



SCRRA Design Quality Assurance Plan

January 2003



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1.0 Forward

1.1 PURPOSE

This document serves to define the procedures that govern the initiation, progress and execution of design work for the Southern California Regional Rail Authority (SCRRA). This is a control document and as such shall be updated on a periodic and as needed basis. The Director of Engineering and Construction will periodically issue revisions to this document. Any deviation from the procedures presented herein must be approved in advance by the Director of Engineering and Construction or his/her designate.

1.2 CHANGES/ UPDATES

Forward any proposed changes or updates to the Director of Engineering and Construction for consideration.

1.3 ACRONYMS

The following acronyms are used in this document:

BNSF	Burlington Northern Santa Fe Railway Company
CADD	Computer-Aided Drafting and Design
CTO	Contract Task Order
DQAP	Design Quality Assurance Plan
GEC	General Engineering Consultant
IEOC	Inland Empire-Orange County
IFB	Invitation for Bids
LACMTA	Los Angeles County Metropolitan Transportation Authority
OCTA	Orange County Transportation Authority
PM	Project Manager
PWP	Project Work Plan
QA/QC	Quality Assurance / Quality Control
RCTC	Riverside County Transportation Commission
SANBAG	San Bernardino Associated Governments
SCRRA	Southern California Regional Rail Authority
UP	Union Pacific Railroad
VCTC	Ventura County Transportation Commission



2.0 Southern California Regional Rail Authority

2.1 INTRODUCTION

Welcome to SCRRA, operators of Metrolink, one of the fastest growing commuter rail systems in the country. With a system comprising more than 400 route-miles, Metrolink is the nation's second largest commuter rail system, second only to the Long Island Railroad.

2.1.1 Metrolink Mission Statement

Metrolink is a premier regional rail system, including commuter and other passenger services, linking communities to employment and activity centers.

Metrolink provides reliable transportation and mobility for the region, leading toward more livable communities.

Metrolink is committed to and characterized by the following attributes:

- *Technically superior and safe operations*
- *Customer focus and accessibility*
- *Dependable, high quality service*
- *Cost-effective and high-value service*
- *Strategically located network of lines and stations*
- *Integration with other transit modes*
- *Environmental sensitivity*
- *Community involvement and partnerships with both the public and private sectors*

In August 1991, SCRRA, a regional Joint Powers Agency (JPA), was formed. Voting members with their respective number of votes are: Los Angeles County Metropolitan Transportation Authority (LACMTA), four votes; Orange County Transportation Authority (OCTA), two votes; Riverside County Transportation Commission (RCTC), two votes; San Bernardino Associated Governments (SANBAG), two votes; and Ventura County Transportation Commission (VCTC), one vote. Ex-officio members of the SCRRA include the Southern California Association of Governments (SCAG), the San Diego Association of Governments and the State of California Department of Transportation (Caltrans).

SCRRA was established to plan, design, construct, operate and maintain regional commuter rail lines that serve the counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura. SCRRA named the regional commuter rail system "Metrolink." The first three lines (San Bernardino, Santa Clarita, and Ventura) started operation in October 1992. The Riverside Line started operation in June 1993, and the Orange County Line, which extends 19 miles into northern San Diego County, started operation in March 1994. The sixth line, Inland Empire-Orange County, began operation in October 1995. Most recently, SCRRA initiated service of the 91 Line (Riverside-Fullerton-Downtown LA) in May 2002.

2.2 METROLINK COMMUTER OPERATIONS

2.2.1 The Metrolink System

SCRRRA operates service on seven lines. These are:

- Ventura County Line
- Antelope Valley Line
- San Bernardino Line
- Riverside Line
- Orange County Line
- Inland Empire-Orange County Line
- 91 (Riverside-Fullerton-Downtown LA) Line

All operations currently run Monday through Friday. Additional weekend services are provided on two (2) lines - the San Bernardino Line, which runs on Saturdays and Sundays; and the Antelope Valley Line, which operates Saturday schedules.

Figure 2-1 below shows the Metrolink System including stations and connecting rail transit lines.

FIGURE 2-1





With the exception of the Inland Empire/Orange County Line, all services extend from the terminal station to LA Union Station.

Metrolink has no operations on the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. Amtrak, BNSF, and UP, however, operate every day of the year on many SCRRA lines.

2.2.2 Services

Hours of operation vary by line. Scheduled passenger services are shown on the most recently issued passenger schedule, which may be obtained from the Official Metrolink Website at www.metrolinktrains.com. Additional special event trains may be operated on some weekends.

2.2.3 SCRRA Facilities & Infrastructure

Metrolink operates on conventional railroad track and right of way, which are owned either by one of the County Transportation Agencies or a private freight railroad company that has conveyed operating rights to SCRRA.

The design, operation and maintenance of the Metrolink System are governed by Federal Railroad Administration (FRA) regulations and California Public Utilities Commission (CPUC) General Orders.

SCRRA owns a fleet of locomotives and coaches that are maintained at the Metrolink Central Maintenance Facility (CMF) located at 1555 San Fernando Road, Los Angeles, California. Vehicle inspection and light repair is also performed at various layover sites throughout the system.

Metrolink train operations are dispatched from the Metrolink Operations Center (MOC) located at 2558 Supply Street, Building A, Pomona, CA. MOC is manned 24 hours a day, 365 days per year.

2.2.4 Operations

In addition to Metrolink service, the SCRRA system tracks also carry Amtrak passenger operations and freight operations. The primary freight carriers on the system are the BNSF and the UP.

