

UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

Project Management Plan for the construction of the San Estevan Bridge in Belize

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FINAL GRADUATION PROJECT SUBMITTED IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE
MASTER IN PROJECT MANAGEMENT (MPM) DEGREE

Belize City,

Belize July 2023


UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

This Final Graduation Project was approved by the University as
partial fulfillment of the requirements to opt for the
Master in Project Management (MPM) Degree

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DEDICATION

I dedicate this project to my fiancée Alexia, and to my family for supporting and encouraging me throughout this entire process and continually pushing me to do better.

ACKNOWLEDGMENTS

I would like to express my gratitude to the professors and academic assistant for their time and dedication to the program through which I have gained a deeper understanding of project management. I would also like to give special thanks to my tutor Mr. Carlos Castro Torres for his guidance in completing this project.

ABSTRACT

The objective of this paper is to develop a project management plan for the construction of the San Estevan Bridge located in Belize using a hybrid approach. Traditionally, the Traditional/waterfall method approach to project management has been employed for construction projects. However, this approach is dependent on all information being known from the commencement of the project and is slow to respond to change.

Upon completion, this project will produce the project management plan for the construction of the bridge which consists of management plans for the following: cost, scope, risks, communications, stakeholders, resources, quality, integration, schedule, procurement and sustainable development. In order to do this, quantitative, qualitative, mixed methods and the guide provided by the Project Management Institute are used.

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ABBREVIATIONS AND ACRONYMS

CV	Cost variation
CPI	Cost Performance Index
EVM	Earned Value Management
FGP	Final Graduation Project
GOB	Government of Belize
LTD	Limited
PMBOK	Project Management Body of Knowledge
PMI	Project Management institute
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RACI Matrix	Responsible, Accountable, Consult, Inform Matrix
RBS	Risk Breakdown Matrix
SPI	Schedule Performance Index
SV	Schedule Variance
WBS	Work Breakdown Structure
WBS Dictionary	Work Breakdown Structure Dictionary

EXECUTIVE SUMMARY

Within the construction industry projects have become increasingly complex and expectations are for them to be completed within shorter time periods with less resources. Within this study, the company of interest is Global Constructors Limited. This company has completed numerous large scale infrastructure projects within Belize and the surrounding region.

Given the increasing demands of the construction industry it has been observed that projects have been under-performing or even failing. This could be in part due to the rigid nature of traditional project management. With a new project to construct the San Estevan Bridge located in Belize on the horizon. Global Constructors Ltd. has taken an interest in the development of a Project management plan for the construction of said bridge which would take a hybrid approach rather than the traditional one often used for construction projects.

The general objective was to develop a Project management plan for the construction of the San Estevan Bridge Project using a hybrid approach. The specific objectives were to: to develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success; to develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion; to create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget; to develop a Quality Management Plan for managing and controlling quality within the project; to design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required; to elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration; to develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks; to create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project; to design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected; to design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project; to create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.

The methodology for this research was to employ the use of the PMBOK Guide, 6th Edition, 2017, project documents of past similar projects, lecture Notes, conference Papers, journals and historical data and information to develop the various elements of the project management plan using best practices and learned lessons from past experience. Mixed methods for research were applied, meaning quantitative as well as qualitative analyses were carried out. This allowed for data to be viewed not only from a statistical perspective but also from a comprehensive one based on current schools of thought. By viewing data in this manner relationships not easily observed become apparent. Tools that facilitated the research were expert judgement, data analysis, meetings and templates.

With the completion of the outlined objectives, it was concluded that the integration management plan elaborated how processes would be combined. The scope management plan was outlined, which allows the project team to understand the work to be carried out. The Schedule management plan defined the activities to be carried out, durations and their sequence. The cost management plan estimated the budget and expected disbursement timelines. The Quality management plan provided procedures to ensure quality for the project. The resource management plan outlined necessary resources and how they would be managed. The communication management plan stated how project communications would be conducted. The Risk management plan was created and identified risks, and produced strategies to minimize negative impacts and maximize positive impacts. The procurement management plan allows the project team to effectively manage procurement of products and services. The stakeholder management plan identified stakeholders and how they would be engaged. The Sustainability management plan outlined how sustainable practices would be integrated into the project management processes.

