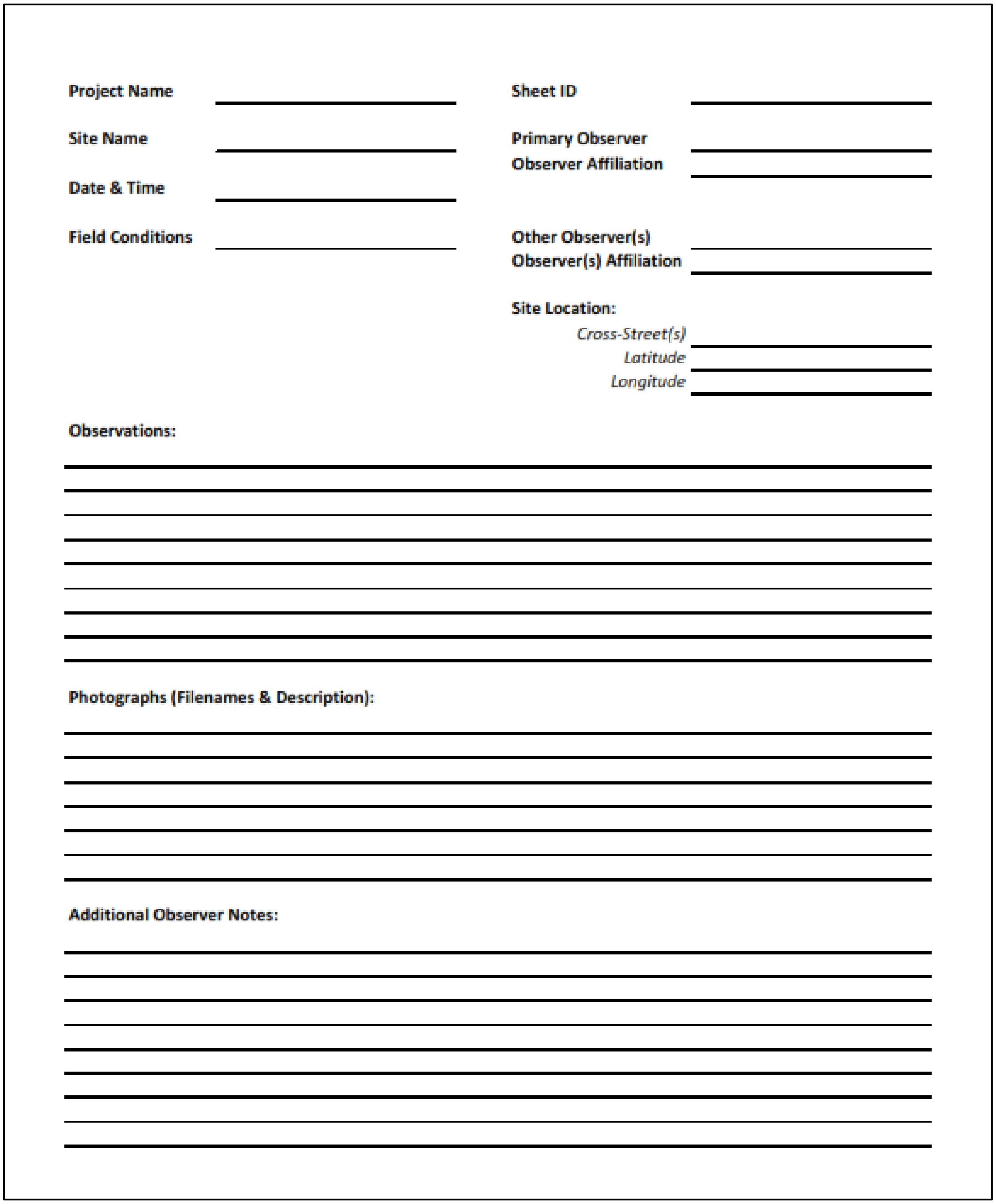
B.2 Sampling Methods

This project will consist of field visits to various locations throughout the Town of Tisbury jurisdiction and will be attended by the GLEC team and municipal staff. The results of the reconnaissance visits will include qualitative field notes and photographs identifying locations suitable for SCM placement. No physical samples will be collected. The following information will be recorded contemporaneously when observed (a sample page from the field logbook is included as **Figure B-1**):

- Project Name
- Sequential Sheet ID (i.e., a unique sheet identifier)
- Observer Name and Affiliation
- Others Present and Affiliations
- Date & Time of the Field Visit
- Site Name & Location
    - Location of the project site along with narrative description of the site

    - Identifying cross-street(s) and GPS coordinates
- Field Conditions (e.g., current weather)
- Observations (recorded by location and time)
    - Location(s) of existing storm drains
    - Location(s) of existing stormwater management infrastructure, including low impact development BMPs, and flood control structures
    - Locations of identifiable utility conflicts (e.g., manholes, valve covers, ground paint, etc.) with description of the type and location
    - Description of right-of-way including the presence of sidewalk, street median, other or easements, condition of any existing curb
    -
- Photographs
    - Identified by unique log number associated with the observation (e.g., filename)
    - Brief description of each photo as related to the observations field
    - Note that all photos should be geotagged and date stamped by the device
- Additional Observer Notes (i.e., relevant items not captured through other fields)

All information compiled will adhere to the procedures outlined in EPA Region 1's SOP (EPA 2017).



