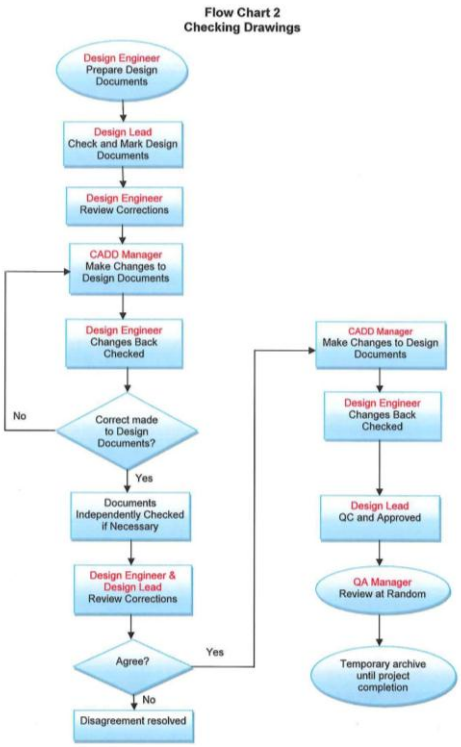
METROLINK

SCRRA Design Quality Assurance Plan



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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).

A Quality control/Quality Assurance (QA/QC) program establishes the formal organizational procedures or practices for ensuring the SCRRA's requirements and expectations are fully met. A QA/QC program provides checks and balances within an organization to assure quality in the final contract documents. QA/QC programs are implemented at different levels or phases of project activities.

Quality Control is the process of checking the accuracy of calculations and consistency of the drawings, detecting and correcting design omissions and errors prior to finalizing design plans and verifying the specifications for the SCRRA design projects.

Quality Assurance is the process of reviewing the quality control process for use and effectiveness at preventing mistakes, ensuring compliance and consistency in the development of design plans and specifications.

The purpose of these guidelines is to assist the consultant-led project team in creating a project specific GEC Quality Control Plan for preconstruction activities. These guidelines represent **minimum** requirements for plan implementation. The GEC merges these guidelines with their Quality Assurance/Quality Control requirements. The GEC is responsible for the overall quality of the final design product and is required to incorporate the review of all sub-consultant's work into the project specific GEC Quality Control plan.

The project specific GEC Quality Control Plan assists with the verification that the design and project documents are produced with due diligence using acceptable industry standards, appropriate techniques, available resources and reasonable decisions by competent professionals. The project specific GEC Quality Control Plan is a process tool and does not replace the sound judgment and experience of competent professionals. It is the project design team's responsibility to ensure the quality of project documents **before** they are submitted to 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
IDR	Interdisciplinary Review
IEOC	Inland Empire-Orange County
IFB	Invitation for Bids
METRO	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

1.4 Definitions

Supervisor/Group Leader	A licensed professional engineer who manages a group of Engineers and Technicians. The supervisor/group leader is responsible for assigning work to Engineers and Technicians based on their level of experience and the complexity of the project. In addition, a supervisor/group leader is responsible for internal Quality Assurance reviews
Design Engineer	A licensed professional engineer or engineering assistant working under the direct supervision of a licensed professional engineer. The Design Engineer is a person capable of performing analyses and calculations.
Checker	A licensed professional engineer or engineering assistant working under the direct supervision of a licensed professional engineer.
Technician	A drafter or engineer who generates and revises details, plan sheets, and drawings in electronic format
Engineer-of-Record	A licensed professional engineer who signs and seals the final plan set

2.0 SCRRA

2.1 Introduction

In August 1991, SCRRA was formed as a regional Joint Powers Authority (JPA). Its purpose is to plan, design, construct, operate, and maintain regional commuter rail lines serving the counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura. Today, SCRRA operates one of the fastest growing commuter rail systems in the country. SCRRA's rail system operates in what can be typically categorized as an urban and suburban environment. With a system comprising more than 512 route-miles, SCRRA is the nation's second largest commuter rail system, second only to the Long Island Railroad.

SCRRA's mission statement declares that SCRRA is a premier regional rail system, including commuter and other passenger services, linking communities to employment and activity centers. SCRRA provides reliable transportation and mobility for the region, leading toward more livable communities.

SCRRA 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

2.2 Commuter Operations

2.2.1 SCRRA System

The SCRRA system began operation in October 1992 with three lines: San Bernardino, Santa Clarita, and Ventura. The Riverside Line started in June 1993, and the Orange County Line, which extends 19 miles into northern San Diego County, started in March 1994. The sixth line, Inland Empire-Orange County, started in October 1995. Most recently, SCRRA initiated service on the 91 Line (Riverside-Fullerton-Downtown Los Angeles) in May 2002.

Today, SCRRA operates service on the following seven lines:

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

With the exception of the Inland Empire-Orange County Line, all services extend from the terminal station to Los Angeles Union Station. Figure 2-1, below, shows the SCRRA system, including stations and connecting rail transit lines.

FIGURE 2.2

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.

2.2.1 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.

2.2.2 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. A new maintenance facility is under construction in the City of Colton (1945 Bordwell St., Colton CA 92324) to service SCRRA locomotives and coaches.

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.

2.2.3 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

SCRRA consists of five county transportation agencies, each of which is a voting member. These county transportation agencies, with their respective number of votes, are:

- Los Angeles County Metropolitan Transportation Authority (METRO), with four votes
- Orange County Transportation Authority (OCTA), with two votes
- Riverside County Transportation Commission (RCTC), with two votes
- San Bernardino Associated Governments (SANBAG), with two votes
- Ventura County Transportation Commission (VCTC), with one vote

Ex-officio members of 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 is governed by a board of directors, consisting of eleven members representing the five counties that comprise the agency. An executive staff manages the operation of the SCRRA system.

2.4 Funding

SCRRA receives operating and capital funding from many sources. SCRRA fare box returns fund the largest portion of the system's operating cost. Constituent counties provide additional funds through operating subsidies, which are calculated relative to the service miles in each 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 from year to year, and from project to project. The primary source of capital funds is SCRRA's constituent counties. Other capital funding comes from federal sources and the State of California. SCRRA also obtains funds from third parties whose contracts require certain work to be performed by SCRRA forces. This is referred to as third party projects 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	In Los Angeles County: In Ventura County:	METRO & UP VCTC & UP
Antelope Valley Line		METRO
River Corridor (Dayton to Soto)		METRO
San Bernardino Line	In Los Angeles County: In San Bernardino County:	METRO SANBAG
Riverside Line	Riverside Terminal: rest of Riverside Line:	RCTC UP
Orange County Line	Los Angeles to Fullerton: Fullerton to San Clemente: In San Diego County:	BNSF OCTA NCTD
IEOC Line	Riverside to Atwood: Atwood to Orange:	BNSF 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 Coordination with SCRRA Engineering Manager Coordination of work under all ongoing CTOs
CTO Manager	Overall task lead for scope fulfillment under assigned CTO Coordination with SCRRA 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
Checker	Check the calculations or detail drawings for errors, omissions, completeness, applicability, and conformance
Technician	Generate and revises details, plan sheets, and drawings in electronic format
Engineer-of-Record	Sign and seals the final plan set

3.2.2 Functional and Technical Interfaces

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

Refer to SCRRA 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 SCRRA 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 submit a baseline schedule at the start of each CTO. The baseline schedule will serve as the basis for monitoring and controlling project activities to help GEC decide how to use their resources to achieve time and cost goals; help management to evaluate alternatives; form the basis for determining staffing resources, materials, and capital

requirements; and, provide a means for tracking progress. The baseline schedule will be reviewed and approved by Contract Manager. The schedule shall show different tasks to be completed, expected sequence of design, and effect of any changes to the overall schedule. The schedule will use Oracle's Primavera product.

