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SUDAN INFRASTRUCTURE SERVICES PROJECT

TASK ORDER 2: JUBA-NIMULE ROAD IMPLEMENTATION PLAN: Revision 1 FY 2009

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Juba-Nimule Road Implementation Plan: Revision 1

TABLE OF CONTENTS (APPENDIX 1)

Table of Contents (Appendix 1) 1
Introduction 1
Method and Approach 3
Security **3**
Demining **3**
Design Stage 4
Community Participation and Involvement **4**
Geotechnical Studies **5**
Topographic Survey **6**
Hydrologic Analysis **6**
Environmental Management **7**
Right of Way and Land Use ..... Error! Bookmark not defined.
Road and Bridge Design **7**
Road Design 7
Bridge Design 8
Construction Stage 9
Initial ROAD Works **9**
Critical Bridges 9
Road maintenance 10
Bridge maintenance 11
Construction Subcontracting **11**
Contract Modality 12
Mobilization 12
Future road Works **12**
Roadway Construction 12
Quality Assurance 15
Deliverables 15
Community Participation Plan **15**
Gender/HIV Plan **16**
Environmental Management Plan **16**
Quality Assurance Plan **16**
Health and Safety Plan **16**
Resource Loaded Schedule (Construction) **17**
Construction Risk Management Plan **17**
Construction Manual **17**
Reports **17**
Budget 18
Staffing 20
Implementation Schedule 23

INTRODUCTION

This document is an update to the original Juba-Nimule Road Implementation Plan that was first developed in January of 2008. Since then, the approach to building this important road has undergone significant changes, most notably the decision to move away from a design-build methodology to design-bid-build and to include provisions that greatly increase opportunities for local companies and local labor to be involved in the construction works. This revision of the Juba-Nimule (JN) Road Implementation Plan describes the activities that have taken place up to the start of roadway construction – the Initial Works - and explains the upcoming task which will see the road completed.

The Juba Nimule Road (JN Road) travels 192km on the east side of the River Nile connecting Juba to Uganda. It is expected to provide a much more efficient corridor for commercial transportation between Uganda and Southern Sudan and support the return of displaced persons. The road will be a 7 meter carriageway with two one and one-half meter wide shoulders. The roadway will be paved with a double bituminous surface treatment. The road includes eight bridges, one of which serves as a border crossing with Uganda. USAID, in consultation and coordination with the Ministry of Transport and Roads (MTR) has designated this road as the most urgent priority for reconstruction.

For FY09, USAID has obligated $35.6 million, bringing the total obligation to $66,232,437. These funds are intended to support the following major activities:

- Rehabilitation of seven critical bridges north of the Ugandan border
- Interim maintenance of the road
- Design and construction of seven new bridges to replace those previously rehabilitated
- Design of the road between the east bank of the River Nile at Juba and the border crossing bridge touchdown point in Uganda
- Reconstruction of the roadway including replacement of failed drainage structures, new pavement with double bituminous surface treatment (DBST), line-marking and signage.

It is anticipated that funding will be made available at the beginning of the next fiscal year (October 09) to complete all of these activities.

Recognizing the critical importance of this roadway to the economic development of Southern Sudan and the return of many displaced persons, LBG developed this implementation plan in order to achieve the following critical objectives:

1. Ensure that the roadway remains a viable corridor during construction.
2. Replace critical failing bridges to required standards.
3. Involve affected communities in the development and implementation of the project and employ local Sudanese workers and businesses to the greatest extent possible.
4. Promote USAID's initiatives on HIV/AIDS awareness and prevention.
5. Complete the construction as quickly as possible while ensuring cost-effective methods and technologies are employed.

6. Construct the roadway to appropriate national and international standards, achieving quality requirements and incorporating sustainable practices for construction and maintenance.
7. Build local capacity.

LBG will use a combination of tactics and approaches to complete the project, such as self-performance, procurement and subcontracting. These tactics will be informed by LBG's knowledge and understanding of the capacity of the local, regional and international markets. They will be bounded by the project specific objectives noted above. They will be informed by experience in the field and modified where appropriate.

The parameters of the JN Road project were originally formulated during the feasibility study conducted in February and March 2007 and subsequently expanded upon as LBG gained a greater understanding of the local environment.

The Implementation Plan that follows provides the critical elements for delivering the project successfully. It is broken into several discrete components, such as methodology, approach, schedule, etc. The plan also includes the framework for the key deliverables required during the implementation of the project.

METHOD AND APPROACH

LBG will implement the Juba Nimule Road (JN Road) as a design-bid-build project with a strong emphasis placed on capacity building and local involvement in the construction process. Up to this point, all seven new bridges on the road are under construction, roadway design is completed, three roadway construction subcontracts have been awarded and mobilization of the subcontractors is underway. The majority of the LBG staff that will provide construction management is in place and the remaining positions will be recruited in the coming weeks. The methodology presented below covers the completed and planned activities that are intended to result in a sustainable, cost-effective roadway that meets requisite design and construction standards and specifications.

SECURITY

Security in Southern Sudan is a significant consideration that must be integrated into all activities. Although the Comprehensive Peace Agreement appears to have achieved a cessation of hostilities between the previously warring parties, various areas of Southern Sudan remain prone to violence and danger. In order to incorporate security aspects into the JN Road, all construction subcontractors will be required to retain the services of a security provider. The security services provider will support movement security and site security for both the subcontractor and LBG field staff that are supervising construction. These providers will fall under the coordination of the overall SISP security program, which is being implemented by the subcontractor Burton Rands and Associates and supervised by the SISP Security Manager.

DEMINING

Demining of the corridor is an essential component of the overall project. There were several large scale battles fought along the roadway during the civil war, and Nimule was one of the larger towns which had a perimeter of defensive mines. Mines were also placed at key bridge locations. At various locations along the road, there is clear evidence of major battles, such as disabled tanks, bomb components and armaments. As such demining and unexploded ordinance clearance are critical components that will allow the improvement project to proceed.

Demining of the JN has been conducted in several stages; prior to the start of SISP, during its emergency road repair works, the World Food Program (WFP) provided some level of demining along the entire road. From Nimule to Juba, an eight meter wide corridor was cleared. This corridor was generally in the footprint of the road; however, the boundary could not be considered precise, as traffic during the rainy season, in maneuvering around potholes and washouts, has effectively created a road bed that in many places was substantially wider than eight meters. In addition to the eight meter clearance of the roadway, WFP also cleared a corridor of twenty-six meters from Nimule to about fifty kilometers north. This clearance area, thirteen meters from what was the road centerline at the time of clearance was not clearly delineated from the center of the road in many places due to the widening that has occurred with the rainy season.

The second phase of demining was conducted by the SISP program through the subcontractor Ronco, This phase was carried out to allow construction of the new bridges that would replace the existing structures and was targeted at the approaches to the new bridge locations, and the adjacent stream valley.

The third phase of demining is currently underway and is being implemented by the SISP program through the subcontractor The Development Initiative (TDI). Up to this point, TDI has completed demining of the locations currently identified for the borrow pits that will provide material to the road construction effort. In addition, TDI has cleared all the camp and equipment lay down areas that will be used by the bridge and road construction teams.

Work is now focused on clearing a 20m corridor along the road alignment; work is progressing on three fronts that correspond to the three construction sections. TDI has developed a work program that ensures that demining will progress in advance of each of the three construction teams in such a way that they will not interfere with construction progress. After the entire corridor has been cleared, TDI may remain on site to deal with any additional demining issues that arise.

DESIGN STAGE

The design stage included various activities that were required to develop plans and to identify special provisions and specifications for the work. LBG used a design-bid-build approach for both the bridge and roadway construction programs, with replacement of the existing bridges the first activity to be addressed.

