

Clean Water Act §319(h) Nonpoint Source Grant Program

Development of the Lower Nueces River Watershed Protection Plan Water Hyacinth Infestation Evaluation

**TSSWCB Project # 12-05
Revision 0**

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Prepared by
Nueces River Authority

Effective Period: Upon EPA approval through September 2015
with annual revisions required

Questions concerning this quality assurance project plan should be directed to:

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Section A1 Approval Sheet

Quality Assurance Project Plan (QAPP) for the *Development of the Lower Nueces River Watershed Protection Plan – Water Hyacinth Infestation Evaluation*.

United States Environmental Protection Agency (EPA), Region VI

Name: Curry Jones
Title: USEPA Chief State/Tribal Programs Section

Signature: _____ Date: _____

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source Project Officer (PO)

Signature: _____ Date: _____

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Jana Lloyd
Title: TSSWCB Project Manager (PM)

Signature: _____ Date: _____

Name: Mitch Conine
Title: TSSWCB Quality Assurance Officer (QAO)

Signature: _____ Date: _____

Nueces River Authority (NRA)

Name: Rocky Freund
Title: Deputy Executive Director / NRA PM

Signature: _____ Date: _____

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List of Acronyms and Abbreviations

BMP	Best Management Practice
BRC	Texas A&M AgriLife Research & Extension – Blackland Research Center
CAR	Corrective Action Report
CD	Compact Disc
CRP	Clean Rivers Program
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
FM	Farm to Market Road
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
NRA	Nueces River Authority
NRWP	Nueces River Watershed Partnership
PM	Project Manager
PO	Project Officer
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAO	Quality Assurance Officer
QC	Quality Control
SH	State Highway
SWPP	Source Water Protection Plan
TDS	Total Dissolved Solids
TCEQ	Texas Commission on Environmental Quality
TSSWCB	Texas State Soil and Water Conservation Board
USGS	United States Geological Survey
WPP	Watershed Protection Plan

Unit Abbreviations

mg/l	milligrams per liter
NTU	Nephelometric Turbidity Unit
µg/l	micrograms per liter

Section A3: Distribution List

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

United States Environmental Protection Agency, Region VI (EPA)

1445 Ross Avenue, Suite 1200 (6WQ-AT)
Dallas, TX 75202-2733

Name: Curry Jones
Title: USEPA Chief State/Tribal Programs Section

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source PO

Texas State Soil and Water Conservation Board (TSSWCB)

PO Box 658
Temple, TX 76503

Name: Jana Lloyd
Title: TSSWCB PM

Name: Mitch Conine
Title: TSSWCB QAO

Nueces River Authority (NRA)

400 Mann St. Suite 1002
Corpus Christi, TX 78401

Name: Rocky Freund
Title: Deputy Executive Director

Section A4: Project/Task Organization

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

EPA – Environmental Protection Agency, Region 6, Dallas, Texas. Provides project oversight and funding at the federal level.

Henry Brewer, EPA Texas Nonpoint Source PO

Responsible for overall performance and direction of the project at the federal level. Ensures that the project assists in achieving the goals of the Clean Water Act. Reviews and approves the QAPP, project progress, and deliverables.

TSSWCB – Texas State Soil and Water Conservation Board, Temple, Texas. Provides project overview at the State level.

Jana Lloyd, TSSWCB PM

Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Tracks and reviews deliverables to ensure that tasks in the workplan are completed as specified. Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants.

Mitch Conine, TSSWCB QAO

Reviews and approves QAPP and any amendments or revisions. Responsible for verifying that the QAPP is followed by project participants. Monitors implementation of corrective actions. Coordinates or conducts audits of modeling procedures. Determines that the project meets the requirements for planning, quality assurance (QA), quality control (QC), and reporting under the TSSWCB Clean Water Act §319(h) Nonpoint Source Grant Program.