2.3 ORGANIZATION

A board of directors, consisting of 11 members, who represent the 5 counties that comprise the agency, governs the SCRRA. An executive staff manages the operation of the system. The chart below reflects the organization of the SCRRA operation.



Southern California Regional Rail Authority (SCRRA)

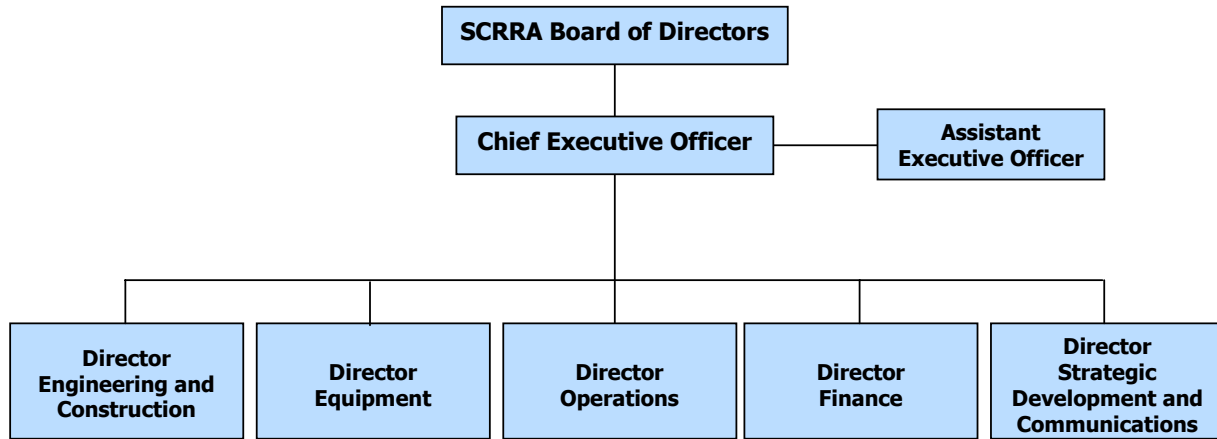


FIGURE 2-2

2.4 FUNDING

The SCRRA receives operating and capital funding from many sources. Metrolink fare box returns account for the largest portion of the operating cost for the system. Additional operating subsidies are received from the constituent counties based on a formula of the service miles in their county. Other sources of operating funds include utility easement fees, advertising revenue, and railroad user charges.

Capital funding is received from several sources and can vary year-to-year, and project-to-project. The primary source of capital funds is from the constituent counties of the SCRRA. Other capital funding is received from federal sources and the State of California. Metrolink also obtains funds from third parties whose contracts require certain work to be performed by SCRRA forces. This is referred to as recollectable work.

2.5 ASSETS

The Real Estate holdings maintained and operated by SCRRA are owned by the individual counties that comprise the authority. The fixed improvements and equipment are owned collectively by the counties that are partners in the SCRRA JPA. Asset ownership is presented below:

Real Property	Owner
Ventura County Line	<i>In Los Angeles County:</i> LACMTA & UP <i>In Ventura County:</i> VCTC & UP
Antelope Valley Line	LACMTA
River Corridor (Dayton to Soto)	LACMTA
San Bernardino Line	<i>In Los Angeles County:</i> LACMTA <i>In San Bernardino County:</i> SANBAG
Riverside Line	<i>Riverside Terminal:</i> RCTC <i>rest of Riverside Line:</i> UP
Orange County Line	<i>Los Angeles to Fullerton:</i> BNSF



Real Property	Owner
	<i>Fullerton to San Clemente:</i> OCTA <i>In San Diego County:</i> NCTD
IEOC Line	<i>Riverside to Atwood:</i> BNSF <i>Atwood to Orange:</i> OCTA
91 Line	BNSF
Central Maintenance Facility	SCRRA
Pomona MOC	SCRRA
Passenger Stations	Varies; however, station sites are typically owned by the local municipality



3.0 Management Responsibility

3.1 POLICY

The policy of SCRRA is to provide a safe, reliable and efficient transportation system that provides mobility and a better quality of life for the SCRRA constituent counties within available financial resources. Each GEC and its subconsultants shall support this policy by attaining a level of quality in the design of project components to meet the objectives and criteria of each CTO assignment.

3.2 ORGANIZATION

The GEC shall establish and shall submit for SCRRA approval an organization for Project Management and Quality Assurance.

The overall project design effort shall be the responsibility of the GEC Project Manager. The GEC shall name a Quality Assurance (QA) Manager, who shall act in an independent role to review, audit and oversee corrective actions through the final design and construction stages.

3.2.1 Responsibility and Authority

The GEC shall designate, by name, the qualified individuals assigned who will be responsible for management, performance of work, and verification activities including quality audits.

The GEC Project Manager shall be responsible for maintaining liaison with SCRRA, as well as for overall technical and administrative control of the project. In turn, the GEC Project Manager shall keep GEC subconsultant staff informed of progress and client directives.

It is the GEC Project Manager’s responsibility to ensure that project assignments are implemented in accordance with the contract and to make available any resources necessary for the successful completion of the project. In addition, the GEC Project Manager shall ensure adherence to the DQAP.

The GEC shall propose a CTO Manager for each CTO, which assignment shall be approved by the SCRRA Engineering Manager. The CTO Manager shall be responsible for the day-to-day execution of work under his or her assigned CTO.

The GEC QA Manager shall be responsible for auditing the implementation and conformance of the DQAP. This may be done by way of periodic project audits, spot checks, interviews with staff, or other means determined by each QA Manager. This DQAP contains the minimum details of the methods to meet the project quality requirements.