Having made the previous conclusions, it is recommended that the Project Manager pay special attention to Integration Management to ensure that all the processes function together cohesively. The Project Team should review the Scope Management Plan to fully understand all the project work included within the project and what is excluded. The Project Manager should invest a high degree of effort in the Change Control process as construction projects can be rigid due to the utilization of Traditional Project Management practices. This means that quick responses to change are necessary to make the project work more agile. The Project Manager and Project Sponsors should carefully review potential project changes and determine the overall effects to the project budget. The Site Engineer and the Project Manager should take note of the stakeholder priorities within the Quality Management Plan to make sure that they are delivered to the required standards. The Project Manager and Project Team will have to carry out proper Resource Management as indicated in the plan to ensure that the correct equipment and materials are available in order to execute work when needed. The Project Team should be as collaborative as possible and distribute project information as needed and in the correct manner to the stakeholders. The Project Manager should monitor identified risks throughout the project and follow up on responses as outlined. The Project Team should make certain that project procurement is carried out as outlined in the Procurement Management Plan. The Project Manager should liaise with the various stakeholders to make certain that their concerns are heard and that they are being engaged appropriately. Additionally, the Project Team should continually look for areas to improve the integration of sustainable practices within the construction process.

1 INTRODUCTION

1.1 Background

Within the region, Global Constructors Limited has been making great advances within the construction industry. Over the years the company has been able to execute numerous high value projects. These projects range from construction of buildings and bridges and even to the supply of products such as pre-stressed concrete piles and Girders. All of this has been possible through a culture of innovation within the company. In that same spirit, Global Constructors is constantly seeking ways to improve their operations. At this point, the company is about to commence a new project for the construction of the San Estevan Bridge located in Belize. However, in order to improve project performance and chances of success, the company would like to create a project management plan which focuses on a hybrid approach to project management rather than a traditional one.

The creation of this hybrid project management plan for the construction of the San Estevan Bridge would cover the 10 knowledge areas covered within the Project Management Body of Knowledge published by the Project Management Institute, as well as how the project could be approached in a way that aligns with the sustainable development goals.

Among the main reasons for project failure, improper selection of a management approach has often been stated. This is because each project is different; having their own circumstances which can contribute to overall complexity. Therefore, application of the same traditional project management approach to all projects as if they were the same could be potentially catastrophic.

1.2. Statement of the problem

Within the construction industry, traditional project management has been and continues to be the standard approach employed. However, as the world's societies continue to grow, the scale of infrastructural projects continue to grow with them. Additionally, in these modern times, these projects are expected to be executed with greater financial efficiency, more rapidly and of course without any losses in quality. All of this leads to more complex projects which require innovative approaches in order to adapt to changes rapidly. Unfortunately, due to the limitations of traditional project management which is known to be rigid and slow to adapt to project changes, it has become normal for construction projects to exceed time, cost and even deliver less value when completed than what was expected.

Within the company Global Constructors Limited, this trend has also been observed and found to be a great risk to the future of the company and the construction industry as a whole. Furthermore, there is a lack of tools such as guidelines and templates which offer a way forward. Currently, within the company there are no project management plans which focus on the utilization of hybrid approaches. When such a plan can be created it would set these guidelines and best practices which could be applied for increased agility, efficiency and improve the chances of successful completion of projects.

1.3. Purpose

Through this project, the investigation will focus on the creation of a Project management plan for the construction of the San Estevan Bridge using a hybrid approach. This is a unique endeavor as typically, construction projects favor the use of traditional/ predictive project management approaches. It is the expectation that through the combination of agile practices with the traditional approach as a base that the project will experience significant increases in efficiency and productivity.

The rural village of San Estevan is located in the Orange Walk district of Belize. Currently, if its residents wish to travel to the most northern district which is Corozal, they must either cross the river by using the small manually operated Ferry which has a capacity of 2- 3 small vehicles at a time or drive south towards Orange Walk in order to connect to the Northern Highway and travel from there, which makes the journey much longer than necessary.

Through the construction of the San Estevan Bridge Project, the country would be able to connect the community of San Estevan to the main Northern Highway, allowing the residents easier access to facilities such as supermarkets, health care facilities and in the case of emergencies, alternative routes of egress.

Ultimately, the bridge would increase traffic flow by 75% due to 24/7 accessibility and increased capacity which would greatly improve the quality of life for those in the surrounding communities.

1.4. General objective

To develop a Project management plan for the construction of the San Estevan Bridge Project using a hybrid approach.

1.5. Specific objectives

1. To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success.
2. To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.
3. To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.
4. To develop a Quality Management Plan for managing and controlling quality within the project
5. To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.
6. To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.
7. To develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks.
8. To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.
9. To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.
10. To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.

11. To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

Global Constructors Limited is a local construction company located in Belize. The company has a focus on production of precast, pre-stressed concrete products and designing and construction of commercial buildings, warehouses and bridges. The company has been operating since 2000; delivering numerous projects within the time, budget and great quality.