Baseline schedule shall utilize computerized Critical Path Method (CPM) network scheduling. Baseline schedule shall show the order in which the GEC proposes to carry out the work with logical links between work activities, and calculations made using the critical path method to determine the controlling operation or operations. The GEC will ensure that activity sequences are logical and that schedule shows a coordinated plan for complete performance of the work. The baseline schedule shall include the entire scope of work through the end of the CTO. The GEC will show how to complete the work, the activities that define the critical path and float on other activities.

The GEC will use the latest version of Primavera P6 Professional Project Management software.

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 fro 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

4.2.1 General

The design shall meet all applicable parts of the State of California general laws, California Public Utilities Commission (CPUC) requirements, FRA safety requirements, and the specific project requirements. Where any conflict in criteria exists, the stricter criteria shall govern.

Unless specifically noted otherwise in these criteria, the latest edition of the standard, code, or guideline that is applicable at the time the design is initiated shall be used. If a new edition of or amendment to a standard, code, or guideline is issued before the design is completed, the design shall conform to the new requirements to the extent approved or required by the agency enforcing the standard, code, or guideline changed.

The most recent editions of the following publications and documents were used:

- AASHTO - American Association of State Highway and Transportation Officials
- ADA - Americans with Disabilities Act
- AREMA - American Railway Engineering and Maintenance-of-Way Association (AREMA) Recommended Practice
- Cal/OSHA - State of California Division of Occupational Safety and Health safety orders
- Caltrans - Caltrans Highway Design Manual (HDM)
- CBC – California Building Code
- CPUC – California Public Utilities Commission General Orders
- FRA – Federal Railroad Administration, Track Safety Standards, particularly 49 Code of Federal Regulations (CFR) 213, 214, 234, and 236
- FTA - Federal Transit Administration, Federal Highway Administration (FHWA)
- "Greenbook" Standard Specifications for Public Works Construction, written and promulgated by Public Works Standards, Inc.
- Government Codes of the State of California
- UBC—Uniform Building Code, including seismic requirements
- 49 CFR 195, Transportation of Hazardous Liquids by Pipeline

4.2.2 SCRRA Standards

SCRRA has developed a number of standard plans, specifications, and manuals that shall be applied to this project. In particular, standard plans and specifications shall be used

wherever possible to reduce engineering and construction costs. All standards and manuals shall be adhered to throughout this project unless waived in writing by SCRRA Director of Engineering and Construction.

- SCRRA Engineering Standards
- SCRRA Standard Specifications
- SCRRA Design Criteria Manual
- SCRRA Design Procedures Manual
- SCRRA Design Quality Assurance Manual
- SCRRA CADD Standards
- SCRRA Track Maintenance, Right-of-Way and Structures Engineering Instructions
- Standard Operating Procedures (SOPs)

4.2.3 SCRRA Guidelines

The following SCRRA documents will also be referenced and revised as appropriate:

- SCRRA Highway-Rail Grade Crossings Recommended Design Practices and Standards Manual
- Grade Separation Guidelines
- Excavation Support Guidelines
- Landscape Design Guidelines
- Rails-with-trails Design Guidelines
- Quiet Zone Implementation Guidelines and Procedures
- SCRRA Temporary Traffic Control Guidelines

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 SCRRA Design Review Comment Form QA-01 or DPM-31 (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 Design Engineer, 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 Design Engineer 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 Design Engineer, 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
- Design Engineer 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.

The process for checking calculations is graphically shown in Flow Chart 1 – Checking Calculations.

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 ***SCRRA 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 SCRRA 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 SCRRA 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 Engineer-of-Record who is responsible charge of the work.

The process for checking calculations is graphically shown in Flow Chart 2 – Checking Drawings.

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 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. Figure 4.4 shows the SCRRA QC Color Chart that shows the method of marking documents during checking process.

4.5 Roles and Responsibilities

4.5.1 GEC Responsible for Quality

- Prepares and administers corporate quality standards.
- Reviews project specific Designer Quality Control Plans for compliance with corporate policies/standards.

4.5.2 Quality Assurance Manager

- Verifies that all project documents were checked in accordance with the Quality
- Assurance/Quality Control procedures.
- Cannot perform **ANY** of the Quality Control Procedures.

4.5.3 Engineer of Record

- Responsible for the design.
- Stamps the final plans and calculations.
- Licensed in the State of California

4.5.4 CTO Manager

- Typically is the Project Manager for the GEC.
- Implements the Quality Assurance/Quality Control Procedures.

4.5.5 Design Engineer (Originator)

- Prepares the contract documents in accordance with applicable standards, manuals, guidelines, procedures, and contract requirements
- Responsible for design completeness, accuracy, adequacy and inter-disciplinary coordination.
- Responsible to ensure quality control is performed and documented.
- Cannot rely upon the Quality Assurance/Quality Control procedure to correct design or calculation deficiencies.
- Presents all calculations in a neat and logical manner to facilitate checking.
- Reviews the completed plan set to ensure that it satisfies the design intent.
- Cannot function as the Checker or Quality Assurance Manager.
- Stamps each drawing, calculations with sign-off stamp.
- Provide black/white reports, calculations, plans originals without any colors.

4.5.6 Design Lead

- Ensures Quality Assurance/Quality Control procedure compliance within their specialized discipline (including sub-consultants).
- Monitors design activities for compliance with criteria and standards.
- Verifies that assigned personnel are capable of performing the required analysis or calculations.
- Releases the completed contract documents for their specialized discipline (Do not release any contract documents until the Quality Assurance/Quality Control process is complete).

4.5.7 CADD Manager

- Verifies that all project drawings follow SCRRA's CADD Standards.
- Develops a CADD management strategy to unify the project teams CAD work (including sub-consultants).

4.5.8 Checker

- Checks work product independently of the Design Engineer.
- Can only check work that he/she did not originate.
- Must be competent and experienced in the type of element being checked.
- Cannot function as the Design Engineer, Back Checker or Quality Assurance Manager.
- Examines the contract documents for requirements of the project, technical adequacy/accuracy, presentation quality, compatibility with other projects elements/documents, and conformance with applicable standards.
- Indicate with Yellow Highlight each item that is correct. Mark in Red the required corrections, additions or deletions. Blue for notes and comments for clarification or direction but not to be drafted.

4.5.9 Back Checker

- Reviews corrections asserted by the Checker.
- Revise the contract documents to include the changes identified by the Checker.
- Place a green check mark near each of the Red corrections to denote each part has been properly updated. STET and cross out will be used when agreed no change should be made.
- Sign and date the check prints.

4.5.10 Updater

- Reviews the revised drawings and the check print/set.
- Cannot function as the Verifier or Quality Assurance Manager.
- Place a green circle near each of the Back Checker's green check mark.
- Consults with the Checker or Design Engineer if not in agreement with the revisions. Any items of disagreement between the Checker, or Design Engineer shall be

submitted to the Project Team Design Leader (Project Engineer or the Project Manager) for resolution.