Project Name ______

Sheet ID ______

Site Name ______

Primary Observer ______

Observer Affiliation ______

Date & Time ______

Field Conditions ______

Other Observer(s) ______

Observer(s) Affiliation ______

Site Location:

Cross-Street(s) ______

Latitude ______

Longitude ______

Observations:

Photographs (Filenames & Description):

Additional Observer Notes:

Figure B-1. Example logbook page for recording field observations.

B.3 Sample Handling and Custody

This section is not application to this QAPP.

B.4 Analytical Methods

This section is not application to this QAPP.

B.5 Quality Control

This section is not application to this QAPP.

B.6 Instrument/Equipment Testing, Inspection, and Maintenance

This section is not application to this QAPP.

B.7 Calibration

The USEPA QAPP guidance indicates that calibration refers to the configuration and refinement of the analytical instruments that will be used to generate analytical data. As eluded to in the QAPP modeling guidance document, by analogy the "instrument" is the predictive tool (i.e. the model) that is to be developed and/or applied. A robust modeling platform not only makes the best use of available data, but also, it may help to highlight certain areas of deficiency in understanding of the natural system. Ultimately a model can inform future data acquisition efforts and improve understanding of the behavior of a natural system. In this context, model calibration is defined as the systematic changing of initial model parameters to minimize error between predicted and observed values. Model validation is an evaluation of the model goodness-of-fit using an independent data set.

Opti-Tool and its SWMM-based sub modules have been developed and their runoff coefficients have been previously calibrated using rainfall-runoff and precipitation data for the Boston metro area from 1992 – 2014 during model development (USEPA 2016). The regionally-calibrated Opti-Tool and its SWMM module will be used to generate total annual stormwater total nitrogen loads and stormwater flow contributions within the watershed.

Precipitation characteristics (i.e., magnitude, intensity, frequency, and duration) are the primary factors that determine both stormwater quality and BMP performance. As part of developing the BMP performance curves for EPA Region 1, precipitation data analyses were conducted using long-term precipitation data from ten (10) locations across the New England region. Based on the results of this analysis, it was concluded that precipitation patterns, primarily the distributions of storm events by depth and inter-event dry periods, are similar throughout the New England region (USEPA 2010). Because of the regional similarity in precipitation patterns cited in the previously mentioned study, EPA has generally considered the default HRU timeseries provided with Opti-Tool to be reasonably representative of precipitation conditions in many areas of New England. Further, this work assignment will focus on achieving relative percent (%) pollutant load reductions from the study area to inform management decisions. The default Opti-Tool loading information should yield meaningful results about the management opportunities needed for achieving percent reductions.

Since the runoff export coefficients were established and calibrated for the region during Opti-Tool model development, no modification of hydrology and water quality parameters is expected and no quantitative calibration against observed data is planned. Instead, a weight-of-evidence approach will be utilized which emphasizes similarity between simulated and observed system behavior. Measurements of similarity will include:

- Reasonable system behavior based on general professional experience (e.g., verifying expected relative water balance between runoff and evapotranspiration, confirming relative pollutant loading trends across land use types, etc.),
- Visual inspection of model timeseries plots and observed rainfall timeseries plots, and
- Comparison of mean data and mean model results.

Any calibration and validation activities and procedures will be documented in associated technical memorandums.

B.8 Instrument/Equipment Calibration and Frequency

This section is not application to this QAPP.

B.9 Data Acquisition (Non-Direct Measurements)

Non-direct measurements (i.e., secondary data) are data that were previously collected under a different effort outside this task order. Non-direct data can come from numerous sources, but the non-direct data most likely to be used for this project will originate from the Massachusetts GIS (MassGIS) repository per USEPA request (MassGIS 2018). Non-project-generated data may be obtained from published or unpublished sources. The published data are likely to have had some form of peer review. These data are generally examined by modelers as part of a data quality assessment. Databases that have not been published are also examined in light of a data quality assessment. The GLEC Team will confirm that data provided by USEPA, USGS or other sources meets precision objectives established by those entities. A preliminary list of secondary datasets identified through review of the PWS and development of the work plan are presented in **Table B-1**.