The following positions will, as a minimum, be covered under this assignment requirement:

Position	Description of Responsibilities
GEC Project Manager	Overall service quality and responsiveness/ Overall contract administration/ CTO Manager and design team assignment/ CTO proposal development/ CTO schedule assurance/



Position	Description of Responsibilities
	Coordination with SCRRRA Engineering Manager/ Coordination of work under all ongoing CTOs
CTO Manager	Overall task lead for scope fulfillment under assigned CTO/ Coordination with SCRRRA Project Manager/ Responsible to advance design, identify conflicts, make recommendation on resolution, communicate final disposition to design team
Quality Assurance Manager	Overall Quality Plan Implementation/ Quality Audits/ Quality Plan/ Submittal Review Assurance
Technical Leads	Technical Oversight/ Quality control/ Engineering checks
Officer-in-Charge	Overall Service Delivery Assurance

3.2.2 Functional and Technical Interfaces

The GEC shall maintain an open dialogue with the SCRRRA Project Manager and other SCRRRA staff during the life of the project. The GEC Project Manager shall work closely with assigned CTO Manager(s), SCRRRA Project Manager(s) and the SCRRRA Engineering Manager to ensure that project goals under each CTO are met.

Refer to SCRRRA Design Procedures Manual for reporting and requirements during design development.

3.3 PROJECT PLANNING AND IMPLEMENTATION

3.3.1 Contract Review

The GEC Project Manager and each CTO Manager shall thoroughly review and understand the provisions of the GEC contract.

3.3.2 Communications Plan

To ensure project coordination, the GEC shall prepare a communications plan to facilitate coordination among team members throughout the life of the project. Elements of the communications plan shall include:

- **Single Point-of-Contact:** The GEC Project Manager shall be in charge of the overall project, shall actively participate in the daily activities, and shall be on the job from start to finish. The CTO Manager for each CTO shall be named.
- **Assignment of Responsibilities:** Roles and responsibilities of the GEC project team members shall be established to assure no duplication of effort. The GEC shall ensure project continuity and provide proactive response to SCRRRA needs and concerns, as required.



- **Project Directory:** Contact information for GEC personnel, SCRRA staff, and relevant third-party stakeholders shall be provided to team members involved in each CTO.
- **Progress Meetings and Reporting:** Project review meetings with GEC team members and appropriate SCRRA staff shall be held at an agreed-upon interval to bring issues to immediate resolution. The GEC shall conduct frequent progress review updates and shall prepare a monthly progress report. The responsible GEC Project Manager shall ensure that meeting minutes are recorded and filed.

3.3.3 Project Work Plan

The GEC shall develop a Project Work Plan (PWP) for each CTO in accordance with the requirements of the **SCRRA Design Procedures Manual**. The PWP shall define how the CTO scope of work will be accomplished to meet SCRRA objectives. The approved CTO Proposal shall be used as input into the development of the PWP. The GEC QA Manager shall review and sign off on the PWP prior to its submission to SCRRA.

In the PWP, the GEC Project Manager and the CTO Manager shall identify and organize the specific assignments in terms of sequence of work, the type and number of people required for each phase, and the timing at which various tasks are to be started and completed.

The PWP shall include the following elements:

- **Project Overview:** project location, SCRRA objectives, key project issues
- **Project Administration:** project organization, assigned responsibilities, staffing plan, contacts, reporting requirements, project control systems
- **Design:** unique design requirements; tasks and methods required to complete engineering, planning, and design activities
- **Scope of Work:** from approved CTO Proposal

The PWP shall contain a level of detail commensurate with the complexity of the CTO activities and knowledge of special concerns and issues.

3.3.4 Project Schedule

The GEC shall develop a detailed Project Schedule reflecting design assignments under each CTO. All preliminary, intermediate and final deliverables required by the Scopes of Work shall be identified. The GEC shall notify SCRRA as soon as possible of the potential for schedule changes. Justification by the GEC and approval by SCRRA is required before schedule changes are implemented.

The baseline schedule, approved by SCRRA, shall serve as the benchmark against which design progress is measured.

3.3.5 Project Kick-Off

The GEC shall schedule and host a team meeting upon receipt of notice to proceed under each CTO. *Refer to SCRRA Design Procedures Manual.*



3.3.6 Design Directives

The GEC Project Manager shall review and concur with all design directives provided by SCRRA prior to the beginning of design work. The GEC Project Manager shall be responsible for advising SCRRA of points requiring clarification, distributing documents for review, and identifying and amending discrepancies within the design directive in a timely manner.

If amendments to the original CTO proposal (assumptions, criteria, standards) are required, these changes shall be documented and filed with the original scope of work. Records of design directive reviews and amendments shall be maintained and made accessible to all personnel involved in the review process. The GEC shall retain these records in the contract file.

3.3.7 Scope Change Management

The written approval of SCRRA is required prior to the performance of any activity or task that is not defined in the approved CTO. Further, the GEC shall obtain approval of SCRRA prior to proceeding with work that reflects a change in basis of design or design approach.

Out of scope work that results from SCRRA request, third party request, regulator request, unanticipated conditions, or change in requirements shall be documented by the GEC. A revised CTO proposal shall be prepared and submitted to SCRRA for approval prior to proceeding with the work, in accordance with the requirements of the SCRRA Design Procedures Manual.