The activities of the design stage included the following:

- Community Participation and Involvement
- Geotechnical Studies
- Topographic Survey
- Hydrologic Analysis
- Environmental Management Plan
- Road and Bridge Design

COMMUNITY PARTICIPATION AND INVOLVEMENT

LBG has invested significant resources into developing a Community / Stakeholder Participation Plan for the JN Road that will guide the manner in which they and their subcontractors engage the public, affected populations and social and government leadership in the development and implementation of the project. The plan had taken on greater significance following USAID's guidance that the project should ensure greater local participation in the actual construction work, by requiring that the construction subcontractors meet specific quotas for hiring local labor and utilizing local subcontractors. The plan was developed in January of 2008 by the subcontractor Winrock International and subsequently refined by LBG staff; all future maintenance and construction activities will incorporate its findings and approved recommendations. As proposed in the plan, SISP engaged a Sudanese Community Development Officer who conducts day to day liaison with the communities along the JN Road. A follow up visit by LBG Community Development Specialists was conducted in July and August to begin implementation of the plan's recommendations.

During the visit the Team accomplished the following:

- Ensured that all the impacted communities understand the Project;
- Developed approaches for maximizing local community participation in the Project to the extent possible (e.g., unskilled labor hired by the sub-contractor);
- Provided a mechanism / local forum for the exchange of information and problem solving; and,
- Acted as the liaison between the communities, and the Project and Government of Southern Sudan (GoSS).

LBG Community Development Specialists from the home office will conduct another visit to the field around the start of construction with the following major goals in mind:

- Follow up with all relevant stakeholders, including GOSS, USAID, and representatives from various NGOs currently implementing community development activities in the area
- Travel to all the villages impacted by the road, and update residents in regards to current schedule and activities for the Juba-Nimule Road
- Check on the community mobilization committees established during the 2008 assignment
- Coordinate with SISP engineers regarding any households/businesses requiring relocation
- Coordinate with SISP COP and engineers regarding road construction subcontractors, to ensure that they meet the responsibility to hire labor from the local community for all their unskilled labor needs, and use of local resources for construction materials
- Conduct ongoing liaison activities between the communities, the subcontractors, and the SISP staff, especially with regard to the start-up of the road works, via community visits and written pamphlets providing information about the project

Periodic visits will be made throughout the construction program to support and develop the field based community development staff and to ensure that targets continue to be met.

GEOTECHNICAL STUDIES

A Geotechnical study, investigations and testing was conducted to establish the surface and subsurface conditions existing along and adjacent to the road section to provide data and information for roadway, bridge foundation and culvert design and construction. The study also included a construction material survey to identify and test possible borrow areas and quarries in and near the vicinity of the project that will provide sufficient quantities of materials for construction operations.

A Kenyan joint venture, African Consulting Engineering Services (AECS) was engaged to conduct both the Geotechnical and Topographic Surveys. Work initially focused on providing geotechnical analysis of the new bridge construction sites to allow design work to get underway as quickly as possible. Boreholes were drilled at the abutment and pier locations of all bridges to a maximum depth of 10m and the collected samples were transported to a laboratory in Kenya for analysis, where the following tests were conducted:

- Atterberg limits
- California Bearing Ratio (CBR) to 95% MDD

- Swell

Once the bridges were completed, ACES began investigations on the mainline of the roadway and in the borrow pits and quarries that will supply material for construction. A total of 547 samples were taken from the roadway and 136 from the pits and quarries. Once again, the samples were transported to a laboratory in Kenya, where the following tests were conducted:

- Moisture content
- Atterberg limits
- Density
- Grading
- Compaction
- California Bearing Ratio (CBR)

A preliminary and final report was provided which included details of soil and rock parameters, stability analysis, bearing capacity, foundation requirements, groundwater and settlement.

TOPOGRAPHIC SURVEY

ACES completed a DTM (Digital Terrain Modeling) topographical survey and mapping of the entire Juba to Nimule roadway and adjacent areas, including the streambeds at the new bridge locations. The survey supported the topographical requirements of the Geotechnical survey and provided the necessary data to the bridge and roadway designers to allow them to proceed. Once again, bridge sites were surveyed first before moving on to the road mainline. The work completed included geodetic survey, traverse survey, cross sections and leveling survey.

Total Stations were used to collect the field data which was downloaded and processed using Liscad v.6.2 software. Generation of contours was carried out using Global Mapper v.9.0 and CAD work was done using AutoCAD 2005.

In addition to conducting the survey, ACES also conducted a monumentation exercise, establishing primary and secondary control points along the length of the road. Six hundred and forty eight secondary points were established at 300m intervals between forty primary points which were spaced every 5km. The locations of the control points were verified using GPS readings to assure that survey accuracy was within tolerable limits.

HYDROLOGIC ANALYSIS

A Hydrologic and Hydraulics analysis was necessary in order to properly site and size the bridges and other drainage structures along the JN Road. LBG conducted a field evaluation which included a survey of the eight existing bridges to evaluate scour at abutments, channel conditions, and bank conditions in addition to a hydrologic evaluation of the existing watershed to estimate peak flow and the potential for flooding. Although much of the analysis was conducted from the home office, field review allowed the hydrologist to identify physical evidence of high water and other stream characteristics, which were used to verify subsequent calculations.

The method of analysis used to predict flow rates contained in the final report were developed using methodologies from the Transport and Road Research Laboratory(TRRL), Department of Environment. The TRRL Laboratory Report 623 “the prediction of storm rainfall in East Africa” and the Report 706 “the TRRL East African flood model” were used to estimate peak flows for bridges along the Nimule-Juba Road. While the TRRL Flood Model was developed primarily for use in Uganda and Kenya it is also believed to be applicable for Southern Sudan and this project.

A final report provided recommendations on the size, height and location of the new bridges and general recommendations regarding channel protection.

ENVIRONMENTAL MANAGEMENT

LBG developed an Environmental Management Plan (EMP) framework that will guide design, construction and maintenance activities to ensure that environmental factors are adequately and appropriately considered during various phases of the project. The EMP is based upon initial work done during the Feasibility Study, LBG’s own best practices, and the Programmatic Environmental Assessment (PEA) that was undertaken for Road Rehabilitation Activities in Southern Sudan. The PEA formed part of USAID’s Sudan Transitional Environment Program (STEP).

As part of the environmental management program, Recommended Environmental Contract Provisions were prepared using the guidelines and mitigation measures outlined in the above documents. The finalized version of these Contract Provisions was included as part of the contract used to engage the construction subcontractors for the JN Road civil works.

A program of monitoring will be undertaken during the rehabilitation of the JN Road by LBG environmental staff. Monitoring will be undertaken in three stages, firstly after completion of the main construction camps to ensure compliance with the proposed contract provisions, secondly at a midway point during construction, and lastly, at the completion of works to ensure that the sub-contractor has made good his camps, borrow pits, etc, according to his contractual conditions.

ROAD AND BRIDGE DESIGN

Road Design

The project road is the shortest route between the City of Juba, the neighboring country of Uganda and the region’s major port, Mombasa; as such, it is likely to be the most heavily traveled road in Southern Sudan. For this reason, the road has been designed to become an all weather DBST highway.

Road design was conducted by LBG Staff in Juba using the following geometric design criteria, based on A Policy on Geometric Design of Highways and Streets, 2001 fourth edition by the American Association of Transport and Highway Officials (AASHTO).