Table B-1. Inventory of non-direct measurement datasets to be collected under this work assignment

Source	Dataset	Purpose
MassGIS	Impervious Surface	Base layer for impervious cover for use within the Opti-Tool HRUs and field reconnaissance
	Land Use	Representing existing lad use within the Opti-Tool model HRUs
	NRCS SSURGO-Certified Soils	Representing Hydrologic Soil Groups (HSG) in the Opti-Tool model HRUs
	Digital Elevation Model (DEM)	Deriving and representing slope categories within the Opti-Tool model HRUs
	LiDAR Terrain	
	Building Structures (2-D)	Representation of buildings to cross-reference against impervious surface layer and for reference use during field reconnaissance
	Drainage Sub-basins	Reference layers for delineation of watershed and subwatershed boundaries; these may be further sub-divided as needed for the project goals
	NRCS HUC-12 Subwatersheds	
Town of Tisbury	Building Footprints	Additional building footprint data published by the City of Tisbury to cross-reference against MassGIS data
	Right-of-Way	Reference for parcel ownership and public right-of-way for use during the desktop opportunity screening and field reconnaissance
	Parcel Lines (2018)	
	Zoning (2007)	Additional land use data published by the City of Tisbury to cross-reference against MassGIS data

The quality of data used for this project is addressed, in part, by the training and experience of project staff (as described in **Section A.8**) and the documentation of project activities (as described in **Section A.9**). This QAPP and other supporting materials will be distributed to all personnel involved in this project. Mr. Craig (Paradigm QA Manager) and Mr. Riverson (Paradigm Modeling QC Officer) will ensure that all tasks described in the task order are carried out in accordance with this QAPP.

GLEC Team personnel performance will be reviewed throughout each of the project phases to ensure adherence to project protocols. QC is defined as the process by which QA is implemented in the project. GLEC Team personnel will conform to the following guidelines:

- All activities that include data interpretation, load calculations, or other related computational activities are subject to audit, peer review, or both. GLEC Team personnel will maintain careful written and electronic records.
- A written record of where the data used in the project analyses were obtained will be kept, and any information on data quality will be documented for inclusion in the final report. A written record on where this information is located on a computer or backup media will be maintained in the project files.
- GLEC Team personnel will evaluate the quality of all existing data. When existing data are published with an accompanying report, document, or other metadata describing data quality, data quality will be inferred from statements made in the accompanying documentation. Additionally, existing data values incorporated into the Opti-Tool model or report will be verified against the source data (i.e., transcription checks).
- Non-modeling data (e.g., watershed characterization and data assessment) will be checked through technical reviews.

B.10 Data Management and Hardware/Software Configuration

The GLEC Team will conduct limited primary data collection consisting primarily of qualitative field reconnaissance for this work assignment. For reconnaissance trips, our team will maintain field notes that summarize information relevant to this project, including details of each location, any USEPA or Town staff present and their observations or comments, the date and location of the observations, and any other noteworthy conditions. The information obtained might include references to other studies or anecdotal information about the watershed/site. All information will be summarized and how and if the information will be used in subsequent analyses will be highlighted.

Secondary data collected as part of this task will be maintained as hardcopy only, both hardcopy and electronic, or electronic only, depending on their nature. In some cases, hardcopy reports will be scanned and/or digitized if they are not too large or in a condition that precludes easy scanning or digitization. If scanned, the document will be included in the electronic repository. Our team routinely deals with large amounts of data from diverse sources and in multiple formats. We are experienced at managing and storing information in an orderly fashion to avoid the production of conflicting or duplicate data and to allow for the efficient transfer of project files and administrative record in a timely and accurate manner. The GLEC Team will perform general quality checks on the transfer of data from any source databases to another database, spreadsheet, or document. Other activities related to model development, such as verifying continuity of boundary conditions and observed data during calibration, will be performed in accordance with direction from the project QC Officer.

The Opti-Tool modeling software will be the primary model use for this project and the code, executables, and project documentation are all readily and publicly available from USEPA.

The nature of the GLEC Team's work requires that we possess and maintain a variety of state-of-the-art computer resources. All of our team's computer resources are covered by on maintenance agreements and can also be serviced by on-site specialist. We also possess computer redundancy to ensure resources are always available. If a problem with a computer or server occurs, our computer specialists diagnose the problem and correct. Routine maintenance of computers and servers is performed by in-house computer specialists. All computers are connected to a surge suppressor to protect them from damaging voltage spikes. The GLEC project files are stored on the company network server which is backed up nightly. Screening for viruses on electronic files loaded on computers or the network is standard company practice and every machine has the latest updated antivirus installed. Regular maintenance, and update if necessary, of software is performed to keep up with changes in computer storage, media, and software.