3.4 DOCUMENTATION REQUIREMENTS

3.4.1 General

The GEC Project Manager shall ensure that a document control filing system is established to address the filing of all documents expected to be developed or received during the term of the contract. A standardized document control index shall serve as the basis for the contract's filing system. A sample file index is provided in Appendix B. All contract-related documents shall be indexed, logged into the project document control log, and filed in accordance with the project filing system. Project records shall include documents of both internal and external origin such as studies, reports, calculations, standards and record drawings, as well as incoming and outgoing correspondence. In-process documents are not required to be placed into the contract files, but may be for convenience.

Electronic communications that are relevant to contract scope, requirements, or budget, or include design inputs, or comments on deliverables shall be printed and placed into the file. Electronic communications, however, shall not be substituted for approvals required by contract.

3.4.2 Document Control Requirements

Documents requiring control shall be maintained by using logs of the current revision level, a master original of the document, and a log of those individuals that received the document. When changes to a controlled document occur, the GEC Project Manager shall ensure that revisions are provided to those requiring the information. The GEC shall maintain records regarding the issuance and revision of controlled documents.



Documents Requiring Control	Means of Control
Calculations	Calculation Indices
Correspondence	Correspondence Log
Design Criteria and Directives	Correspondence Log
Drawings	Drawing Lists
Reports	Report List / Correspondence
Specifications	Specifications List / Correspondence

3.4.3 Document and Data Changes

GEC shall assure that all changes to documents and data are reviewed and approvals documented. The document changes shall be made following the procedures established in this plan prior to documents being released to SCRRA.

3.4.4 Document Submittal to SCRRA

Upon completion of each CTO, and at designated milestone submittals, the GEC shall submit hardcopy and electronic documents to the SCRRA Engineering Manager. Quality records, such as review comment forms and checklists, shall be submitted with deliverables to demonstrate that appropriate quality procedures have been followed. Refer to SCRRA Design Procedures Manual.

3.4.5 Records Close-Out

Upon completion of the term of the GEC contract, the GEC Project Manager shall ensure that files are maintained in accordance with the retention requirements of the contract.

3.5 CONTROL OF SUBCONSULTANTS

3.5.1 General

Prior to the start of work, the GEC shall provide each subconsultant with a copy of the DQAP. All subconsultants shall adhere to the requirements of the Design Quality Assurance Plan.

3.5.2 Subconsultant Performance Review

The GEC shall monitor the performance of each of its subconsultants.

The GEC shall conduct regular status and review meetings with subconsultants to review progress, ensure that up-to-date information is being used, and verify that appropriate activities are being performed.

The GEC Project Manager has the responsibility to verify that all subconsultant work has been reviewed and checked prior to submittal. Subconsultants shall make advanced submissions of all studies, reports and plans to GEC prior to submission to other agencies and SCRRA. The GEC shall review the subconsultant submissions for conformity with the design control procedure described herein.



4.0 Design Control

4.1 GENERAL

The GEC and its subconsultants shall become familiar with the SCRRA DQAP before proceeding with design activities. The DQAP shall be implemented and utilized throughout the course of design development.

4.2 DESIGN INPUT

Designs shall be prepared based upon current published standards and criteria documents, including, but not limited to:

- SCRRA Engineering Standard Drawings
- SCRRA Design Criteria
- SCRRA Engineering Instructions
- SCRRA Standard Specifications
- SCRRA CADD Drafting Standards, Guidelines and Criteria
- American Railway Engineering and Maintenance of Way (AREMA) Manual

Where procedures, standards, or codes outside of SCRRA-published documents are used to define the design, these design inputs shall be approved by the SCRRA Engineering Manager prior to implementation. Any exceptions to SCRRA design criteria or other stated design requirements shall also be documented for submittal and approval by the SCRRA Engineering Manager. A list of relevant design criteria, including codes and standards, shall be prepared and made available to all design personnel.

The GEC and subconsultants shall compile, record, and verify project site condition information through appropriate field surveys, inspections, and document searches. Refer to SCRRA Design Procedures Manual.

4.3 DESIGN OUTPUT

The GEC shall ensure that the completed designs comply with published SCRRA standards, procedures, and criteria, as well as with referenced standards and codes and documented design directives received from SCRRA.

Design control measures, as described below, shall be implemented in the development of engineering designs. Design review comments may be recorded directly on the design documents or through use of a Design Review Form (see Appendix A).

4.3.1 Calculations

Calculations shall be legible and suitable for reproduction. Calculations shall be reviewed in accordance with this procedure prior to use of results or conclusions in subsequent work. Calculations shall be organized in a logical manner with sufficient notes such that they can be understood, without clarification from the originator, by an individual technically competent in the subject matter.



Results of calculations shall be clearly identified, and voided/superseded calculations shall be marked as such. The originator shall check to see that results of a design are adequately reflected in documents that are influenced by the design (e.g., drawings, specifications and estimates).

All calculations shall include:

- Purpose of calculation
- Assumptions
- Input data, with source
- Design methods or theories
- Design criteria and applicable codes
- Conclusions
- References
- Identification of information requiring confirmation

The GEC shall assign to a qualified person, other than the originator, the task of checking calculations. That person shall review the calculations to assure that all work intended to be covered by the calculation has been performed. The calculations shall also be examined for the following:

- Purpose of calculation has been clearly identified
- Approach is satisfactory
- Current design criteria and codes have been used
- Assumptions are clearly identified as such, and are reasonable
- Design methods are consistent with accepted practice
- Calculation results are reasonable based on engineering judgment and comparison with previous solutions to similar problems
- Mathematics are correct and accurate
- Computer programs used are applicable for the problem being solved
- Originator has initialed and dated the calculations, including revisions
- Calculations are legible and suitable for reproduction and filing
- Superseded and voided calculations are so noted

The checker shall record his/her review of the calculations by initialing the "checked by" space on each sheet. The reviewer shall record all comments on a calculations checklist (Manual and Computer Calculation Check Lists are included at Appendix A). The comments shall indicate which calculations were found to be satisfactory and which were found to be unsatisfactory.