NRA – Nueces River Authority, Corpus Christi, Texas. Provides project coordination and administration, coordinates QA, and modeling.

Rocky Freund, NRA Deputy Executive Director,

Responsible for ensuring the smooth operation of the project, timely delivery of quality deliverables and general project coordination and administration at the local level. Coordinates contractor activities and inclusion of modeling and survey results into the watershed protection plan (WPP). Facilitates the watershed steering committee and development of the WPP. Responsible for the development of a geographic information system inventory of the project watershed. Responsible for creating an inventory of on-site sewage facilities. Responsible for development of data quality objectives (DQOs) and QAPP. Responsible for data acquisition.

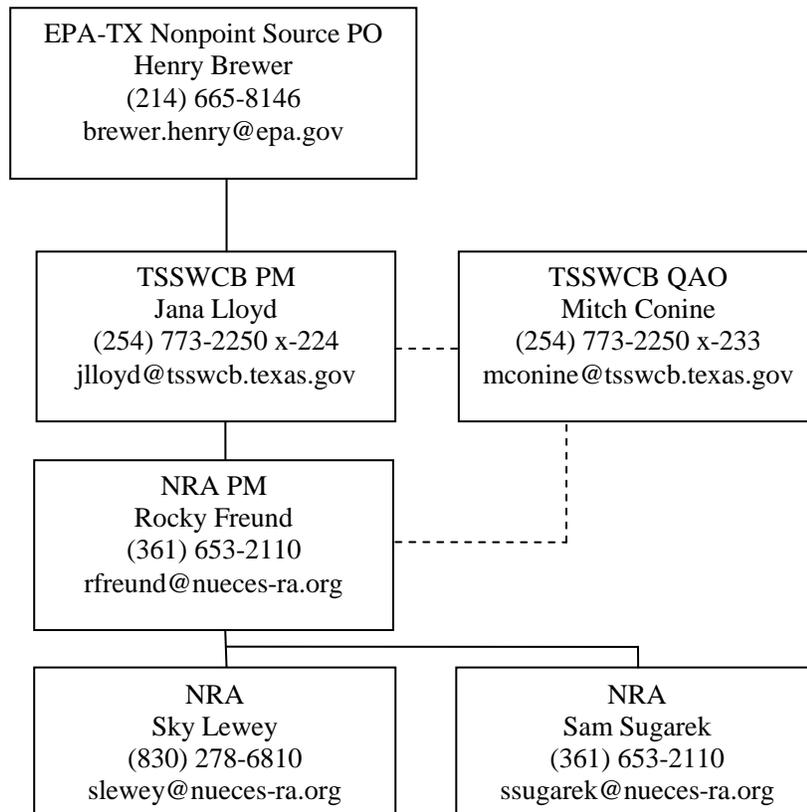
Sky Lewey, Resource Protection and Education Director

Responsible for assisting with the development of the DQOs and QAPP. Responsible for assisting with data acquisition.

Sam Sugarek, Director of Water Quality Programs

Responsible for assisting with data acquisition. Responsible for supervising field work to collect ground truth information.

Figure A4-1. Project Organization Chart



Section A5: Problem Definition/Background

The Lower Nueces River is 39 river miles long and is located in parts of Jim Wells, Nueces, and San Patricio Counties. The 116,862-acre watershed is primarily agricultural (cultivated crops hay, and pasture lands). The City of Corpus Christi, population 305,215, lies at the downstream end of the segment, but only a small portion (<1%) falls within the watershed boundary. The City of San Patricio, population 395, is located in the middle of the watershed near the river along Farm to Market Road (FM) 666. 83% of the City of Mathis, population 4,936, is located in the watershed between the river and the Bayou Creek tributary. There are no permitted wastewater treatment facilities in the watershed. The wastewater permit annotation on the map is a no-discharge permit for a sand and gravel operation in the event of excessive rainfall events. There are only two road crossings on this segment – State Highway (SH) 359 just below Wesley Seale Dam at Lake Corpus Christi and FM 666.