C. ASSESSMENT AND OVERSIGHT

The QA program for this TO provides a framework to oversee the quality of work being released to clients. It consists of QC reviews, QA audits, and technical reviews. QC is the process of checking specific work products completed for a task. QA audits provide a method for checking that work performed follows established procedures. Audits help to standardize the product that is provided to the client. Finally, technical reviews ensure the accuracy of reports that are published for or delivered to the client.

C.1 Assessment and Response Actions

The GLEC Team will use secondary data discussed in **Section B.9** for development of model inputs. The Paradigm Modeling Quality Control Officer (QCO), Mr. Riverson, will conduct an examination of representativeness and comparability of project-generated input and output data. Modelers will cross-check data for normality, outliers, and other potential problems through visual inspection of timeseries and comparison of mean data to model means as discussed in **Section B.7**.

The QA program under which this TO will operate includes surveillance, with independent checks of the data obtained from sampling, analysis, and data-gathering activities. The essential steps in the QA program are as follows:

- Identify and define the problem;
- Assign responsibility for investigating the problem;
- Investigate and determine the cause of the problem;
- Assign and accept responsibility for implementing appropriate corrective action;
- Establish the effectiveness of and implement the corrective action; and
- Verify that the corrective action has eliminated the problem.

If problems arise in the process of completing the aforementioned activities, the GLEC PM will determine the appropriate long-term or short-term action to be taken. Steps to address the problem could include investigation and determining the cause of the problem, implementing a corrective action, and following up with team members to ensure that the appropriate corrective action has been taken and that the problem has been resolved. If these steps do not adequately address the problem, the GLEC QAO will be responsible for corrective action and will inform the GLEC PM as appropriate.

GLEC will prepare monthly progress reports and provide them to the TOCOR. These progress reports will describe the status of the project and work completed, including any identified problems with remedies, as well as anticipated work to be completed during the next reporting period.

C.2 Reports to Management

Individual assignment status will be reported on a monthly basis to the PM by each individual staff member. These reports will be submitted at the beginning of the month and will cover the previous month's activities. The PM will compile inputs from all project staff and create a monthly report for their task order that will be reviewed by the GLEC PM. The monthly report will be edited and formatted by the document preparation staff prior to submission to the COR. All QC documentation forms will be signed by the Project Manager. This will ensure that the Project Manager is kept informed about QA/QC problems that may exist within the project.

D. DATA VALIDATION AND USABILITY

D.1 Departures from Validation Criteria

Data review is an internal check performed to ensure that data have been recorded, calculated, and transmitted correctly by checking original records, transcription, and calculations for errors (USPEA 2002). The GLEC Team will perform a proof-read level check (i.e., 100% check) for all data transcribed from existing data sheets, field notebooks, literature sources, and other data sources to work assignment products (e.g., spreadsheets models, databases, reports). The GLEC team Program Manager and Project Manager will be responsible for the review of data.

Data verification is process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements (USPEA 2002). The GLEC Team will compare the data to the data quality criteria presented in **Table A-3** and identify any data that do not meet the requirements. The GLEC team Project Manager, or his designee, will be responsible for data verification.

Opti-Tool model inputs and Opti-Tool model outputs will be evaluated as part of data verification as part of the "weight of evidence" approach described in **Section B.7** which will rely on visual inspection of model data plots and observed input data. Any comparison of model results yielding differences in system behavior from visual inspection or comparison with expected mean values will trigger a discussion between the GLEC Team and USEPA regarding: (1) potential causes of the discrepancy, and (2) obtaining a consensus on how the discrepancy will affect the use of the model for application purposes. Discussion will generally reflect the cause of non-agreement within the context of the study objectives.

D.2 Validation Methods

Data validation is an analyte and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set. No data validation will be performed because no sample data will be collected as part of the work assignment.

D.3 Reconciliation with User Requirements

All data quality indicators will be calculated at the completion of the data analysis phase. Measurement quality requirements will be met and compared with the DQOs to confirm that the correct type, quality, and quantity of data are being used for the analyses. The Paradigm QCM (Mr. Riverson) will perform internal reviews to assess departures from assumptions established in the planning phase of the modeling process. If requested by the USEPA COR and funding is available, the GLEC Team will perform a post-audit for the project. A post-audit is an evaluation of the correctness of the initial model predictions conducted several years after the original modeling study is completed. If the models' predictions are deemed to be representative of the natural system, the model can be considered valid for making management decision at the specific site and the actual stresses. A post-audit requires new field observations for the predicted variables, which are to be collected at a time after the system has had a chance to adjust to the management changes. Uncertainties and limitations in the use of such data and interpretation of results will be provided to USEPA.

E. REFERENCES

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