The GEC Project Manager shall ensure that checker comments reconciled and appropriate revisions made.

Calculations and checklists shall become part of the project record.



4.3.2 Drawings

Drawings shall be prepared and reviewed in accordance with the DQAP and shall specify the characteristic elements which, if properly constructed, will produce a product that is consistent with the design objective. The GEC Project Manager and the CTO Manager shall ensure that design personnel are provided with proper information to prepare the drawings. The GEC PM and/or CTO Manager shall conduct frequent reviews of drawings to assure that proper standards and format are being utilized in their preparation.

Drawings shall be checked and back checked prior to each progress submittal. Each check print drawing set shall bear a stamp, imprint, or cover sheet that documents the progression of design checks, corrections, back checks, and approval, accompanied by name and initials of checkers and reviewers. The dates of checks and back checks, corrections, and approval shall be documented on the check print set.

The check print drawing set shall be reviewed for the following:

- Scope of drawings is satisfactory
- Interfaces with other drawings are correct
- Previous comments to check prints have been incorporated into completed drawing
- Details are presented clearly
- Dimensions are correct and consistent, and tolerances are appropriate
- Drawing is legible and will reproduce satisfactorily
- Originating Design Engineer has initialed and dated drawing
- Drawing Titles and Numbers agree with drawing list
- Revisions are adequately identified as to what was changed, and the correct revision number and date are shown (only after submission of final drawings)
- Conforms to **SCRRRA CADD Drafting Standards, Guidelines, and Criteria**

Upon completion of the check print review and correction process, the GEC shall assign qualified personnel to ensure that drawings are complete and meet SCRRRA project objectives. The Drawing Checklist included in Appendix A shall be used for this purpose. This review shall encompass:

- Previous comments to check prints have been incorporated into completed drawing
- Client comments on previous progress submittals have been incorporated or otherwise addressed
- Design is in compliance with SCRRRA approved design requirements, standards, and codes
- Material specifications referenced in design incorporated into drawings
- Drawings incorporate design elements of the supporting engineering disciplines



- Drawing set, combined with specifications and reference standards, adequately describes the entirety of work that is to be performed in the associated construction contract

The final drawings shall be signed and sealed by the professional engineer in responsible charge of the work.

4.3.3 Specifications

The GEC shall prepare the technical specifications in accordance with the SCRRA's most recent standards. Technical Specifications shall include Project Specific Specifications, which revise, amend, or supplement SCRRA Standard Specifications.

The specifications shall be reviewed by qualified personnel to ensure that all elements are appropriately detailed to reflect the needs of the project. The Specification Review Checklist in Appendix A shall be used for this purpose.

Specifications review shall encompass checks for the following:

- Basic technical requirements are listed, including reference specifications, codes, and industrial standards
- Quality acceptance criteria are established
- Unique material, product, or installation requirements are identified
- Source inspection and audit requirements are identified
- Submittal requirements, including certifications and shop drawings, are clearly presented
- Provisions for measurement and payment are consistent with SCRRA standard specifications
- Requirements have been coordinated with appropriate SCRRA General Conditions
- Specifications do not duplicate or conflict with contract drawings

4.3.4 Engineer's Estimates

Supporting calculations for Engineer's Estimates shall be reviewed in accordance with the Calculations review procedure described above. Additionally, the Engineer's Estimate shall be subjected to a separate review to consider its completeness and consistency with the drawings and specifications. The GEC PM and CTO Manager shall verify that this review has been completed.

The Engineer's Estimate review shall consider the following:

- Quantities are supported by calculations in conformance with this DQAP
- Sources or calculation methods for unit prices and back-up calculations for lump sum prices are provided
- Pay items and measurement units are consistent with the specifications, including SCRRA Standard Specifications and Project Specific Specifications.



- Work items included in the Engineer's Estimate is consistent with the representation of the work on the Drawings and in the Specifications
- The entirety of the work required is covered by the sum of the bid items, without duplication

4.3.5 Technical Studies and Reports

The format of technical studies and reports shall be appropriate to the scope and complexity of the report. The GEC Project Manager shall coordinate specific format requirements with SCRRA prior to submission. At a minimum, a technical study or report document shall contain the following elements: Cover, Introduction (Purpose), Technical Analysis, and Conclusions.

The study or report shall be reviewed by a technically competent individual for technical adequacy and completeness. The Study or Report Review Checklist in Appendix A shall be used for this purpose. Study and Report review shall encompass checks for the following:

- Input data sources are cited
- Objectives are clearly stated
- Assumptions or criteria have been identified
- Alternatives considered are consistent with assigned scope
- Conclusions or recommendations are provided

Prior to submission, the GEC Project Manager shall review the study or report for overall adequacy, completeness, and compliance with SCRRA requirements.

4.4 CHECKING PROCEDURE

Each reviewer/checker shall mark design output to indicate corrections, questions, actions, agreement, and final disposition of review comments. Design documents may cycle through several iterations of corrections or questions if the CTO Manager is not satisfied that review comments have been adequately addressed. In the case of disagreement among GEC reviewers, the GEC Project Manager shall determine if input from SCRRA is required (Refer to *Design Input and Response to SCRRA Comments*). If the disagreement does not require SCRRA input, then the supervising engineer (engineer in charge) shall have ultimate authority over the resolution of review comments within his or her area of charge.