Horizontal Alignment

Maximum Speed	60kph
Maximum Speed, mountainous	40kph

Minimum Radius without super-elevation at 60kph	1417m

Vertical Alignment

Minimum K value, Crest Curve, 100kph	11
Minimum K value, Sag Curve, 100kph	18
Minimum Longitudinal Gradient	0.50%
Maximum Longitudinal Gradient	6.0%

Values may be adapted to reduce cost on earthworks and other related items of work. Values may also be adjusted to reduce the effect on environmental issues such as ROW acquisition and removal of trees.

Cross Section Elements

Road Lane Width		2 x 3.5m
Bridge Lane Width		2 x 3.7m
Bridge Sidewalk Width		2 x 1.0m
Shoulder Width, Flat Areas		2 x 1.5m
	Mountainous	2 x 1.0m
Normal cross-fall		2.0%
Side Slope Ratio,	Fill	2H: 1V up to 3.0m
		1.5H: 1V over 3.0m
	Cut	1.5H: 1.0V <2.0m Common Exc.
		1.0H: 1.0V >2.0m Common Exc.
		1.0H: 3.0V-4.0V >2.0m Rock Exc.

Sight Distances

Stopping Sight Distance	130m
Driver's Eye Height	1.08m
Height of Object for Stopping	0.60m

Widening

Based on traffic counts conducted during the Feasibility Study, the adopted design vehicle was a single unit truck. Widening on substandard curves (50m radius) will be based on the largest vehicle recorded on the traffic survey for safety reasons. This widening is essentially required in mountainous areas (Gordon Hill).

Bridge Design

The designs of bridge and culvert structures on the project road are based on Standard Specifications for Highway Bridges 16th Edition (1996) with 1997-2001 Interims adopted by American Association of State Highway and Transportation Officials (AASHTO). Additional references such as ACI and AISC specifications were adopted as necessary.

Design Loads

Dead Loads

- Reinforced Concrete Unit Weight = 24kN/m3
- Structural Steel Unit Weight = 78.5 kN/m3

Vehicle Loads: The Greater of

- 130% of HS20-44 Truck Plus Impact
- Military Vehicle with Two 24,000-lb Axles

Wind Load: Based on 120mph Wind Speed
Thermal Forces: Based on 70°C Temperature Difference
Stream Current Forces: Based on Hydrologic/Hydraulic Studies
Earthquake: Based on Seismic Coefficient of Acceleration for road zone

The foundations for the seven bridges on the JN Road were originally designed by the subcontractor A&A Consultants and subsequently modified by LBG design staff in Juba to rationalize material and excavation quantities. The steel superstructures were designed and supplied by Reid Steel of the UK.

CONSTRUCTION STAGE

The construction stage consists of a variety of activities that lead to the completion of useful facilities. Since the initial obligation of funding (approximately $28 million) for the JN Road was not sufficient to complete the road to the desired standard, initial works, based on priorities agreed with USAID and MTR, were completed first. These initial works included design and construction of the seven new bridges, construction of the approaches to those bridges, roadway design, and tendering of the roadway construction subcontracts. A second obligation of funding ($36 million) has allowed construction of the roadway proper to begin, on the understanding that a third obligation of funding will be made available at the beginning of FY10 to complete the works.

The specific activities included as part of the construction stage include the following:

- Critical Bridges;
- Construction Subcontracting;
- Contractor Mobilization;
- Roadway Works.

Each of these is described below.

INITIAL ROAD WORKS

The initial stage of construction had two primary components—the replacement of the critical bridges and initial roadway works, which included maintenance of the road and the existing bridges.

Critical Bridges

The deteriorated condition of the seven existing bridges on the JN Road dictated that they should be replaced as soon as possible, to promote safe travel that will support economic development and facilitate the return of displaced persons. The new bridges are two-lane and of composite construction with steel girders and reinforced concrete decks; construction is currently underway at all seven sites.

In an effort to speed up construction of the bridges, LBG adopted an aggressive schedule that encompassed separate subcontracts for design, foundation construction and superstructure supply and erection. This approach was adopted based on the following logic:

- The design subcontractor, A&A Consulting, was a member of the original SISP proposal team and as such could be engaged directly without the need for a lengthy tendering process; this would allow design work to begin as quickly as possible
- By utilizing prefabricated steel superstructures, manufacture and delivery could be conducted in parallel with foundation construction, thus reducing the time to completion. Initial contacts with prominent prefabricated bridge manufacturers (Acrow, Bailey, Mabey Johnson) indicated that they would only be willing to supply the superstructures, as they did not have local construction capacity.
- The relatively small value of the project would likely restrict interested subcontractors to regional companies, few of which are capable of providing a complete design-build service.

The bridge foundation construction contract was awarded to the Kenyan subcontractor, Civicon, while bridge supply and erection was awarded to the Ugandan subcontractor, Terrain Services, using steel structures manufactured by Reid Steel of the UK. Both subcontracts were tendered and implemented in accordance with the requirements of the Federal Acquisition Regulations (FAR) and the *Federation Internationale des Ingenieurs-Conseils* (FIDIC), consistent with the requirements of the SISP basic contract. A final contract was awarded to the Kenyan subcontractor, Kirinyaga, to construct the approach roads that link the new bridges to the existing roadway. These new approaches also serve as a launching platform during erection of the superstructures.

The time saving that was envisaged using this approach was not fully realized. Due to delays in awarding the topographical and geotechnical survey contract, the necessary data was not provided to the designers, A&A, in a timely manner, so design was not completed before construction tenders were issued. As a result the BOQ used in the tender documents for the foundation construction was based on notional quantities developed from field observations, rather than a final design. When the actual designs were completed, they were significantly more massive than had been anticipated, with corresponding increases in excavation and material requirements. Civcon's mobilization of manpower and equipment was based on the original estimates in the tender documents, so they did not have adequate assets in the field to build to the new design and keep up with the original schedule.

Road maintenance

USAID and MTR agreed that it was appropriate for LBG to assume interim maintenance of the JN Road at the earliest opportunity. LBG assumed maintenance responsibility for the roadway early in 2008.

LBG solicited a grading subcontract for surface maintenance which was awarded to the local subcontractor, Bright Star. The purpose of the surface maintenance was to re-work the travel way in order to promote a more consistent grade, to fill voids and potholes, to ensure proper drainage away from the road surface and to replace lost or displaced materials. In addition to the regrading, the subcontract also included provisions for additional material to be placed to correct extreme situations.

A second maintenance subcontract was awarded in late 2008, following the end of the rainy season, to return degraded sections to a fully functional standard. This work was awarded to Sudanese subcontractor Eyat Roads and Bridges and included scarifying, shaping and grading. A further provision was included in the contract that required Eyat to retain a small team on the road after completion of the major work to provide continuous shaping anywhere along the road alignment, as directed by the LBG.

Bridge maintenance

The existing, single lane Bailey-type bridges along the Juba–Nimule Road were in very poor condition following years of neglect and chronic vehicle overloading. To ensure that this critical road remained open, LBG implemented a repair program on all eight bridges between Juba and the Ugandan border. Using structural elements salvaged from the recently dismantled Juba Nile Bridge (a 256-meter Bailey-type bridge) and working with a small Sudanese subcontractor, Rhino Star, the bridges were restored to a safe working condition.

CONSTRUCTION SUBCONTRACTING

The subcontracts to complete construction of the JN Road were tendered and implemented in accordance with the requirements of the Federal Acquisition Regulations (FAR) and the *Federation Internationale des Ingenieurs-Conseils* (FIDIC), consistent with the requirements of the SISP basic contract. In order to expedite the construction subcontract procurement process, LBG combined subcontractor prequalification with development of the tendering documents. Subcontractor prequalification addressed minimum levels of company experience, financial and managerial capacity and equipment and labor and was conducted on a parallel path while the tender documents were under development. LBG awarded the construction subcontracts on the basis of best value among responsive bidders.