4.5.11 Corrector

- Incorporates all corrections.
- In most cases, the Corrector is the Design Engineer.
- Cannot function as the Verifier or Quality Assurance Manager.
- Print final document when all updates are complete.

4.5.12 Verifier

- Verifies back checked corrections were accurately made.
- Indicate with Yellow Highlight all information is correctly updated.
- In most cases, the Verifier is the Checker.
- Cannot function as the Corrector or Quality Assurance Manager.

4.6 Detailed Checking Procedure

4.6.1 Provide Check Prints

The Design Engineer (Originator) provides check prints to the Checker by completing the following:

- Create the check print. The check print does not have to be a hard copy. It may be a .pdf or other format that the Checker and Back Checker can appropriately review and annotate as required.

- Place a check print stamp on the check print

- Number, sign, and date the check print.

4.6.2 Checking

The Checker performs a thorough review of the check print for design intent, completeness, consistency, technical adequacy, and conformance to applicable standards and format. Use the following color code on the check print to document the QC review:

- **Yellow Highlight** – Verification/Concurrence of Correct items, highlight if correct.

- **Red** - Corrections, line through incorrect item and provide correction or add missing items.

- **Blue** - Commentary notes, including discussion items, questions, references, and methods of checking**.**

Complete the appropriate design QC checklist or checklist items. Sign and date the check print stamp when complete. Give the completed and signed check prints, design QC checklist, and cover sheet to the Back Checker.

There is no need for back checking or further signatures on the check print stamp in the case where no corrections, additions, or deletions are found. Return all completed and signed QC documentation to the Design Engineer.

4.6.3 Back Checking

The Back Checker reviews the Checker's corrections on the check print. To document the back check review process:

- **Green Checkmark** - Agreement with the Checker's corrections, place a check next to the Checker's correction.
- **Green** - Additional corrections or alterations to the Checker's corrections. The Checker then confirms the Back Checker's corrections with red check.

The Back Checker crosses out the Checker's correction and adds additional corrections or alterations in green when not in agreement with the Checker's marks. Do not obliterate any of the Checker's marks.

Discuss all changes to the Checker's corrections with the Checker. The Checker places a red check next to the cross out if in agreement. The Back Checker and Checker should resolve differences encountered during the checking process together. The discipline design lead is consulted to resolve the differences if the two individuals cannot reach resolution.

Sign and date the check print stamp when back checking is completed. Document the decisions on the check print or cover sheet if discussion between the Checker and Back Checker was needed to resolve concerns. Sign and date the check print stamp when back checking is completed.

4.6.4 Corrections

The Corrector makes the corrections and circles the red (or green) check print corrections in **green** when incorporated. Sign and date the check print stamp when all of the corrections are made. Provide the Verifier with the original check print and an updated check print. Do not place a check print stamp on the updated check print.

4.6.5 Verifying

The Verifier compares the original check print with the updated check print to confirm that all corrections are incorporated without error. Highlight the green-circled item in **yellow** on the check print if a correction was properly made. Annotate the updated check print with instructions and return it to the Corrector if a correction was not made or is in error. The Corrector then completes the corrections and prints a new updated check print for the Verifier.

Sign and date the check print stamp once all corrections are verified. All information must be highlighted indicating that all information was checked.

4.6.6 Disposition of Checked Project Documents

The Design Engineer uploads the QC check prints into E: Drive once all verification is complete and maintain all original check prints.

4.6.7 Additional Changes or Corrections

A new check print must be made to check the area that is changed when a change is made to a checked specification or special provision. The check print is stamped and labeled check print 2, 3, 4, etc., as applicable and attached to the previous check prints. The checking follows the same procedure as that of the original check print except only the portions that changed need to be checked.

4.7 Disciplinary Reviews

Discipline reviews will be conducted by technical leaders. The goal of discipline review is to validate all components within a discipline, including calculations, drawings, specifications, Engineer's Estimates, technical studies and reports, conformance with standards, and design theory.

4.8 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.

Refer to Flow Chart 3 – Interdisciplinary Reviews for visual depiction of this process.

4.9 Independent Reviews

Depending on project complexity, peer reviews by independent teams will be performed. Constructability reviews will target thoroughness and completeness, staging and traffic, schedule, and reduction in claims.

4.10 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.

4.11 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.

Refer to Flow Chart 4 – Intra-Disciplinary Reviews Prior to Client Submittal for visual depiction of this process and Flow Chart 5 – Intra-Disciplinary Reviews After Client Review for visual depiction of this process

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.

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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 SCRRA DQAP.