The following color code, or similar convention that is communicated to the GEC design team and to SCRRA, shall be used in reviewing and checking design documents:

Corrections	Red
Correction Made	Yellow
Design Engineer Verification of Correction Made	Blue
Design Engineer Notes, Questions, Clarifications	Green



4.5 INTERDISCIPLINARY REVIEWS

Drawings and specifications that interface with other departments or disciplines shall receive an interdisciplinary review (IDR). This review shall take place at each milestone submittal.

The IDR shall include a review for interface, coordination, consistency and correct representation, interferences, correct identification of materials, etc. The issues presented in the Design Interface Matrix (refer to *SCRRA Design Procedures Manual*) shall be reviewed for completeness and interfaces verified.

Duplication of information shall be avoided on drawings and between drawings and specifications.

4.6 QUALITY ASSURANCE REVIEWS

At each submittal milestone, a Quality Assurance Review shall be performed. The Quality Assurance Manager, in conjunction with the Project Manager, shall assign a qualified person, who has not been directly involved in the preparation of the design calculations, drawings, specifications, or estimate, the task of performing the Quality Assurance Review.

The reviewer shall complete the Quality Assurance Review checklist. A Quality Assurance Statement (see Appendix A) shall be included with submittals which states that the appropriate reviews have taken place in accordance with this plan.

Quality Assurance comments shall be reviewed by the GEC Project Manager and assigned CTO Manager. Actions taken, to include those comments not to be incorporated into the drawings, shall be provided to the Quality Assurance Manager by the GEC Project Manager. These responses will be reviewed and any disagreements shall be resolved prior to submittal to SCRRA.

4.7 RESPONSE TO SCRRA COMMENTS

The GEC Project Manager shall receive all SCRRA comments on design submittals. These shall be distributed to the CTO Manager and appropriate Technical Leads. The GEC Project Manager shall be responsible for ascertaining that all of SCRRA's review comments are properly closed out before any subsequent milestone submission is made.

If any SCRRA comments are not to be incorporated into the drawings, a written response shall be made to the SCRRA Project Manager, with copy to the SCRRA Engineering Manager by the GEC Project Manager. The GEC Project Manager shall coordinate resolution of these issues with SCRRA prior to subsequent submittal milestones.



5.0 Quality Audit Program

5.1 GENERAL

The GEC Quality Assurance (QA) Manager shall perform or shall cause to be performed periodic quality audits to provide timely, objective, and independent evaluations regarding the extent of compliance with the requirements of the SCRRA DQAP. The audit shall comprise a review of management processes and design control procedure to determine conformance with the SCRRA DQAP. The QA Manager or his/her assigned auditor shall prepare an audit report and conduct a post-audit conference to present the audit conclusions to the GEC Project Manager.

SCRRA shall be provided with copies of Audit Reports and Audit Nonconformity Report Reply forms. SCRRA may also assign its own staff to perform a quality audit of GEC management and design processes.

5.2 AUDIT ITEM FINDINGS

Any nonconforming conditions shall be documented on a Quality Audit Finding form (see Appendix A). Each Quality Audit Finding shall indicate the applicable quality system element, subject, or activity that was reviewed. The GEC Project Manager shall be promptly notified of conditions that appear to require immediate corrective action.

5.3 AUDIT REPORTS

Upon completion of the audit, an audit report shall be prepared to include the following:

- Scope and objectives of the audit
- Details of the audit
- Identification of the audit team
- Identification of individuals contacted during the audit
- Audit dates
- Audit team's judgment on the extent of compliance with the SCRRA DQAP
- Quality Audit Item Finding forms, as appropriate

5.4 CORRECTIVE AND PREVENTIVE ACTION

Should a disposition of nonconformity be required, the GEC Project Manager shall complete an Audit Nonconformity Report Reply form and forward it to the auditor. The reply shall describe the cause and extent of the unsatisfactory condition, the proposed action to correct and, as required, prevent recurrence of the unsatisfactory condition. The reply shall also include the names of the individuals assigned to take corrective actions and the date that those measures will be completed.

Auditors shall evaluate the adequacy of the reply and verify that proposed corrective/preventive actions are accomplished in a satisfactory and timely manner. Such verifications shall be recorded.



6.0 Quality Records

Sufficient documentation and records will be accumulated to provide objective evidence that the design development and review process has been performed in accordance with good engineering practice, in conformance with contractual requirements, and according to GEC and SCRRA's direction. The documentation will include not only phase submission design documents such as drawings, studies, reports, design calculations, communications, instructions and directives which have a direct bearing on the project, but it will also include Quality Assurance checklists, as described above.

The quality records will be stored with the project documents and retained in accordance with contract requirements.

6.1 SCRRA COMMENTS

SCRRA review comments made as a mark-up to drawings and specifications shall be preserved by the GEC until the end of the project.

SCRRA review comments made in letter or memorandum format (including electronic) shall be retained in the project files together with the GEC comment resolution.

6.2 DESIGN REVIEW FORMS

Design review comment forms, indicating disposition of each comment, shall be retained in the project files.

6.3 CHECK PRINTS

Check prints shall be kept on file as long as required (at least through bid opening) to ensure that all review comments have been incorporated into the drawings.

6.4 CHECKLISTS

Quality review checklists for each milestone submission shall be preserved in the contract files.