Water quality monitoring at SH 359 (12965) and FM 666 (12964) has been conducted since 1977 (Figure A5-1). Early sampling was conducted by the City of Corpus Christi and the United States Geological Survey (USGS). NRA began routine quarterly sampling under the Texas Commission on Environmental Quality's (TCEQ) Clean Rivers Program (CRP) in 1998. A third site at Hazel Bazemore Park (20936) was added to the CRP routine quarterly sampling beginning Fiscal Year (FY) 2011.

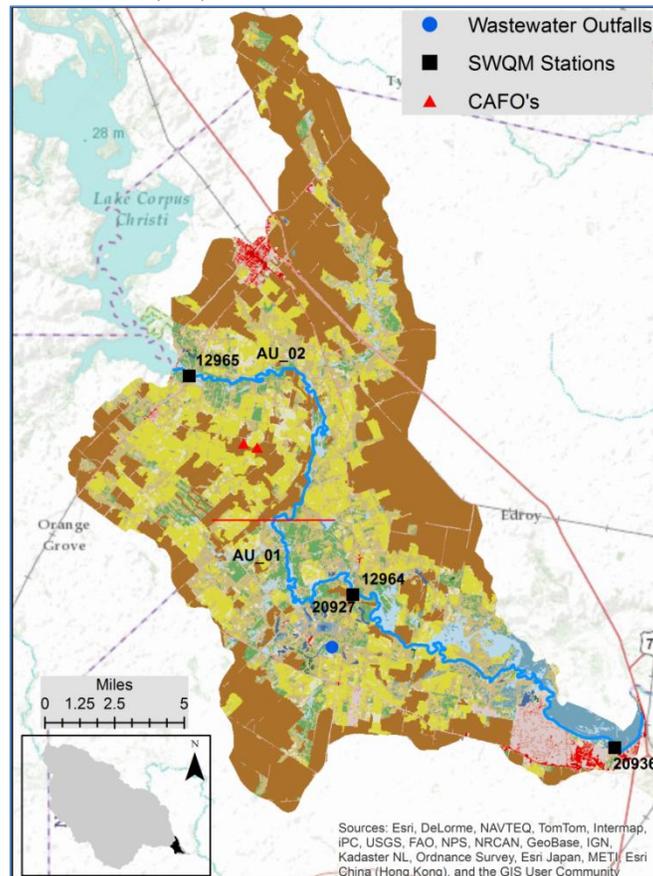


Figure A5-1. Lower Nueces River Watershed

State and federal water resource management and environmental protection agencies have embraced the watershed approach for managing water quality. The watershed approach involves assessing sources and causes of impairments and potential impairment concerns, and utilizing this information to develop and implement watershed management plans. The 2012 303(d) list indicates the Lower Nueces River (Segment 2102) is impaired for total dissolved solids (TDS) and has a concern for chlorophyll-*a*. The average TDS level of 546 mg/l exceeds the 500 mg/l standard. The chlorophyll-*a* concern is based on 9 of 28 samples exceeding the 14.1 µg/l. This project will address these issues as well as sediment issues in the Lower Nueces River watershed.

A turbidity spike (from 20 NTU to 1,900 NTU) in November 2009 resulted in a drinking water violation at the City of Corpus Christi O.N. Stevens Water Treatment Plant. A sediment loading model, developed by USGS, indicated that the turbidity increase was most likely due to localized, heavy rainfall in the Bayou Creek tributary. The land use in the Bayou Creek watershed is primary farmland, which was bare after crop harvest at the time of the storm event. However, major bank manipulation by landowners, may also be contributing to the problem.

The Lower Nueces River is the primary drinking water source for nearly 500,000 people in the Coastal Bend Region and also supplies industrial users in the area. The water is released from Lake Corpus Christi and travels approximately 39 miles to water treatment plant intakes. Better water quality reduces treatment costs and allows industry to cycle water through their cooling towers for longer periods of time, reducing the overall amount of water needed for their operations.