Three subcontracts were issued on separate sections of the road that together run from Juba to the Ugandan border 2 km south of Nimule town. The first section, km 00 (the Ugandan border) to km 55 was awarded to Progressive Construction Ltd. of India, the second section, km55 to km125 was also awarded to Progressive Construction, and the third section, km125 to km192 was awarded to Eyat Roads and Bridges of Sudan. Breaking the road into three contracts allows progress to be maintained on multiple fronts and provides the option to replace contractors that do not meet performance standards.

To meet the need to build local capacity and generate employment, the contracts specify that a minimum of 15% of the value of the work must be subcontracted to Southern Sudanese companies and 50% of the casual labor force must be recruited from the local community.

The total funding required to complete the entire roadway has not yet been obligated by USAID. It is anticipated that an additional obligation of approximately $100 million will be required to complete the road. Notice to Proceed has been given to the construction subcontractors so that work can be completed by the earliest possible date but this assumes that the next obligation of funding will be made available on time to avoid additional costs related to demobilization, remobilization and idle claims.

Contract Modality

The three construction subcontracts were awarded as firm fixed price contracts utilizing fixed unit rates as a basis for pricing the Bill of Quantities (BOQ). These unit prices are fixed for the duration of the project. This represented a departure from the original strategy of awarding design-build contracts and required that LBG complete design of the roadway before issuing the tender documents, so that an accurate BOQ was available for pricing. Payment under the construction subcontract will be based upon the actual quantities of work ordered and carried out by the contractors and verified by the Engineer

Mobilization

Notice to Proceed was given to the construction subcontractors in late April, 2009. Each construction subcontractor is required to quickly mobilize and initiate project related activities including:

- Location and Construction of camp including potable water, waste disposal, power and communications, laboratory, housing, offices, warehousing, etc.;
- Mobilization of roadway construction equipment;
- Establishment of lay down yards or temporary camps at remote locations;
- Installation of bore holes and establishment of other water sources at various locations throughout the project corridor;
- Initiation of borrow pits and quarry operations;
- Commencement of the initial roadwork relating to replacement of unsuitable materials and the replacement of failed drainage structures; and

FUTURE ROAD WORKS

The next phase of construction will provide a seven meter, paved carriageway with one and one-half meter shoulders and adequate drainage throughout. The entire length of the road will be paved with a double bituminous surface treatment to provide a durable, easily maintained and smooth riding surface. Replacement of the border crossing bridge between Southern Sudan and Uganda is not currently in the construction program.

Roadway Construction

In preparation for application of the all-weather surface, the selected subcontractors will perform the following activities:

- Completion of earthwork activities required to adjust horizontal and vertical alignment as indicated in areas where unsuitable materials are encountered
- Construction of road sub-base in areas that require engineered sub-base because of unsuitable native soil conditions
- Construction and/or replacement of failed drainage appurtenances and structures

Roadway construction will include the production of necessary materials to support construction, with aggregate being a significant component.

Drainage Structure Replacement

During construction of the roadway, the contractor will replace an estimated ten percent of existing cross pipes and other drainage structures that are believed to have failed. This will require the construction subcontractor to install reinforced concrete pipes, boxes and culverts, and masonry headwalls, channels and lined ditches as required. Maximizing the involvement of local companies and creating local employment was an important criterion during the contracting process; it is anticipated that this will be an area where local subcontractors can play a major role.

Water for Road Construction

During the construction activities the subcontractors will require a considerable amount of water for the compaction of the murram material for the embankments and for reducing the dust pollution generated by the traffic. There are 8 river/streams that dot the road corridor which during the dry season, or the prolonged dry spells, have little or no water at all so, as a result of that, a consistent number of boreholes needs to be drilled at various strategic locations to extract ground water. The intensity and the final required number of boreholes will be determined upon the productivity of the drilled ones.

Aggregate Production

The construction of the JN Road will require large amounts of aggregate. The original assessment during the feasibility study determined that there would be locations along the corridor which would support quarry operations, but this requires that the construction subcontractors establish their own rock crushing operations.

The required quantities would involve substantial cost if crushed aggregate is utilized. Considering this, it is recommended that natural gravel (aggregates) should be used instead which must be cement-stabilized in order to attain the required design density. Cement treatment of about 4% by weight is initially specified to satisfy the strength requirement. Type 1 & Type 1A (Air entraining cement) is extensively used. The main objective is to attain the required CBR value necessary to withstand the volume of traffic that would last the design life of 7 to 10 years as specified in Annex 2 of Feasibility Study. It is not always necessary to attain 100% CBR in Base Course because oftentimes lower CBR value is adopted but compensated with structural layers thicknesses, e.g. Improve Subgrade, Sub-base, Base and Wearing Course.

Method of Stabilizing Road Base Using Portland Cement

Several Codes and Manuals have been written as guide to stabilize Road Bases using Portland cement. Two options are hereby presented as options.

Option 1:

Granular Base Stabilization by CTB method in accordance to PCA (Portland Cement Association) in conjunction with FP03 Standard Specification, Federal Highway Administration.

CTB is an intimate mixture of natural aggregate material and/or granular soils combined with measured amounts of Portland cement and water that hardens after compaction and curing to form a durable paving material. A bituminous or Portland cement concrete wearing course is placed on the CTB to complete the pavement structure. CTB is widely used as a pavement base for highways, roads, streets, parking areas, airports, and materials handling and storage areas.

In CTB construction the objective is to obtain a thorough mixture of an aggregate/granular material with the correct quantity of Portland cement and enough water to permit maximum compaction. The completed CTB must be adequately cured to both let the cement hydrate and to harden the cement-aggregate mixture. The fundamental control factors for quality CTB are:

1. Proper cement content
2. Adequate moisture content
3. Thorough mixing
4. Adequate compaction
5. Proper curing

The aggregate/granular material, cement, and water are to be mixed in a central mixing plant. Central plants can either be continuous-flow or batch-type pugmill mixers. CTB can also be mixed-in-place using transverse-shaft pulvermixers or traveling mixing machines.

CTB thicknesses are less than those required for granular bases carrying the same traffic because CTB is a cemented, rigid material that distributes the load over a large area. Its slab-like characteristics and beam strength are unmatched by granular bases that can fail when interlock is lost. This happens when wet subgrade soil is forced up into the base by traffic loads. Hard, rigid CTB is practically impervious. It resists cyclic freezing, rain, and spring-weather damage. CTB continues to gain strength with age even under traffic. This reserve strength accounts in part for CTB's excellent performance.

The cement content is a function of aggregate gradation and Plasticity Index of soil-cement mixture. Initial estimate of required cement content is about 4% for the type of soil along JN road section. Thus, further tests with geotechnical investigation by way of soil classifications, will determine the cement content relative to the type of materials from approved source (quarry). Determining Cement Content would follow the procedure in accordance to ASTM procedure D423 & D424.

Aggregate gradation requirement is based on FP03 Table 703-2, which allows 100% passing maximum size of 50mm sieve.

Option 2:

Adopting Stabilization of Base in accordance to Chapter 3 of US Army Road Construction Manual TM 5-822-14/AFJMAN.

The similarity of the approach as with FP03 is hereby noted. The only difference is the approach with regards to determination of cement content and the gradation requirements of aggregates of both Base and Sub-base. Cement Content in Soil-Cement Mixture shall be determined by the formula A=100*BC,*

Where:

A = design cement content in percent total of weight of soil

B= percent passing No. 40 sieve size, expressed as a decimal.