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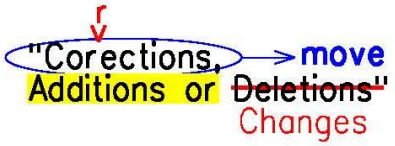
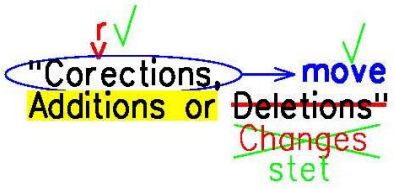
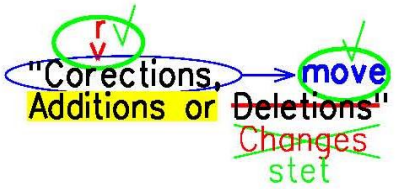
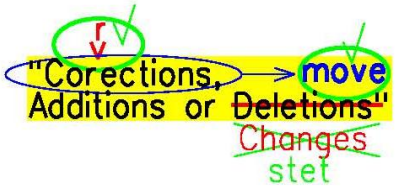
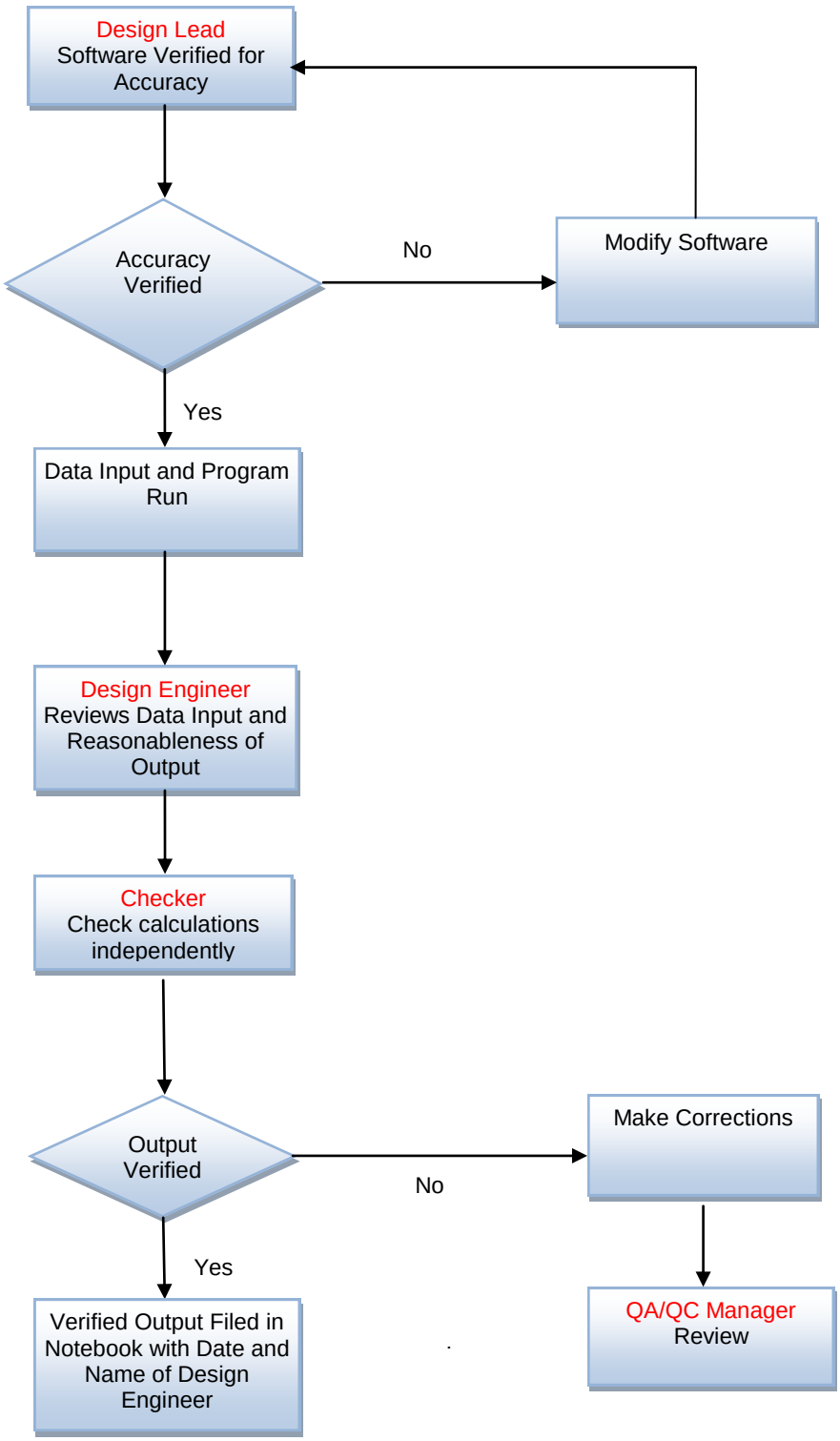
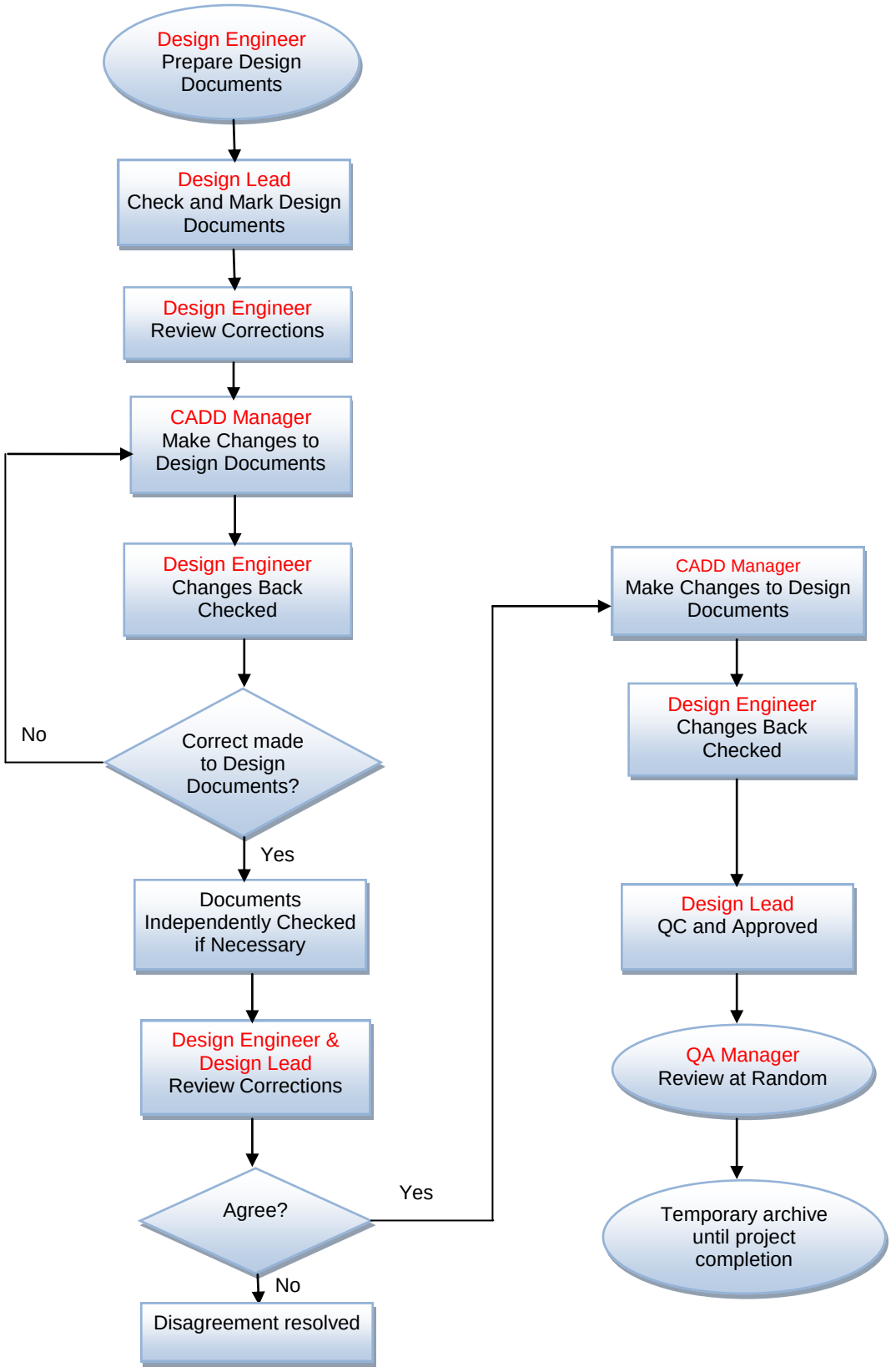
Figure 4.4
SCRRA QC Color Chart

ORIGINATE CHECK PRINT: (ORIGINATOR/DESIGNER)	CREATE CHECK PRINT. DO NOT USE RED,YELLOW OR BLUE.	"Corections, Additions or Deletions"
CHECK: (CHECKER)	YELLOW HIGHLIGHT IS USED FOR CORRECT ITEMS. RED FOR CORRECTIONS,ADDITIONS,OR DELETIONS. BLUE FOR NOTES AND COMMENTS FOR CLARIFICATION OR DIRECTION BUT NOT TO BE DRAFTED.	
BACK CHECK: (BACK CHECKER / ORIGINATOR)	GREEN CHECK MARK INDICATES AGREEMENT WITH CHANGE. STET AND CROSS OUT IS USED WHEN AGREED NO CHANGE SHOULD BE MADE.	
CORRECT: (CORRECTOR / ORIGINATOR)	GREEN CIRCLE WHEN UPDATE COMPLETE. PRINT FINAL DOCUMENT WHEN ALL UPDATES ARE COMPLETE.	
VERIFY: (VERIFIER / CHECKER)	CHECK AGAINST UPDATED PRINT AND YELLOW HIGHLIGHT ALL ITEMS CORRECTLY UPDATED.	
UPDATED PRINT:		"Corrections, Additions or Deletions"