The City of Corpus Christi contracted with NRA (FYs 2011 and 2012) to develop a Source Water Protection Plan (SWPP) to provide evaluation and cost estimates of best management practices (BMP) to help protect the river and the water it provides. It was modeled after USEPA's Elements of Successful WPPs and will be incorporated into the Lower Nueces River WPP.

The Nueces River Watershed Partnership (NRWP) was formed to serve as a means to gather stakeholder input and direction in development of the SWPP. The NRWP met six times between January 2011 and July 2012. Workgroups were also formed to provide more specific input and information. The following workgroups each met once between February 2011 and May 2011: Education and Outreach, Water Quality, Utilities, Agriculture, and Recreation. The mission statement of the NRWP, developed by the Education and Outreach workgroup and adopted by the full NRWP is *"To improve and protect the water quality of the Nueces River Watershed so that the river is restored and preserved for current and future generations."* The SWPP document is available on the NRWP website <http://www.nuecesriverpartnership.org/>.

The purpose of this project is to develop a nine element WPP for the Nueces River Below Lake Corpus Christi Watershed by providing direction for a stakeholder group that will serve as a decision-making body, identify potential nonpoint source pollution threats and/or

concerns, conduct pollutant load evaluations, identify management measures to reduce and protect water quality, as well as conduct education and outreach activities.

Section A6: Project Goals and Task Description

Water hyacinth is a free-floating perennial aquatic plant. It is prolific and can double its population in a short amount of time. When left uncontrolled, water hyacinth can completely cover the surface water of lakes, ponds, and sections of rivers. This blocks sunlight from reaching native aquatic plants and reduces oxygen level, which could result in a reduction of aquatic life such as fish and turtles.

NRWP stakeholders have voiced concerns about the rapid spread of large colonies of water hyacinth (or other invasive species) and their effect on water quality, aquatic environment, riparian habitat, and its obstruction to water flow. Areas of the river being completely covered by water hyacinth have been documented on a number of occasions. The City of Corpus Christi has previously removed water hyacinth from the river, but no routine maintenance has been established in order to prevent re-occurrence.

NRA subcontracted with Texas A&M AgriLife Research and Extension – Blackland Research Center (BRC) to conduct an evaluation of the river to document large debris using side scan sonar and was asked to report on any water hyacinth colonies they observed. In April 2014, BRC surveyed the river from the saltwater barrier to approximately 12 miles upstream. At this point the river became too shallow for the boat. There is no access to launch a boat above this point. They reported seeing no significant water hyacinth colonies during their survey.

NRA will subcontract with a licensed helicopter service to conduct the hyacinth survey of the river. NRA personnel will be on the flight, one to take geo-referenced photographs, and the other to take a continuous stream of still photographs (one photo every 5 – 60 seconds, depending on altitude, as opposed to a continuous video). The photographs will be compared to Google Earth to obtain Global Positioning System (GPS) coordinates of the observed colony locations. NRA personnel will also conduct a short on-the-river survey to document location and size of at least one area of infestation. This data will be used to ground truth the data collected during the helicopter survey. The ground-truthing survey will be conducted shortly after the QAPP has been approved and is in place for this project. NRA may conduct a second survey, in the same manner, to document temporal changes of the hyacinth colonies.

The objective of this survey is to identify and map areas of water hyacinth colonies within Nueces River Segment 2102. Data will be collected and analyzed to determine percentage of infestation in relation to the total river area. This objective is centered on the qualitative field data acquisition of GPS coordinates. These coordinates and estimated colony sizes will be transferred to a Geographic Information System (GIS) data layer. Deliverables of this project, a map, and associated statistics, will be developed using this data layer. Based on this information, quantitative inferences may be made with regard to environmental impact, risk potential, and remediation cost. Results of the evaluation will be used to develop a management plan for water hyacinth removal and control. Results will ultimately be incorporated into the WPP.