C= percent of cement required to obtain the desired PI of minus 40 material, expressed as a decimal.

US Army manual allows maximum size of aggregates with 100% passing 11/2 in. (38mm) and plasticity index determination in accordance to ASTM D423 and ASTM D424.

Unsuitable Soils Replacement

The assessment done during the feasibility study estimated unsuitable soils will be encountered in less than ten percent of the project area. Where unsuitable soils were identified during the geotechnical investigation, the primary solution is expected to be removal and replacement with suitable material. However, depending upon geotechnical requirements, an alternative approach may be required such as capping or other techniques.

QUALITY ASSURANCE

LBG will provide quality assurance of all activities on the project. Quality assurance will be conducted in accordance with the Quality Assurance Plan. Individual subcontractors will be responsible for quality control of their activities under the oversight of the contractor and consistent with the Quality Assurance Plan as described subsequently.

LBG has identified staff positions that will be involved in assuring quality of construction and maintenance activities. Field based staff, assigned to oversee and inspect construction subcontracts will monitor construction works to ensure that the work adheres to contract requirements and specifications and to ensure that the work achieves its intended results.

LBG assigned qualified staff to oversee the maintenance subcontracts.

DELIVERABLES

LBG will provide deliverables and submittals in accordance with the requirements of the task order and consistent with the approach to project execution. In addition to the deliverables associated with construction works described above, LBG will provide additional items as necessary. These additional items include the following:

COMMUNITY PARTICIPATION PLAN

The purpose of the Community / Stakeholder Participation Plan is to provide a framework that will guide the contractor and subcontractors in working with stakeholders affected by the project.

LBG has developed and implemented a Community / Stakeholder Participation program, to include consultations with GoSS Ministries (Ministry of Transport and Roads (MTR), Ministry of Housing, Land and Public Utilities (MHLPU), Ministry of the Environment, Ministry of Gender and others as appropriate), State authorities (Governor's office, and associated State Ministries as appropriate), local authorities as may be available and local communities. Effort will be extended to include participation from women, vulnerable groups and local residents affected by the project. LBG will conduct town hall meetings in each community through which the project passes prior to the start of construction in that community. The town hall meetings will address concerns of the community and explain the project to the community members. Particular attention will be emphasized to assure that women and vulnerable group members are adequately represented at these meetings.

GENDER/HIV PLAN

The contractor developed the framework for a Gender/HIV Plan early in the program. This framework will be used to guide the project specific Gender/HIV plan that will be developed during the project development. The Gender/HIV plan will also incorporate elements of the Community/Stakeholder Participation Plan that is currently under development.

In addition, LBG will require construction subcontractors to incorporate a variety of HIV/AIDS prevention activities for their workforce. Special opportunities for women and other disadvantaged people will be provided through the provision to maximize the use of local labor that was built into the construction subcontracts.

ENVIRONMENTAL MANAGEMENT PLAN

As noted previously, LBG will provide an EMP framework that will guide subcontract specific environmental monitoring.

QUALITY ASSURANCE PLAN

The Contractor has both a Design Quality Management Plan and a Manual of Project Management Guidelines for Supervision of International Construction Contracts as part of its corporate QC/QA program. Both of these manuals will be used, and adapted as necessary, for the Juba Nimule Road. These will be finalized in conjunction with the construction subcontractors' individual project quality control plan.

In addition to the use of these manuals by the design and construction management teams, LBG corporate maintains an active QA Board of review to monitor designs and construction progress and overall quality.

HEALTH AND SAFETY PLAN

Each individual construction subcontract will require the development of a project specific health and safety plan. Upon award of the construction subcontracts and prior to the preconstruction conference, construction subcontractors will submit their Health and Safety Plan to LBG and to USAID for review.

RESOURCE LOADED SCHEDULE (CONSTRUCTION)

Once construction subcontracts have been awarded, LBG will direct the subcontractor in the development of resource loaded project schedules. These schedules will be developed on the Contractor's Program Controls System which will be initiated in conjunction with the start of the construction subcontracts. The resource loaded schedule will provide an initial baseline plan for implementing the construction works.

The schedules will be updated on a minimum of a weekly basis or more frequently as the situation may require. The Program Controls System will allow the generation of specific reports that will be used by LBG and by USAID in monitoring progress, indentifying critical deliverables and anticipating and resolving problems.

CONSTRUCTION RISK MANAGEMENT PLAN

LBG will update and submit a revised construction risk management plan to USAID for review.

CONTRACTOR"S CONSTRUCTION MANUAL

A Contractor's Construction Manual will be developed that will set forth guidelines and requirements for the subcontractor's working relationship with LBG.

REPORTS

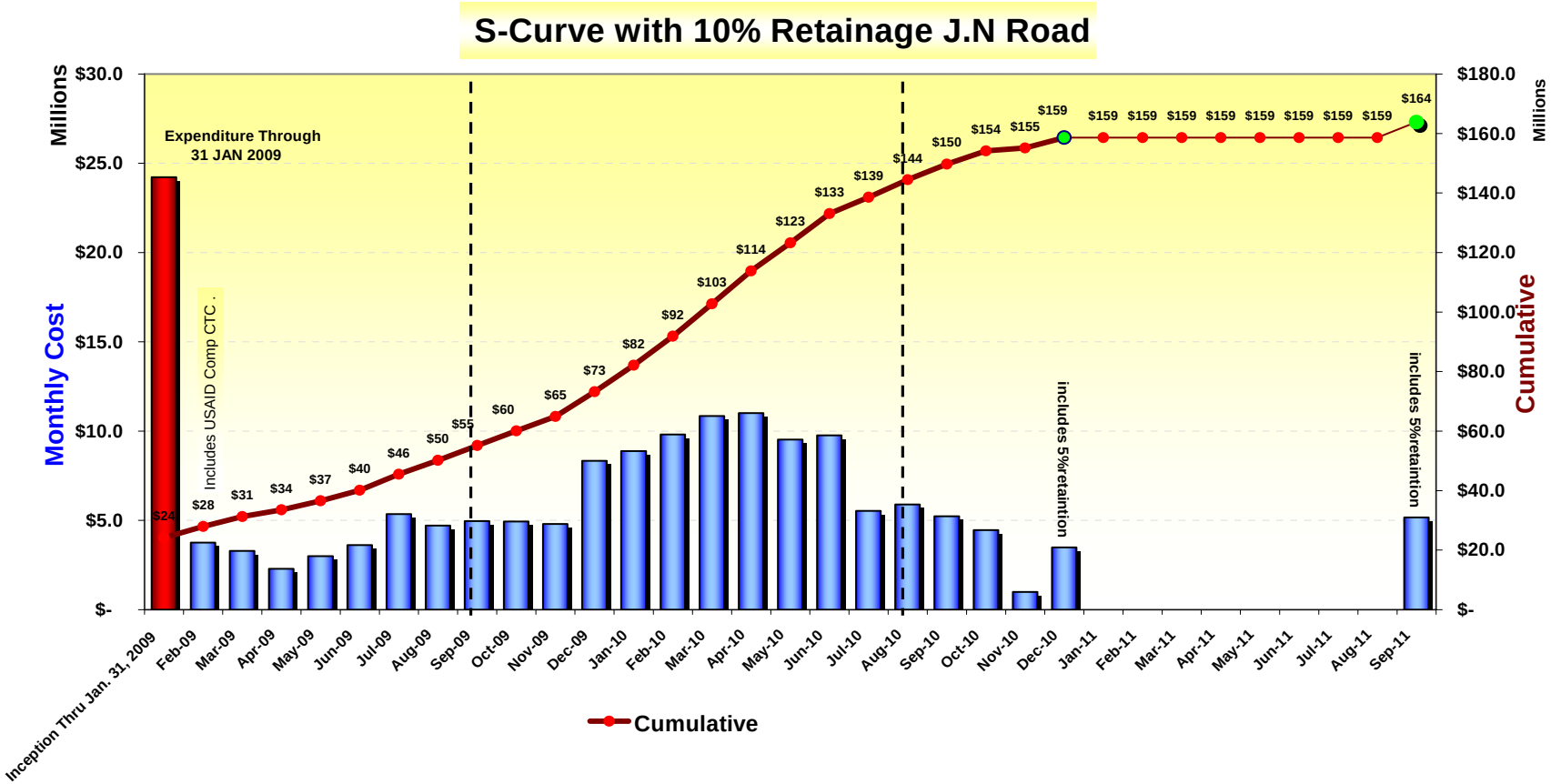
LBG will submit standard reports on a daily, weekly, monthly and quarterly basis. These reports will detail project activities, provide an analysis of project status and progress toward meeting key objectives and deliverables, financial information, including burn rate and cost to complete and, where appropriate, data and information relating to performance metrics.