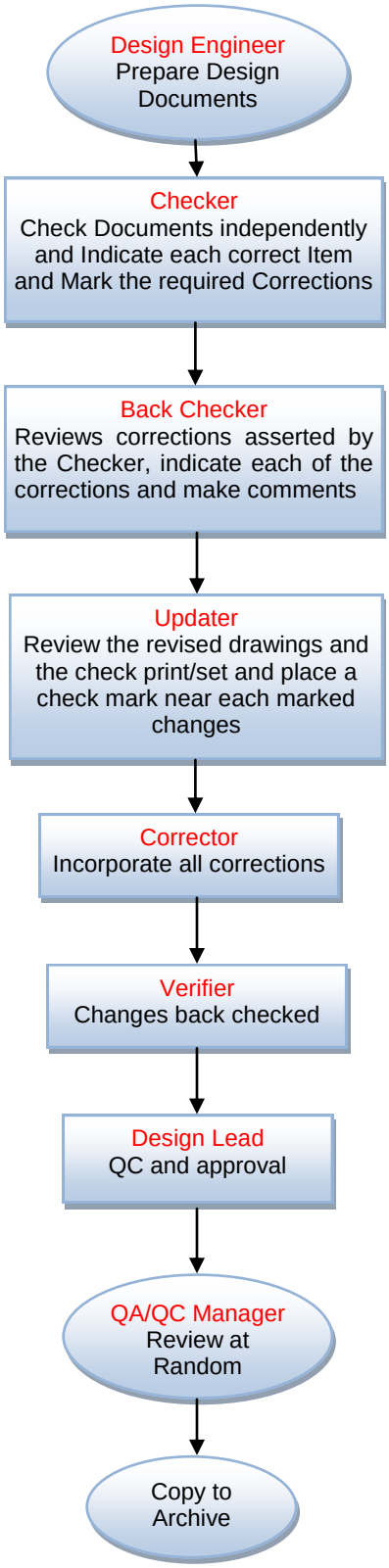
Flow Chart 1
Checking Calculations



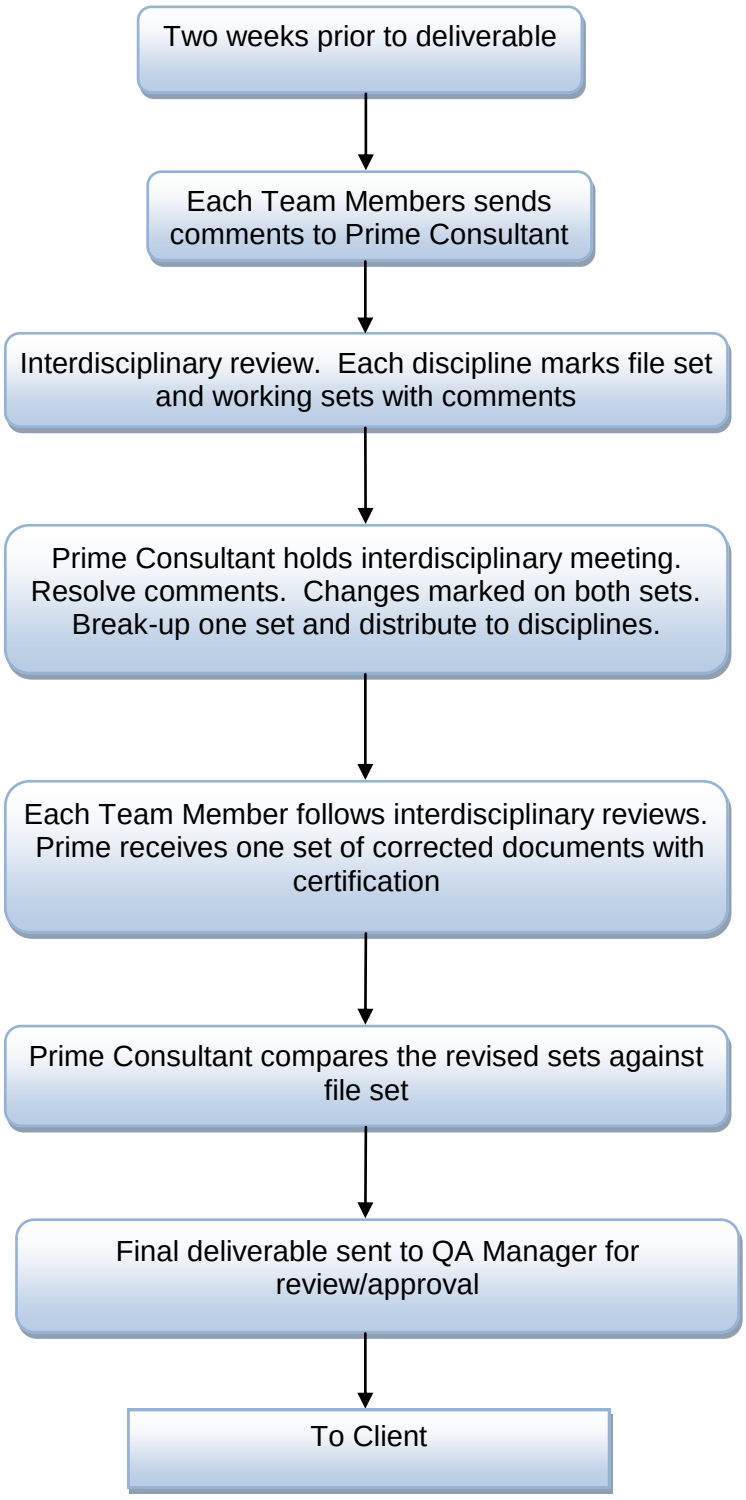
Flow Chart 2
Checking Drawings



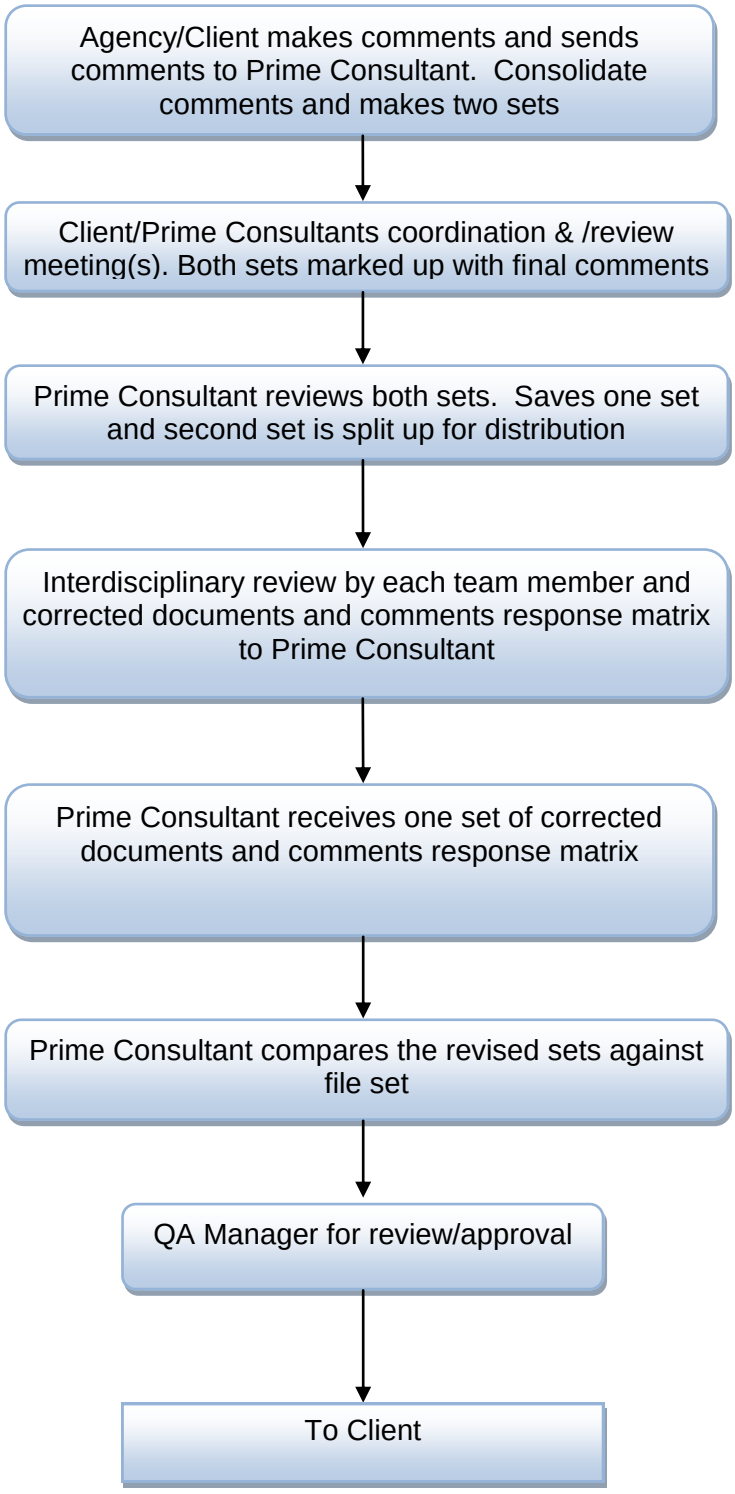
Flow Chart 3
Disciplinary and Interdisciplinary Reviews



Flow Chart 4
Interdisciplinary Reviews
Prior to Client Submittal



FLOW CHART 5
Interdisciplinary Reviews
After Client Reviews



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 REVIEW COMMENTS

Reviewer: _____ **SCRRA File No.:** _____

Submittal Name: _____ **SCRRA Project No.:** _____

Response Codes: **A**=Agreed and will comply/take action. **B**= Will investigate. **C**=Disagree for reasons noted in Response/Status Column. **D**=Will address in next phase.

REVIEWER RESPONSIBILITY								RESPONDER RESPONSIBILITY			
NO.	DATE	SPEC	DWG	REPOR	REF. PAGE	DISCIPLINE	COMMENT	RESPONDER	RESPONSE CODE	RESPONSE	RESOLUTION-ACTION ITEM
1	04/30/15	X			1000	General	Summary of work requires additional description.		A		
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
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METROLINK

DESIGN QUALITY ASSURANCE PROGRAM

CALCULATION CHECKLIST

Consultant:		**Contract No.:**	
Project Name:		**Date:**	
Calculation Title:		**Reviewed By:**	
Purpose of Calculation:		**Computed By:**	

	Comments:	Yes	No	NA	Remark
1.	Purpose of calculation clearly defined				
2.	Input data taken from reviewed and accepted calculations				
3.	Test data appropriately factored into the calculations				
4.	Design criteria referenced				
5.	Data from interfacing sections appropriately factored in calculations				
6.	Assumptions clearly defined and applicable				
7.	Theories are applicable				
8.	Design methods used are consistent with accepted practices				
9.	Mathematics are correct and accurate				
10.	Results are reasonable				
11.	Originator of calculations initialed and dated calculations				
12.	Reviewer initialed the calculations				
13.	Calculations are legible in a form suitable for reproduction and filing				
14.	Copies of pertinent graphs or tables are attached				
15.	All work intended to be covered by calculations was performed				
16.	Calculations are listed in project index				

Remarks: _____

_____

_____ _____

Reviewer Date GEC Manager Date

Follow Up Action Required? ☐ Yes ☐ No If Yes Date of Follow Up Review: _____

_____

QA Manager Date

METROLINK

DESIGN QUALITY ASSURANCE PROGRAM

DRAWINGS CHECKLIST

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

	Comments:	**Yes**	**No**	**NA**
1.	Is the scope of the set of drawings satisfactory?			
2.	Do the structures, equipment or comments satisfactorily meet the functional needs and requirements?			
3.	Have the results of the latest design calculations been incorporated?			
4.	Are interfaces with other discipline drawings correct?			
5.	Have previous comments to check prints been incorporated?			
6.	Has an interdisciplinary review been made using an approved checklist?			
7.	Have the designer and CADD Tech signed the drawing?			
8.	Have the technical managers signed and dated the “checked by” space in the title box?			