Section A7: Quality Objectives and Criteria

WPP development for the Nueces River below Lake Corpus Christi will include consideration of water hyacinth survey results in order to evaluate the extent of infestation in Nueces River Segment 2102. The GPS coordinates and aerial extent approximations obtained while conducting the survey will be able to provide adequate information to initiate development of a management plan for control and removal. This information will be used to help stakeholders make informed decisions regarding WPP development and the resulting management plan. Data obtained during this survey will meet the data needs presented in Section A6.

Precision

Precision is the ability of a measurement to be consistently reproduced; the number of significant digits to which a value has been reliably measured. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error. In reference to this project, precision will be determined by the ability to compare photographs and video collected during the course of the survey to Google Earth in order to obtain GPS coordinates for the observed colony locations. Data collected during the ground truthing survey will be used to verify aerial extent estimated from the photographs and video.

Accuracy

Accuracy is the ability of a measurement to match the actual value of the quantity being measured; it is the degree of agreement between a measured or computed value of a physical quantity and the standard or accepted value for that quantity. In reference to this project, accuracy will be determined by the ability to reasonably estimate the size and location of the hyacinth colonies based on the correlation of the photographs and video to Google Earth. Google Earth depends on the accuracy of the GPS satellites from which it gathers its information.

The GPS coordinates taken during the ground truthing survey will be recorded using a Garmin GPSmap® 76. It is wide area augmentation system enabled for accuracy with 3 meters. The aerial photographs will be taken with a Sony Cyber-shot DSC-HX100V camera with 16.2 megapixels resolution and equipped with GPS. Latitude and longitudes plotted from some photos have been off by up to 50'. This distance will be close enough to accurately locate the area on Google Earth. A GoPro® Hero 3 Black Edition will be used to record the continuous stream of still photographs.

Representativeness

Representativeness is the degree to which the photographs and video document the hyacinth colonies.

Completeness

The GoPro® will be used to record a video over the river during the entire flight over the river for 100% coverage.

Section A8: Special Training Requirements/Certification

NRA staff have received the appropriate experience, education and/or training required to adequately perform their duties. No special certifications are required. Personnel involved in the use of GPS instruments have training and/or expertise regarding their appropriate use.

Section A9: Documentation and Records

All records, including notebooks and electronic files, will be archived by NRA for at least five years. Notes, photographs, and video will be stored on the PM’s computer and on a thumb drive. Electronic data on the project computer are backed up daily to the primary network drive. The network drive is backed up monthly to a secondary/redundant network drive and to compact discs (CDs). In the event of a catastrophic systems failure of the project computer, the primary network drive can be used to restore the data in less than one day’s time. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases. In the event of a catastrophic systems failure of the primary network drive, project data on the secondary network drive will be brought up to date with the information on the project computer.

Corrective Action Reports (CARs) will be utilized when necessary (Appendix A). CARs document root cause, impact, specific corrective action to address the deficiency, action to prevent recurrence, individuals responsible for each action, the timetable for completion of each action, and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports and will be maintained in an accessible location for reference at NRA. CARs resulting in any changes or variations from the QAPP will be made known to pertinent project personnel and will result in an amendment to the QAPP. In addition, significant conditions (situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

Table A9-1 Project Documents and Records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	NRA	5 years	Paper/Electronic
QAPP distribution documentation	NRA	5 years	Paper/Electronic
CARs	NRA	5 years	Paper/Electronic
Notes, photographs, video	NRA	5 years	Paper/Electronic
Progress reports/ Final Reports	NRA/TSSWCB	5 years	Paper/Electronic

TSSWCB may elect to take possession of records at the conclusion of the specified retention period. The notes, photographs, and video will be delivered to the TSSWCB as requested.