BUDGET

The total cost for construction of the Juba Nimule Road is projected to be approximately $164 million. In the following table, these costs are broken out against the various entities conducting the work. The first budget category, Program Support, captures a range of costs associated with LBG's management and construction supervision. Included also in this are general and administrative costs, overhead, other direct costs to the project and fee through the entire period.

Cost Element:	Inception Thru Jan. 31, 2009	Year 3	Year 4	Year 5	Total
1. PROGRAM SUPPORT	**$8,765,960.02**	**$3,399,698.85**	**$6,217,992.21**	**$1,284,699.14**	**$19,668,350.22**
A. Salaries and Wages	$1,637,661.99	$1,024,938.84	$2,057,728.51	$390,872.17	$5,111,201.51
B. Overhead & Fringes	$1,553,207.38	$942,241.20	$1,791,021.12	$348,804.50	$4,635,274.20
C. Travel and Transportation	$593,511.19	$354,188.00	$451,752.00	$195,146.03	$1,594,597.22
D. Allowances	$613,507.13	$458,929.87	$858,781.70	$164,306.22	$2,095,524.92
E. Other Direct Costs	$4,368,072.33	$619,400.94	$1,058,708.88	$185,570.22	$6,231,752.37
2. HOME OFFICE G&A (Total Incurred Costs)	**$223,768.47**	**$95,568.27**	**$189,159.09**	**$32,901.30**	**$541,397.13**
3. SUBCONTRACTORS	**$13,961,546.09**	**$28,644,467.37**	**$89,893,649.78**	**$2,445,656.34**	**$134,945,319.58**
AFEX	$1,019,478.33	$448,464.00	$387,024.00	$48,080.00	$1,903,046.33
AMEG	$305,852.46	$120,000.00	$0.00	$0.00	$425,852.46
USAID Compound	$0.00	$374,680.47	$0.00	$0.00	$374,680.47
Utility Resource Group	$500.00	$0.00	$0.00	$0.00	$500.00
EA Engineering	$14,661.76	$15,546.08	$23,319.12	$3,886.52	$57,413.48
BRA	$1,848,236.54	$3,366,216.45	$1,916,810.23	$330,386.52	$7,461,649.74
Surtech/ACES	$920,006.64	$339,737.82	$0.00	$0.00	$1,259,744.46
Kirinyaga GH2002-08-09	$689,686.20	$127,877.03	$0.00	$0.00	$817,563.23
Kirinyaga GH2002-08-002	$67,204.00	$0.00	$0.00	$0.00	$67,204.00
Rhino Star	$300,782.02	$0.00	$0.00	$0.00	$300,782.02
Bright Star	$1,132,736.51	$0.00	$0.00	$0.00	$1,132,736.51
Winrock	$56,660.00	$0.00	$0.00	$0.00	$56,660.00
EYAT Road Maintenance	$0.00	$1,323,450.00	$0.00	$0.00	$1,323,450.00
Civicon	$1,476,926.00	$4,011,059.00	$0.00	$0.00	$5,487,985.00
Ronco	$1,076,163.02	$0.00	$0.00	$0.00	$1,076,163.02
Intercompany CF Division	$14,139.00	$0.00	$0.00	$0.00	$14,139.00
Intercompany OR Division	$18,619.56	$9,467.41	$0.00	$0.00	$28,086.97
TDI	$1,146,696.85	$1,257,606.00	$0.00	$0.00	$2,404,302.85
Sudken	$180,110.00	$0.00	$0.00	$0.00	$180,110.00
Terrain Services	$3,402,359.85	$2,883,070.00	$0.00	$0.00	$6,285,429.85
A&A Consultants	$194,564.83	$4,826.31	$0.00	$0.00	$199,391.14
Intercompany JC Division	$22,391.44	$0.00	$0.00	$0.00	$22,391.44
H&A	$73,771.08	$0.00	$0.00	$0.00	$73,771.08
Progressive (sec 1)	$0.00	$4,385,160.50	$28,663,576.44	$961,967.40	$34,010,704.34
Progressive (sec 2)	$0.00	$4,572,531.00	$30,141,481.79	$1,025,735.90	$35,739,748.69
EYAT (sec 3)	$0.00	$5,215,775.30	$28,307,838.20	$0.00	$33,523,613.50
Messing	$0.00	$189,000.00	$453,600.00	$75,600.00	$718,200.00
4. INTERMEDIATE G&A (Total Direct Costs)	**$330,319.06**	**$485,190.03**	**$1,471,401.69**	**$52,752.20**	**$2,339,662.98**
TOTAL PROGRAM COSTS	**$23,281,593.64**	**$32,624,924.52**	**$97,772,202.77**	**$3,816,008.98**	**$157,494,729.91**
5. FIXED FEE	**$931,263.75**	**$1,304,996.98**	**$3,910,888.11**	**$152,640.36**	**$6,299,789.20**
TOTAL PROGRAM COSTS PLUS FEE	**$24,212,857.39**	**$33,929,921.50**	**$101,683,090.88**	**$3,968,649.34**	**$163,794,519.11**

The following graphic displays anticipated monthly and cumulative costs. The rapid growth around the end of 2009 coincides with the end of the rainy season, when production rates will be at a maximum. After peaking in April, costs will gradually decrease on a monthly basis as the construction subcontractors complete the works and demobilize from the project.


S-Curve with 10% Retainage J.N Road
Millions
Monthly Cost
Cumulative
Millions
$30.0
$25.0
$20.0
$15.0
$10.0
$5.0
$-
$180.0
$160.0
$140.0
$120.0
$100.0
$80.0
$60.0
$40.0
$20.0
$-
Expenditure Through
31 JAN 2009
Includes USAID Comp CTC .
includes 5%retaintion
includes 5%retaintion
$24
$28
$31
$34
$37
$40
$46
$50
$55
$60
$65
$73
$82
$92
$103
$114
$123
$133
$139
$144
$150
$154
$155
$159
$159
$159
$159
$159
$159
$159
$159
$159
$164
Inception Thru Jan. 31, 2009
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Cumulative

STAFFING

LBG has developed a staffing plan to implement the various activities associated with the construction works on the JN Road. LBG's workforce is made up of expatriate and third country national professionals and technicians and local Sudanese technicians and professionals. Staffing includes long-term technical assistance (LTTA) positions that will be responsible for the execution of the construction program. The majority of LTTA staff positions will be located in the field at various construction camps and construction offices. This deployed staff will have responsibility for managing and supervising the day-to-day activities of the engineering, specialty and construction subcontractors.