6.5 AUDIT DOCUMENTS

Audit Reports, including Audit Item Findings, replies, and verification documents shall be preserved in the contract files.

Audit Item Findings, if any, along with associated replies and verification documents, shall be submitted to SCRRA with each progress submittal.



7.0 Training

The GEC shall provide CTO Managers and design staff with adequate training and supervision to ensure that personnel are adequately knowledgeable of the requirements of the SCRRRA DQAP.



8.0 Appendix A: Quality Assurance Forms

QA-01	Review Comments
QA-02	Calculations Checklist
QA-03	Drawings Checklist
QA-04	Specifications Checklist
QA-05	Engineer's Estimate Checklist
QA-06	Study or Report Checklist
QA-07	Quality Assurance Statement
QA-08	Quality Audit
QA-09	Quality Audit Item Finding



DESIGN QUALITY ASSURANCE PROGRAM
ENGINEER'S ESTIMATE CHECKLIST

Consultant:		Contract No.:	
Project Name:		Date:	
Design Progress Submittal:		Reviewed By:	

	Comments:	Yes	No	NA	Remark
1.	Item quantities supported by checked calculations				
2.	Sources or calculation methods for unit prices provided				
3.	Calculations for lump sum prices provided				
4.	Work items consistent with representation of work on drawings				
5.	Work items consistent with representation of work in specifications				
6.	Pay items and measurement units consistent with specifications				
7.	Entirety of work covered by sum of bid items				
8.	Bid items are without duplication				
9.	Additives (agency costs, CM, flagging, etc.) are consistent with SCRRA standards.				
10.	Construction and project contingency are appropriate for design level.				
11.	Engineer's Estimate is listed in project index				

Remarks: _____

 Reviewer Date

 GEC Manager Date

Follow Up Action Required? Yes No

If Yes Date of Follow Up Review: _____

 GEC QA Manager Date



DESIGN QUALITY ASSURANCE PROGRAM
STUDY OR REPORT CHECKLIST

Consultant:		Contract No.:	
Project Name:		Date:	
Report Title:		Reviewed By:	
Progress Submittal:			

Comment		YES	NO	NA
1.	Objective of the Work was defined prior to start and conforms to contractual work scope			
2.	Supporting material was prepared and retained in accordance with the appropriate QAP			
3.	Supporting Data was included or referenced and retained			
4.	Report contains			
	a) Objectives			
	b) List of assumption requiring verification			
	c) Section on conclusions			
5.	Job file contains identification of all material used in study or report preparation			
6.	Calculation(s) included have been checked in accordance with DQAP			
7.	Drawing(s) included have been checked in accordance with DQAP			
8.	Engineer's Estimate(s) included have been checked in accordance with DQAP			
9.	Previous review comments have been incorporated			
10.	Report is listed in Project Index			

Remarks: _____

Reviewer Date

GEC Manager Date

Follow Up Action Required? Yes No

If Yes Date of Follow Up Review: _____

GEC QA Manager Date



DESIGN QUALITY ASSURANCE PROGRAM
QUALITY ASSURANCE STATEMENT

Consultant:		Contract No.:	
Project Name:		Date:	
Progress Submittal:			

This submittal contains the following design documents (check all that apply):

<input checked="" type="checkbox"/>	Design Document
<input type="checkbox"/>	Drawings
<input type="checkbox"/>	Project-Specific Specifications
<input type="checkbox"/>	Engineer's Estimate
<input type="checkbox"/>	Design Calculations
<input type="checkbox"/>	Study or Report

"The design documents included in this submittal have been reviewed in accordance with the SCRRRA Design Quality Assurance Plan and have been found to meet the quality objectives set forth therein."

Remarks: _____

GEC Project Manager Date

GEC QA Manager Date



QUALITY AUDIT

		Date:	
Firm Receiving Audit:		Auditor:	
Contract:		Discussed With:	
Project:		File Code:	
<p>PURPOSE: To review conformance to Quality requirements established in SCRRA quality standards. This Quality Assurance audit covers all activities associated with SCRRA design, procurement and construction activities. Yes/No</p>			
1.	Was the required plan and checklist to be used in the audit provided as part of the advance notice?		
2.	Was a pre-audit conference held to establish the ground rules for the conduct of the audit?		
3.	Was a follow up audit conducted for previous audits to verify completion and the effectiveness of corrective actions?		
4.	Upon audit completion did the lead auditor conduct a post audit conference with management and supervision in the areas audited to review the audit findings?		
5.	Did the auditor document the audit results in an Audit Report and include reference to:		
	<ul style="list-style-type: none"> Documents reviewed, the location of the documents and the acceptability of items or deficiencies observed in the documentation review? 		
	<ul style="list-style-type: none"> Operations reviewed and the acceptable or non-acceptable areas observed? 		
	<ul style="list-style-type: none"> Notations of any audit deficiencies found through interviews with persons involved in the performance of tasks? 		
6.	Were audit deficiencies documented on a Quality Item Report (see attached) or similar document and included as part of the audit report?		
7.	Is the Audit Report addressed to the management of the audited organization, and distributed to the GEC Quality Manager and others as appropriate?		
8.	Is the date established for the management of the activity audited to provide corrective action responses?		

All questions answered as "NO" are to be described in detail as to the non-conformance and the action to be taken for each necessary correction. Use Quality Audit Item Finding for this purpose.