9.	Are applicable codes, standards, loadings, etc., shown on the drawings?			
10.	Has accessibility for maintenance, repair and in-service inspection been provided?			
11.	Are materials properly identified on the drawings?			
12.	Are items constructible as shown?			
13.	Has the normal sequencing of construction trades been allowed?			
14	Are right of way and construction easement boundaries clearly identified?			
14.	Is construction phasing or staging clearly shown?			
15.	Are dimensions and tolerances correct and consistent?			
16.	Does drafting technique conform to the SCRRA CAD standards?			
17.	Have duplications and redundancy of information, data and dimensioning been eliminated?			
18.	Do the titles and drawing numbers agree with the cover sheet list of drawings?			
19.	Have the revisions been adequately identified?			
20.	Are there outstanding comments?			

Remarks: _____

_____

_____

_____ _____

Reviewer Date GEC Manager Date

Follow Up Action Required? ☐ Yes ☐ No If Yes Date of Follow Up Review: _____

_____

GEC QA Manager Date

METROLINK

DESIGN QUALITY ASSURANCE PROGRAM

SPECIFICATIONS CHECKLIST

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

	Comments:	Yes	No	NA
1.	Is the specification based on CSI format or other SCRRA approved format?			
2.	Are project-specific specifications consistent with SCRRA Standard Specifications? Or do project specific specifications clearly replace SCRRA Standard Specifications?			
3.	Is the specification complete and clear to the extent necessary to properly specify construction and performance requirements?			
4.	Have duplications between drawings and specifications been eliminated?			
5.	Are proper codes, standards, processes, etc. referenced?			
6.	Have all new or unusual technical sections been approved by SCRRA?			
7.	Are requirements for shop drawings and other submittals properly specified, both to content and timely submission?			
8.	Are material identification requirements properly specified?			
9.	Are new materials employed and installed in the manner approved by the manufacturer?			
10.	Is proper test and inspection documentation properly specified?			
11.	Are the acceptance criteria tests, tolerances, etc. specified and are they adequate, realistic, and in line with ordinary construction practice?			
12.	Are provisions made for the qualification and approval of special construction processes and for the personnel performing these processes?			
13.	Are measuring and test equipment calibration requirements and cleaning, storage and handling requirements properly specified?			
14.	Are requirements for product identification and traceability included?			
15.	Are requirements for operation and maintenance manuals included?			
16.	Are requirements for spare parts and special tools included?			
17.	Are methods of measuring completed work and basis of payment properly specified?			
18.	Is nomenclature used in specification exactly as used on drawings?			
19.	Have all the SCRRA review comments to previous drafts been closed out?			