LBG requires various short-term technical assistance (STAA) staff. The intent of STTA is to provide periodic and temporary augmentation of the LTTA staff. For example, the project required the services of a hydrologic engineer during the initial design of the bridges, and proposes a short-term assignment for this activity. Unlike the hydrologic engineer, who may be required only for a short period, individuals such as the Community Development Specialist may be required not only for a brief initial assignment, but also for periodic visits to the project throughout its life.

An organization chart and level of effort (LOE) tables are included on the following pages. Both the organization chart and the LOE are based upon the anticipated workload and the methodology planned for construction of the JN Road. Staffing and LOE will be adjusted depending upon specific requirements which will be constantly reassessed during project implementation.

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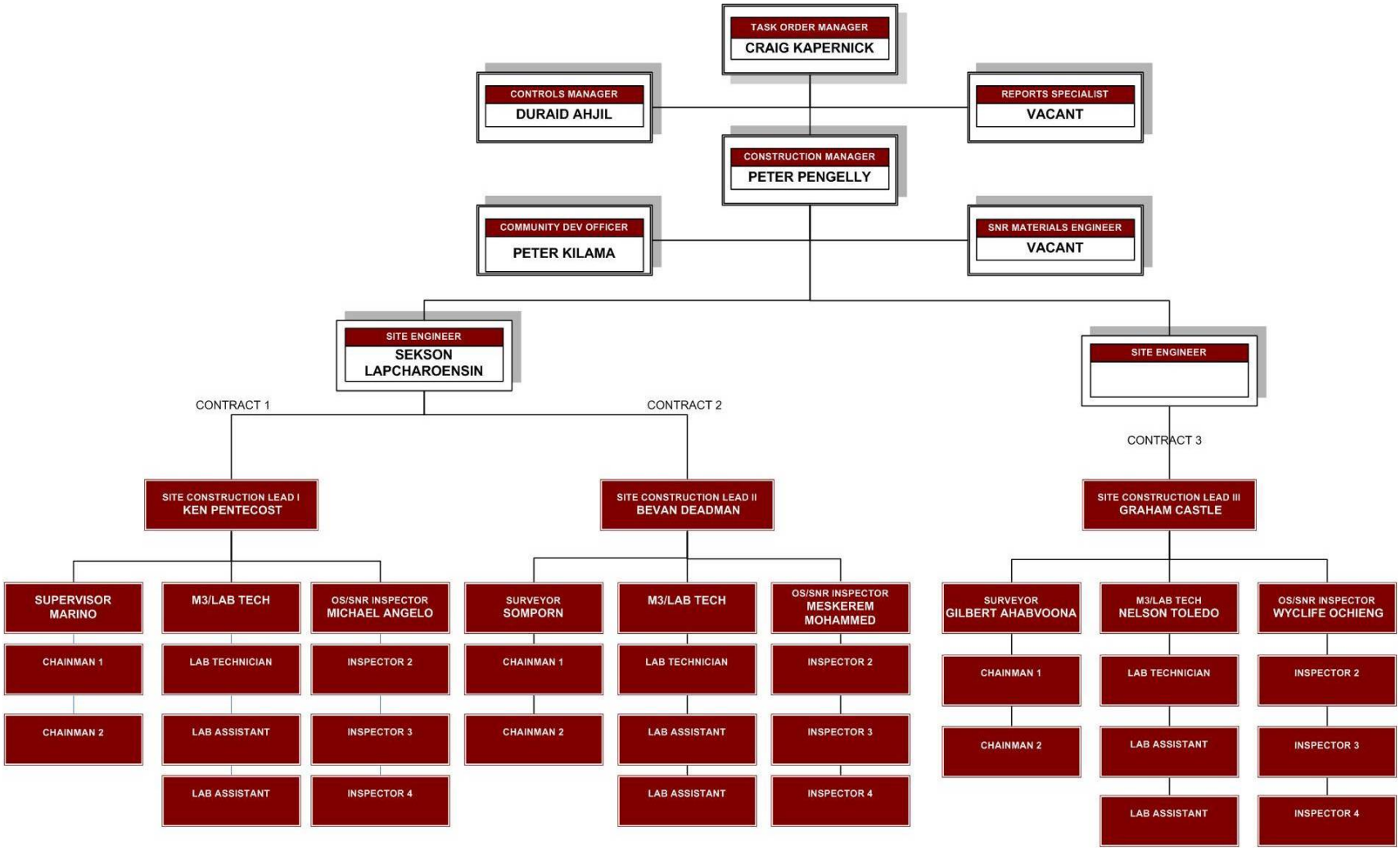
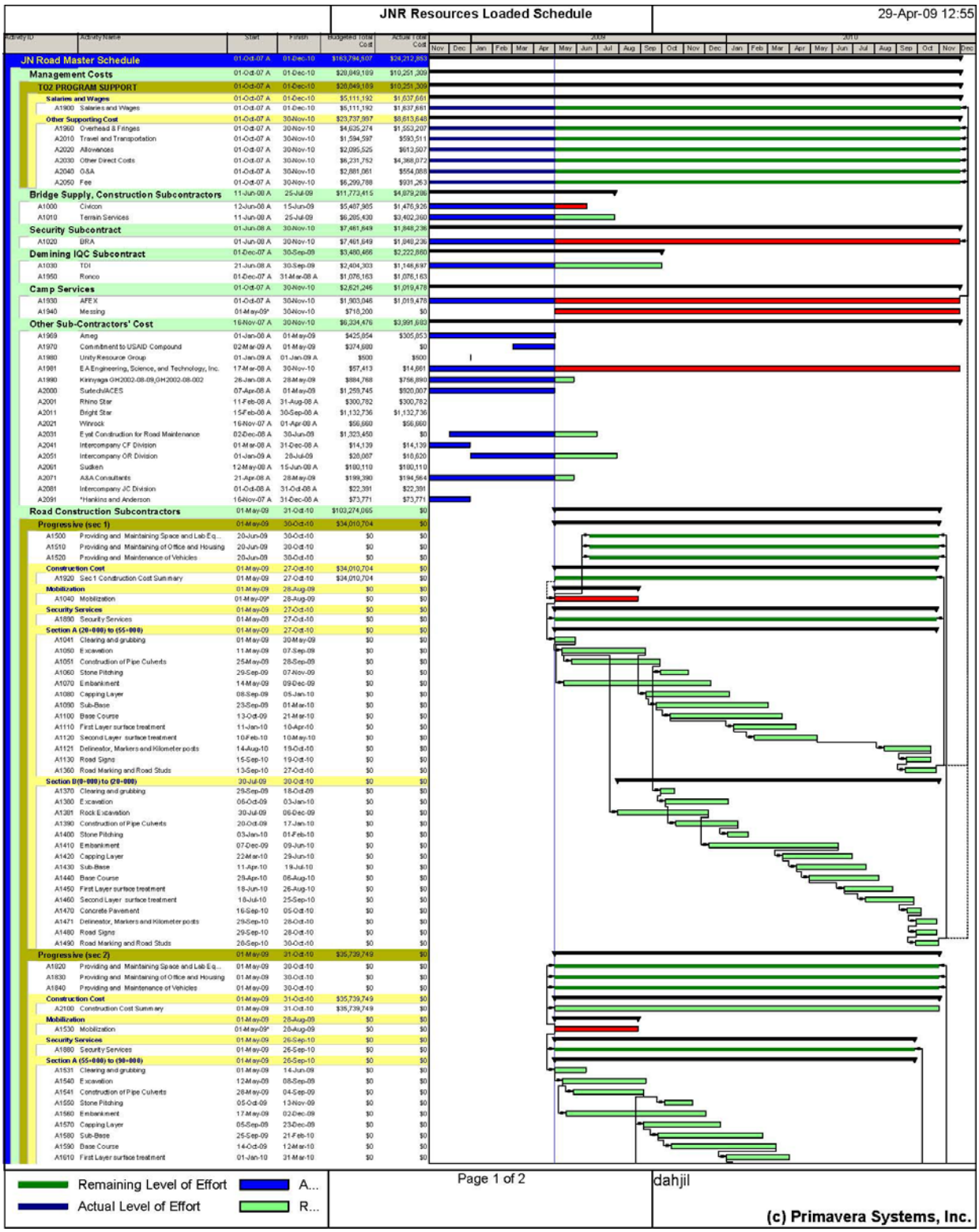
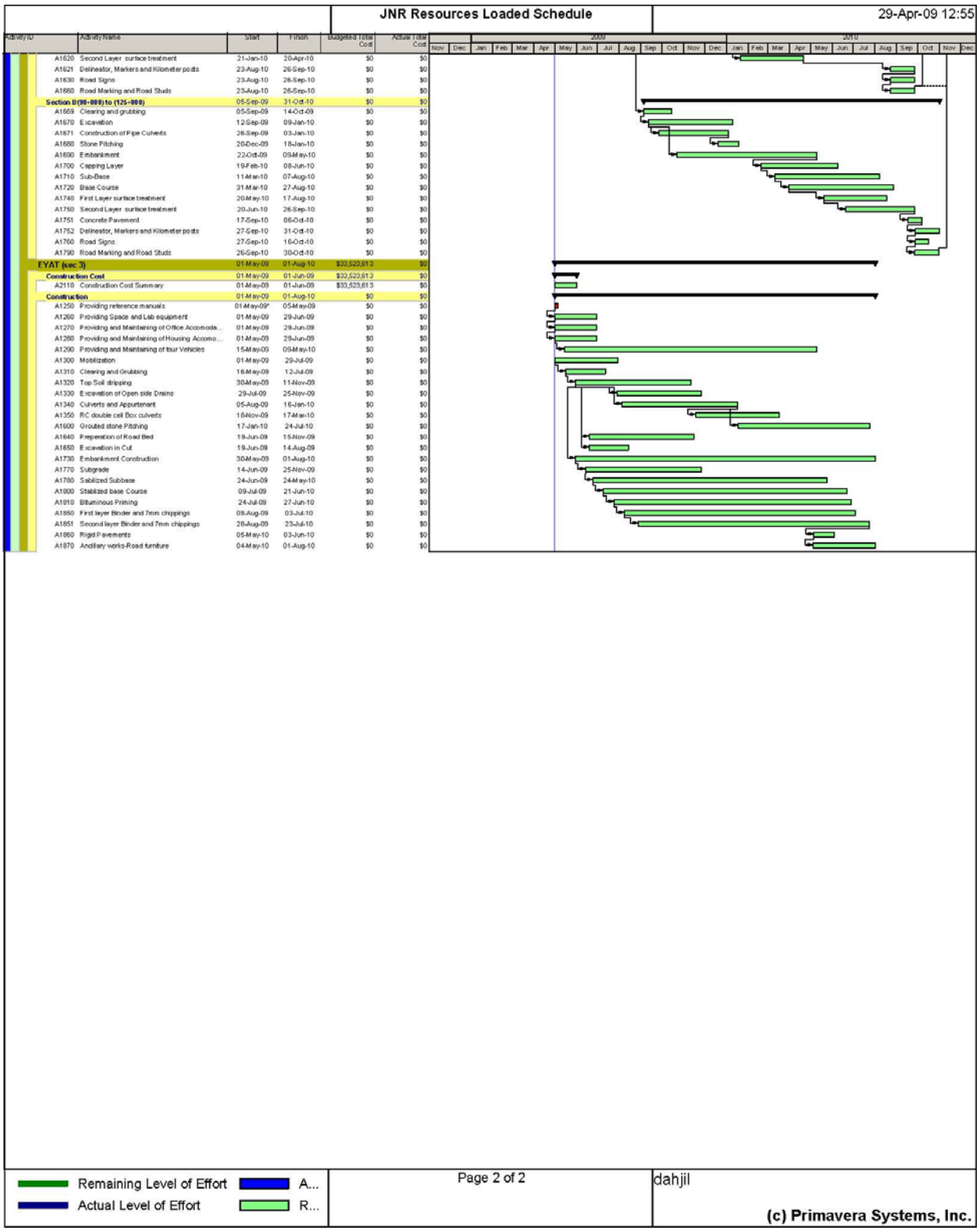