QAPP Amendments

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods; address deficiencies and non-conformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the NRA PM to the TSSWCB PM in writing. The changes are effective immediately upon approval by the TSSWCB PM and QAO, or their designees, and the EPA PO. Amendments to the QAPP and the reasons for the changes will be documented and distributed to all individuals on the QAPP distribution list by the NRA PM. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process.

QAPP Revisions

This QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved version of the QAPP shall remain in effect until a revised version has been fully approved by the TSSWCB PM and QAO and the EPA PO; the revision must be submitted to the TSSWCB for approval before the last approved version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This can be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Section B1: Sampling Process Design (Experimental Design)

NRA will subcontract with a licensed helicopter service to conduct the hyacinth survey of the river. NRA personnel will be on the flight to take geo-referenced photographs and continuous video of the survey. The photographs and video will be compared to Google Earth to help verify colony locations. NRA personnel will also conduct a short survey, via boat, to document location and size of at least one area of infestation. This data will be used to ground truth the data collected during the helicopter survey. The ground truthing survey will take place within one week of the aerial survey. NRA will conduct a second survey in the same manner to document temporal changes of the hyacinth colonies. GIS maps will be created using the information obtained during the surveys.

Section B2: Data Collection Methods

The GPS coordinates taken during the ground truthing survey will be recorded using a Garmin GPSmap® 76. It is wide area augmentation system enabled for accuracy within 3 meters. Aerial photographs will be taken with a GPS-equipped Sony Cyber-shot DSC-HX100V camera with 16.2 megapixels resolution. The accuracy of the latitude and longitudes plotted from some photos may vary by up to 50'. This distance is sufficient to accurately locate the area on Google Earth. A GoPro® Hero 3 Black Edition will be used to record the stream of still photographs.

Section B3: Sample Handling and Custody Requirements

A series of photographs and video, along with GPS coordinates, will be collected as part of this evaluation. All photographs and video will be logged electronically and transferred to backup electronic media.

Section B4: Analytical Methods

The photographs and video will be compared to Google Earth to help verify colony locations. Aerial extent will be calculated based on coordinates derived from Google Earth. GIS maps will be created using the information obtained during the surveys.

Section B5: Quality Control Requirements

GPS locations and aerial parameters recorded during the ground truthing survey will serve as a QC check.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

All equipment, including battery life, will be inspected and confirmed to be in operating order according to manufacturer's specifications, prior to the helicopter and ground truthing surveys. Extra batteries will be included for use if needed during the surveys.

Section B7: Instrument Calibration and Frequency

Although no calibration of GPS is necessary, a position confidence check will be conducted through standard static techniques. Surveyed values will be reviewed to assure target horizontal accuracy is achieved.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

No significant consumables are required because all data are digitally recorded.

Section B9: Data Acquisition Requirements (Non-direct Measurements)

Additional GIS layers used to create maps will be obtained from agencies such as TCEQ, United States Department of Agriculture – Natural Resources Conservation Service, USGS, Texas Water Development Board, and any other entities, not directly mentioned, that maintain and make available accurate, state-wide information.

Section B10: Data Management

Backup and Disaster Recovery

Electronic data on the project computer are backed up daily to the primary network drive. The network drive is backed up monthly to a secondary/redundant network drive and to CDs. In the event of a catastrophic systems failure of the project computer, the primary network drive can be used to restore the data in less than one day's time. Computer data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases. In the event of a catastrophic systems failure of the primary network drive, project data on the secondary network drive will be brought up to date with the information on the project computer.

Archives and Data Retention

All records, including notebooks and electronic files, will be archived by NRA for at least five years. Notes, photographs, and video will be stored on the PM's computer and on a thumb drive.

Section C1: Assessments and Response Actions

Table C1-1 presents the types of assessments and response actions for activities applicable to the QAPP.