Remarks: _____

_____

_____

_____ _____

Reviewer Date GEC Manager Date

Follow Up Action Required? ☐ Yes ☐ No If Yes Date of Follow Up Review: _____

_____

GEC QA Manager Date

METROLINK

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

METROLINK

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

METROLINK

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):

✓	**Design Document**
	Drawings
	Project-Specific Specifications
	Engineer's Estimate
	Design Calculations
	Study or Report

"The design documents included in this submittal have been reviewed in accordance with the SCRRA 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

METROLINK

QUALITY AUDIT

		Date:	
Firm Receiving Audit:		**Auditor:**	
Contract:		**Discussed With:**	
Project:		**File Code:**	

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
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:	
	• Documents reviewed, the location of the documents and the acceptability of items or deficiencies observed in the documentation review?	
	• Operations reviewed and the acceptable or non-acceptable areas observed?	
	• 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

METROLINK	QUALITY AUDIT ITEM FINDING		
	File Code:		
	Page	1 of	

☐ Audit ☐ Surveillance	Drawing/Sheet:	Specification:

1. Consultant	2. Contract No.	3. Location	4. QA Item Number
5. Subject		6. Check sheet Number	7. Issue Date
8. Discussed with		9. QA Auditor	10. Auditor Phone Number

11. Requirement reference and description of condition
12. Cause of the problem
13. Corrective action

14. Response due date	15. Response date	16. Effective date

17. Corrective action ☐ Accept ☐ Reject	18. QA Auditor Date
19. Verification of corrective action(s)	
20. Implementation ☐ Accept ☐ Reject	21. QA Engineer Date

APPENDIX B: SAMPLE DOCUMENTS

Project File Index

Document Control Log

Check Print Stamp

PROJECT FILE STRUCTURE

8XXXXX/CXXXX-XX		PROJECT/CONTRACT NO.
NO	SECTION	CATEGORY/DESCRIPTION
10		STRATEGIC PHASE
	10.1	Strategic Plan/Funding Plan
	10.2	Project Justification Proposal
	10.3	Funds/Grants
	10.4	Project Proposal Approval
20		INITIATION PHASE
	20.1	Project Charter
	20.1	Project Budget
	20.3	Project Charter Approval
	20.4	Project Kickoff Meeting
30		PLANNING PHASE
	30.1	Project Management Plan
40		DESIGN PHASE
	40.1	Contract
	40.1.1	Request for Proposal
	40.1.2	Proposal
	40.1.3	Conformed Contract and Amendments
	40.1.4	Insurance
	40.1.5	Correspondence
	40.2	CTO Management
	40.2.1	Contract Administration
	40.2.2	Work Plans
	40.2.3	Communications Plan
	40.2.4	Risk Management
	40.3	Contract Task Orders (CTO)
	40.3.1	CTO requests
	40.3.2	CTO Proposals
	40.3.3	Executed/Approved CTO's
	40.3.4	CTO Trackers
	40.4	Subcontractors
	40.4.1	Organization
	40.4.2	Subcontractor List
	40.4.3	Resumes/Qualifications
	40.5	DBE and EED
	40.5.1	DBE Plan
	40.5.2	DBE Monthly Reports
	40.5.3	Labor Compliance Reports
	40.5.4	Certified payroll
	40.5.5	Certified Payroll Non-Compliance Notice
	40.6	Invoices and Payment
	40.6.1	Invoices
	40.6.2	Payments
	40.7	Technical Data and Criteria
	40.7.1	Basis of Design
	40.7.2	Design Calculations
	40.7.3	Technical Reports
	40.7.4	Request for Special Considerations
	40.8	Schedule
	40.8.1	Milestone Schedules
	40.8.2	Progress Schedules
	40.9	Meetings
	4.9.1	Agendas
	4.9.2	Meeting Minutes
	40.10	General Correspondence
	40.10.1	Outgoing
	40.10.2	Incoming
	40.10.3	Inter-Office
	40.10.4	E-Mails
	40.11	Photograph Records
	40.11.1	Pre-Condition Photos
	40.11.2	Progress Photos
	40.11.3	Safety Photos
	40.12	Project Documents
	40.12.1	Drawings
	40.12.1.1	5% Design
	40.12.1.2	30% Design
	40.12.1.3	60% design
	40.12.1.4	90% design
	40.12.1.5	100% Design
	40.12.1.6	Camera ready

8XXXXX/CXXXX-XX		PROJECT/CONTRACT NO.
NO	SECTION	CATEGORY/DESCRIPTION
	40.12.2	Specifications
	40.12.2.1	Standard Specifications
	40.12.2.2	Project Specific Specifications
	40.13	Submittals
	40.13.1	Problem Screening
	40.13.1.1	Tier 1 Screening
	40.13.1.2	Tier 2 Screening
	40.13.1.3	Problem Screening Approvals
	40.13.2	Concept Development
	40.13.2.1	Concept Development Initiation
	40.13.2.2	Concept Development Report
	40.13.2.3	Quality Management
	40.13.2.4	Communications
	40.13.2.5	Concept Development Approvals
	40.13.2.6	Contracts
	40.13.3	Preliminary Engineering
	40.13.3.1	Preliminary Engineering Initiation
	40.13.3.2	Communications
	40.13.3.3	Environmental Documents
	40.13.3.4	Preliminary Engineering Report
	40.13.3.5	Quality Management
	40.13.3.6	Right-of-Way Access
	40.13.3.7	Roadway Engineering
	40.13.3.8	Structural Engineering
	40.13.3.9	Utility Engineering
	40.13.3.10	Preliminary Engineering Approvals
	40.13.3.11	Contracts
	40.13.4	Final Design
	40.13.4.1	Final Design Initiation
	40.13.4.2	Roadway Engineering
	40.13.4.3	Right-of-Way Access
	40.13.4.4	Quality Management
	40.13.4.5	Environmental Documents
	40.13.4.6	Structural Engineering
	40.13.4.7	Utility Engineering
	40.13.4.8	Communications
	40.13.4.9	Final Design Submission
	40.13.4.10	Certified Plans, Specifications, and Estimates
	40.13.4.11	Final Design Approvals
	40.13.4.12	Contracts
	40.14	Project Cost Estimate
	40.14.1	Quantity Calculations
	40.14.2	Engineer's Estimate
	40.14.3	Material List
	40.14.4	Schedule of Quantities and Prices
	40.15	Design Review
	40.15.1	Design Interface Matrix
	40.15.2	QC Reviews
	40.15.3	Client Comments
	40.15.4	Quality Assurance records
	40.16	QA/QC
	40.16.1	GEC QA/QC Plan
	40.16.2	QC Manager Qualifications
	40.16.3	Non-Compliance Reports
	40.17	Third Party Coordination
	40.17.1	Utilities
	40.17.1.1	Letters
	40.17.1.2	Utility Matrix
	40.17.1.3	Utility Agreements
	40.17.1.4	Utility As-Built
	40.17.1.5	Utility Relocations
	40.17.2	Fiber Optic Lines
	40.17.3	Permits
	40.17.3.1	Letters
	40.17.3.2	Permit Matrix
	40.17.4	Member Agencies
	40.17.5	Local Agencies
	40.17.6	Railroads
	40.17.7	FRA/FTA/Level Boarding
	40.17.8	CPUC