TASK ORDER MANAGER
CRAIG KAPERNICK
CONTROLS MANAGER
DURAID AHJIL
REPORTS SPECIALIST
VACANT
CONSTRUCTION MANAGER
PETER PENGELLY
COMMUNITY DEV OFFICER
PETER KILAMA
SNR MATERIALS ENGINEER
VACANT
SITE ENGINEER
SEKSON LAPCHAROENSIN
SITE ENGINEER
CONTRACT 1
CONTRACT 2
CONTRACT 3
SITE CONSTRUCTION LEAD I
KEN PENTECOST
SITE CONSTRUCTION LEAD II
BEVAN DEADMAN
SITE CONSTRUCTION LEAD III
GRAHAM CASTLE
SUPERVISOR MARINO
CHAINMAN 1
CHAINMAN 2
M3/LAB TECH
LAB TECHNICIAN
LAB ASSISTANT
LAB ASSISTANT
OS/SNR INSPECTOR MICHAEL ANGELO
INSPECTOR 2
INSPECTOR 3
INSPECTOR 4
SURVEYOR SOMPORN
CHAINMAN 1
CHAINMAN 2
M3/LAB TECH
LAB TECHNICIAN
LAB ASSISTANT
LAB ASSISTANT
OS/SNR INSPECTOR MESKEREM MOHAMMED
INSPECTOR 2
INSPECTOR 3
INSPECTOR 4
SURVEYOR GILBERT AHABVOONA
CHAINMAN 1
CHAINMAN 2
M3/LAB TECH NELSON TOLEDO
LAB TECHNICIAN
LAB ASSISTANT
LAB ASSISTANT
OS/SNR INSPECTOR WYCLIFE OCHIENG
INSPECTOR 2
INSPECTOR 3
INSPECTOR 4

	LOE (months)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LTTA EXPATRIATE/TCN																									
Task Order Manager	21																								
Construction Manager	18																								
Senior Materials Engineer	16																								
Site Engineer 1	19																								
Site Engineer 2	16																								
Site Construction Lead 1	21																								
Site Construction Lead 2	21																								
Site Construction Lead 3	17																								
Site Surveyor 1	17																								
Site Surveyor 2	16																								
Materials Engineer 1	18																								
Materials Engineer 2	16																								
Materials Engineer 3	15																								
Senior Inspector 1	21																								
Senior Inspector 2	21																								
Design Manager	3																								
Controls Manager	12																								

	LOE (months)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LTTA- (CCN)																									
Reporting Specialist	19																								
Site Surveyor	23																								
Senior Inspector	18																								
Inspector 1	22																								
Inspector 2	22																								
Inspector 3	17																								
Inspector 4	17																								
Inspector 5	17																								
Inspector 6	17																								
Inspector 7	17																								
Inspector 8	17																								
Inspector 9	17																								
Com. Dev. Officer	23																								

IMPLEMENTATION SCHEDULE





LBG is currently using this schedule to drive its own work activities and to monitor achievement of critical milestones. This will be updated once construction subcontractors are mobilized and have developed their own resource loaded schedules.