Table C1-1 Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party(ies)	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	NRA	Monitoring of the project status and records to ensure requirements are being fulfilled. Monitoring and review of performance and data quality.	Report to project lead in Quarterly Report
Technical Systems Audit	Minimum of one during the course of this project.	TSSWCB QAO	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Facility review and data management as they relate to the project.	30 days to respond in writing to the TSSWCB QAO to address corrective actions

Project deliverables will be quality controlled by the TSSWCB PM in-house review. The TSSWCB PM will maintain overall responsibility for examining NRA’s work to ensure methodologies and processes are consistent with the procedures outlined in this QAPP.

The TSSWCB QAO (or designee) may conduct an audit of the technical systems activities for this project as needed. The NRA PM will have the responsibility for initiating and implementing response actions associated with findings identified during the on-site audit. Once the response actions have been implemented, the TSSWCB QAO (or designee) may perform a follow-up audit to verify and document that the response actions were implemented effectively. Records of audit findings and corrective actions are maintained by the TSSWCB PM and NRA PM. Corrective action documentation will be submitted to the TSSWCB PM within 30 days of receiving audit findings. If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work is specified in agreements or contracts between participating organizations.

Section C2: Reports to Management

Quarterly progress reports developed by the NRA PM will note activities conducted in connection with the hyacinth survey, items or areas identified as potential problems, and any variations or supplements to the QAPP. Quarterly progress reports will be submitted to the TSSWCB PM. CAR forms will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at NRA. CARs that result in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in an update or amendment to the QAPP.

If the procedures and guidelines established in this QAPP are not successful, corrective action is required to ensure that conditions adverse to quality data are identified promptly and corrected as soon as possible and will be reported to the NRA PM and TSSWCB PM immediately both verbally and in writing. Corrective actions include identification of root causes of problems and successful correction of identified problem. CARs will be filled out to document the problems and the remedial action taken. Copies of CARs will be included in quarterly progress reports. Following any audit performed, a report of findings, recommendations and responses are sent to the TSSWCB PM in the quarterly progress report.

A report will be developed documenting the results of the hyacinth survey. Items in this report will include: a description of the methodologies utilized that also indicate assumed initial conditions, and a detailed narrative regarding specific findings, along with a discussion and conclusions section that highlights the implications of these findings. The report will also include a discussion as to how the findings will be used to complete the WPP, implement identified BMPs, and document WPP activities.

Section D1: Data Review, Validation and Verification

All generated data will be reviewed, validated, and verified against the data quality objectives outlined in Section A7, "Quality Objectives and Criteria." Only those data that are supported by appropriate QC will be considered acceptable for use.

The procedures for verification and validation are described in Section D2, below. The NRA PM is responsible for validating that all data collected meet the DQOs of the project and are suitable for reporting.

Section D2: Validation Methods

The photographs and video will be compared to Google Earth to obtain coordinates of the colony locations. Aerial parameters will be calculated based on coordinates derived from Google Earth.

Section D3: Reconciliation with User Requirements

Results of the hyacinth survey will be incorporated into the WPP and used in the development of a management plan for control and removal. The management plan will also (1) determine whether further water quality sampling, in addition to routine CRP monitoring, should be conducted; and (2) determine whether periodic surveys of hyacinth growth should be conducted.

DQOs for accuracy will be achieved by meeting the 100% coverage of the river and documented as a GIS map.

APPENDIX A

Corrective Action Report

Corrective Action Report

SOP-QA-001

CAR #: _____

Date: _____

Area/Location: _____

Reported by: _____

Activity: _____

State the nature of the problem, nonconformance or out-of-control situation:

Possible causes:

Recommended Corrective Actions:

CAR routed to: _____

Received by: _____

Corrective Actions taken:

Has problem been corrected?:

YES

NO

Immediate Supervisor: _____

Program Manager: _____

NRA Quality Assurance Officer: _____

TSSWCB Quality Assurance Officer: _____