8XXXXX/CXXXX-XX		PROJECT/CONTRACT NO.
NO	SECTION	CATEGORY/DESCRIPTION
	40.18	DSDC
	40.18.1	Meetings
	40.18.2	RFI
	40.18.3	CN
	40.18.4	Shop Drawings
	40.18.5	As-Built
	40.19	PTC
	40.19.1	Change Management
	40.19.2	Reporting Procedures
	40.19.3	Surveying
	40.19.4	Databases
	40.19.5	Track Charts/Composite Maps
	40.20	CTO Close-Out
50		BID AWARD PHASE
	50.1	IFB Documents
	50.2	Contractor Questions
	50.3	Addenda
	50.4	Bid Summary Sheet
	50.5	Bid Opening
	50.6	Conformed Contract
	50.7	Notice to Proceed
60		CONSTRUCTION PHASE
	60.1	Contract
	60.1.1	Pre-Bid Information
	60.1.2	Conformed Contract
	60.1.3	Change Orders/CN
	60.1.4	Notifications
	60.1.5	Final Acceptance/Close Out
	60.1.6	Bonds
	60.1.7	Insurance
	60.1.8	Warranties
	60.1.9	Permits
	60.2	Partnering
	60.3	Contractor Information
	60.3.1	Equipment List
	60.3.2	Subcontractor List
	60.3.3	Resumes/Qualifications
	60.4	Subcontractors
	60.4.1	Organization
	60.4.2	Subcontractor List
	60.4.3	Resumes/Qualifications
	60.5	DBE and EED
	60.5.1	DBE Plan
	60.5.2	DBE Monthly Reports
	60.5.3	Labor Compliance Reports
	60.5.4	Certified payroll
	60.5.5	Certified Payroll Non-Compliance Notice
	60.6	Invoices and Payment
	60.6.1	Invoices
	60.6.2	Payments
	60.7	Schedule
	60.7.1	Baseline
	60.7.2	Progress Reports/Updates
	60.7.3	Two-Week Look Ahead
	60.7.4	Monthly
	60.8	Meetings
	60.8.1	Agendas
	60.8.2	Meeting Minutes
	60.9	General Correspondence
	60.9.1	To Contractor
	60.9.2	From Contractor
	60.9.3	To SCRRA
	60.9.4	From SCRRA
	60.9.5	To GEC
	60.9.6	From GEC
	60.9.7	To Utility
	60.9.8	From Utility
	60.9.9	To Others
	60.9.10	From Others
	60.9.11	E-Mails

8XXXXX/CXXXX-XX		PROJECT/CONTRACT NO.
NO	SECTION	CATEGORY/DESCRIPTION
	60.10	Photograph Records
	60.10.1	Pre-Condition Photos
	60.10.2	Progress Photos
	60.10.3	Safety Photos
	60.11	Contract Documents
	60.11.1	Drawings
	60.11.2	Specifications
	60.20	Submittals
	60.20.1	RFI
	60.20.2	RFC
	60.13	Cost
	60.13.1	Schedule of Values
	60.13.2	Estimate Data
	60.13.3	Claims
	60.13.4	Conditional Waiver/Release
	60.13.5	Labor/Fringe/Equipment Rates
	60.13.6	Preliminary Notice
	60.14	QA/QC
	60.14.1	Contractor's QA/QC Plan
	60.14.2	Contractor QC Manager Qualifications
	60.14.3	Non-Compliance Reports
	60.15	Operating Railroads
	60.16	Local Agencies
	60.17	Permits
	60.18	Utilities
	60.19	Right-of-Way
	60.20	Construction Surveys
	60.20.1	Survey Request by CM
	60.20.2	CM's Construction Surveys
	60.20.3	Contractor's Construction Surveys
	60.21	RE Reports
	60.21.1	Daily Reports
	60.21.2	Weekly Reports
	60.21.3	Monthly Status Reports
	60.21.4	Extra Work Reports
	60.22	Project Office Equipment and Supplies
	60.22.1	Equipment Inventory
	60.22.2	Shipping Records/Invoices
	60.22.3	Automotive Records
	60.22.4	Purchase Orders
	60.23	Office Services
	60.23.1	Rent
	60.23.2	Utilities
	60.23.3	Clerical
	60.24	Safety
	60.24.1	Safety program
	60.24.2	Incident Reports
	60.24.3	Safety Meetings
	60.24.4	Training
	60.24.5	Monthly Reports
	60.24.6	Third party Claims
	60.24.7	Contractor's Monthly Incident Summary
	60.25	Public Relations
	60.26	Environmental
	60.26.1	Noise Control Reports
	60.26.2	SWPPP Inspection Reports
	60.26.3	Soil Monitoring Records
	60.26.4	Environments Non-Conformance Reports
	60.26.5	Cultural Resources Monitoring Reports
	60.26.6	Construction Mitigation Monitoring Forms
	60.27	Materials
	60.27.1	Material Reports/Diaries
	60.27.2	Material Testing
	60.27.3	Material Certificate of Compliance
	60.27.4	Acceptance Tests
	60.27.5	Delivery Tickets
	60.28	Hazardous Material
	60.29	Project Close-Out
	60.30	Team Kickoff
	60.31	Construction Phases

8XXXXX/CXXXX-XX		PROJECT/CONTRACT NO.
NO	SECTION	CATEGORY/DESCRIPTION
	60.32	Construction Complete
70		CLOSEOUT PHASE
	70.1	Project Closeout Activities
80		RAIL INFRASTRUCTURE ASSETS
	80.1	Track
	80.1.1	Track Engineering
	80.1.2	Drainage and Utilities
	80.1.3	Property Acquisition Plans
	80.1.4	Construction Phasing Plan
	80.1.5	Erosion and Sedimentation Control Plan
	80.1.6	Surveying
	80.1.7	Geotechnical
	80.2	Structures
	80.2.1	Bridges
	80.2.2	Tunnels
	80.2.3	Culverts
	80.2.4	Retaining Walls
	80.3	Facilities
	80.4	Stations
	80.4.1	Site Work
	80.4.2	Parking
	80.4.3	Platforms
	80.4.4	Pedestrian Crossings
	80.4.5	Platform Amenities
	80.4.6	Architectural Design
	80.4.7	Structural Design
	80.4.8	Mechanical Design
	80.4.9	Electrical Design
	80.4.10	Landscape Design
	80.4.11	Communication Design
	80.4.12	CIS Design
	80.5	Grade Crossings
	80.6	Layover Facilities
90		SCRRA DEPARTMENTS AND COORDINATION
	90.1	Communications and Signals
	90.1.1	Signals
	90.1.2	Communications
	90.1.3	PTC
	90.2	Engineering and Construction
	90.3	Equipment/Rolling Stock
	90.4	Operations
100		PUBLIC PARTICIPATION

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	06/01/15	06/01/15	Sender of Document	Addressee			06/01/15	
2								
3								
4								
5								
6								
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Drawn By: _____ Date: _____ Print No.: _____

QUALITY CONTROL STAMP

Checked: _____ Date: _____

Back Checked: _____ Date: _____

Corrected: _____ Date: _____

Verified: _____ Date: _____

Color Code:

Red = Correction/Change/Additions
Yellow = Changes/Additions Made
Blue = Changes/Additions Verified
Green = Comments/Notes

APPENDIX C: REFERENCES

1. Jack Shah, AIA 2002, "*Quality Assurance Procedures Manual*," prepared for Korve Engineering.

2. Utah Department of Transportation, "*UDOT Quality Control/Quality Assurance (QA/QC) Procedures*," Version 03/11/2014.