Prepared By:

Acknowledged By:

Auditor Signature

GEC Project Manager



9.0 Appendix B: Sample Documents

Project File Index

Document Control Log

Check Print Stamp

100 Contract

- 101 Request for Proposal
- 102 Proposal
- 103 Contract & Amendments

- 104 Executed Contract Task Orders
 - 104.01 CTO #1
 - 104.02 CTO #2
 - 104.03 CTO #3

- 105 Subcontracts
 - 105.01 Not Used
 - 105.02 Sub #1
 - 105.03 Sub #2

- 106 Insurance Certificates
 - 106.01 Prime
 - 106.02 Sub #1
 - 106.03 Sub #2

200 Correspondence

- 201 Outgoing
 - 201.01 SCRRA
 - 201.02 Sub #1
 - 201.03 Sub #2

- 202 Incoming
 - 202.01 SCRRA
 - 202.02 Sub #1
 - 202.03 Sub #2

- 203 Inter-Office
- 204 Phone & E-Mail Record

300 Invoice & Payment

- 301 Invoices
 - 301.01 SCRRA
 - 301.02 Sub #1
 - 301.03 Sub #2

- 302 Payments
- 303 Retention Release Records

400 Project Management and Administration

- 401 Project Performance
 - 401.01 Project Budgets
 - 401.02 Project Performance Reports
 - 401.03 Labor Reports

- 402 Contract Administration
 - 402.01 Progress Reports
 - 402.02 CTO Status Reports
 - 402.03 DBE Reports

- 403 Progress Meetings
- 404 CTO Tracker
- 405 Communications Plan

500 Quality Assurance Records

- 501 Quality Assurance Plan / Organization
- 502 Quality Assurance Audit Reports
- 503 Quality Assurance Item Findings
- 504 Corrective and Preventive Actions

600 CTO Files

- 601 CTO #1
 - 601.01 Project Work Plan
 - 601.02 Design Schedule and Progress
 - 601.03 Technical Correspondence & Memoranda
 - 601.04 Meetings

 - 601.05 Existing Conditions
 - 601.05.01 Photos
 - 601.05.02 Field Measurements
 - 601.05.03 Surveys

 - 601.06 Technical Data & Criteria
 - 601.06.01 Basis of Design
 - 601.06.02 Design Calculations
 - 601.06.03 Technical Reports

- 601.07 Project Cost Estimate
 - 601.07.01 Quantity Calculations
 - 601.07.02 Engineer's Estimate
 - 601.07.03 Materials List
 - 601.07.04 Schedule of Quantities and Prices
- 601.08 Technical Specifications
 - 601.08.01 Modifications to Standard Specs
 - 601.08.02 Supplemental Specifications
- 601.09 Submittals
 - 601.09.01 Design Submittal Reports
 - 601.09.02 Project Concept
 - 601.09.03 Preliminary Design
 - 601.09.04 Interim Design
 - 601.09.05 Pre-Final Design
 - 601.09.06 Final Design
 - 601.09.07 IFB Data
 - 601.09.08 Camera-Ready
- 601.10 Design Review
 - 601.10.01 Design Interface Matrix
 - 601.10.02 QC Reviews
 - 601.10.03 Client Comments
 - 601.10.04 Quality Assurance Records
- 601.11 Third Party Coordination
 - 601.11.01 Agency #1
 - 601.11.02 Agency #2
 - 601.11.03 Agency #3
- 601.12 Permits
 - 601.12.01 Permit Matrix
 - 601.12.02 Permit Agency #1
 - 601.12.03 Permit Agency #2
 - 601.12.04 Permit Agency #3
- 601.13 Utilities
 - 601.13.01 Utility Matrix
 - 601.13.02 Utility Request Letters
 - 601.13.03 Utility Agreements
 - 601.13.04 Utility As-Builts
 - 601.13.05 Utility Relocations
- 601.14 Bid and Award
 - 601.14.01 IFB Documents
 - 601.14.02 Pre-Bid Meeting
- 601.14.03 Contractor Questions
- 601.14.04 Addenda
- 601.14.05 Bid Summary Sheets
- 601.14.06 Contract Award
- 601.14.07 Conformed Contract
- 601.15 Construction Phase Services
 - 601.15.01 Construction Correspondence
 - 601.15.02 RFI's
 - 601.15.03 Submittals
 - 601.15.04 Construction Meetings
 - 601.15.05 Field Notes and Photos
 - 601.15.06 Change Notices and Change Orders
 - 601.15.07 Protests and Claims
 - 601.15.08 As-Built Drawings
- 601.16 Project Close-Out
 - 601.16.01 Checklist
 - 601.16.02 Lessons Learned
- 602 CTO #2
 - ...
- 603 CTO #3
 - ...

Contract No. XXXX, GEC Name

DOCUMENT LOG

File No. _____

Project No. _____

File Name _____

Project Name _____

Type _____

Serial No.	Item Dated	Date Recorded	From	To	Description	Required Action / Distribution	Date Action Complete	Superseded By (Serial No.)
1	01/01/01	01/01/01	Sender of Document	Addressee			01/01/01	
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								

DMJM+HARRIS
DRAWING QUALITY CONTROL STAMP

SUBMITTAL: _____

MARK-UPS BY ENGINEER	___	DATE	_____
CHANGES MADE BY CADD TECH	___	DATE	_____
CHANGES CHECKED BY ENGINEER	___	DATE	_____

COLOR CODE:

RED (ENGINEER)	= CORRECTION / CHANGE / ADDITION
YELLOW (CADD TECH)	= CHANGES / ADDITIONS MADE
BLUE (ENGINEER)	= CHANGES / ADDITIONS VERIFIED
GREEN (ENGINEER)	= COMMENTS / NOTES TO CADD TECH