2.1.2 Mission and vision statements

Mission

To be an industry leader in the Construction sector, whereby projects are completed within time and budget through the use of dynamical and innovative approaches to project management.

Vision

To become the leading construction company in the region; providing the highest level of service and quality to customers.

2.1.3 Organizational structure

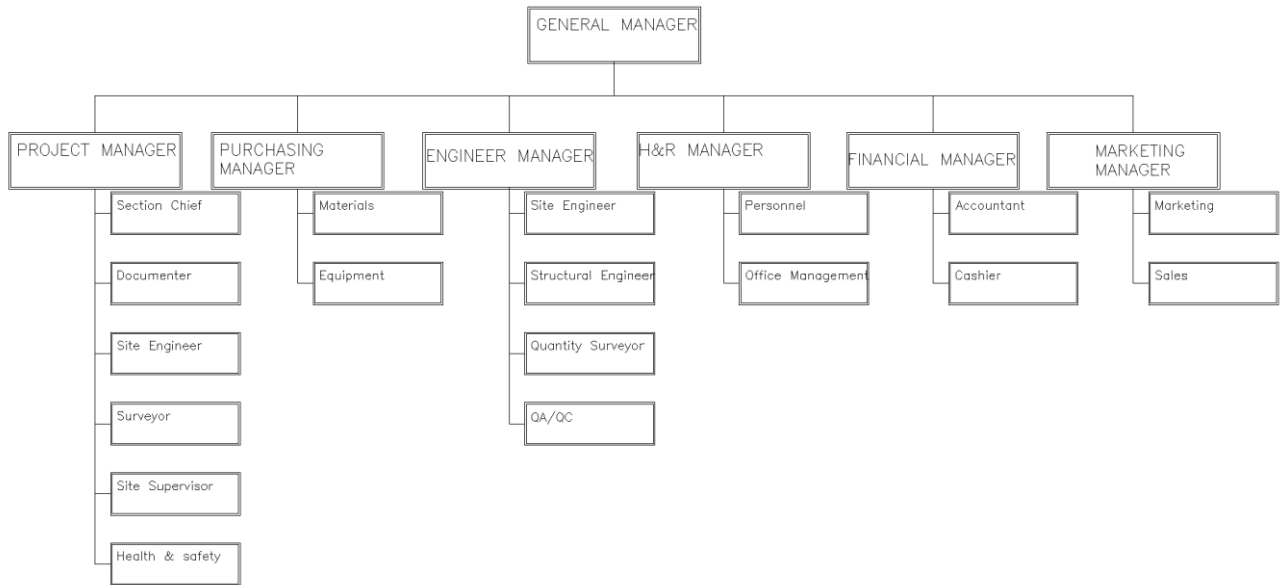


Figure 1 - Organizational Structure (Source: R. Nurse, 2023)

2.1.4 Products offered

Global Constructors Ltd. offers a number of services and products depending on the needs of the customer. These may include:

- Structural designs for Commercial Buildings, Piers, Warehouses and Bridges
- Construction of reinforced concrete buildings
- Construction of warehouses
- Construction of Bridges
- Production and installation of Precast Pre-stressed Concrete Piles, Girders and T-Beams
- Project management and supervision services

These products and services reflect the company's years of experience in the construction sector. The capacity to design and build numerous types of structures and an intimate knowledge from the designing stage are utilized to carry out project management and supervision of any type of project the client may require.

2.2 Project Management concepts

2.2.1 Project management principles

Project

The PMBOK Body of Knowledge 7th Edition (2021) defines a project as a temporary endeavor which is carried out in order to achieve a unique product, service or result.

Process Groups

Project Management Process Groups are logically grouped project management processes.

The 5 groupings as outlined by the PMBOK Body of Knowledge 6th Edition (2017) are as follows:

- Initiating Process Group
- Planning Process Group
- Executing Process Group
- Monitoring and Controlling Process Group
- Closing Process Group

2.2.2 Project management domains

The PMBOK Body of Knowledge 7th Edition (2021) states that project performance domains are “a group of related activities that are critical for the effective delivery of project outcomes.” This means these activities are essential for the execution of successful projects.

There are 8 Project Performance Domains and they include:

1. Stakeholders
2. Team
3. Development, Approach and Lifecycle
4. Planning
5. Project Work
6. Delivery
7. Measurement
8. Uncertainty

2.2.3 Predictive, adaptive and hybrid projects

Predictive

Predictive project management or as it is also called Traditional project management, is employed where details and requirements are clear from the beginning of the project. This allows for detailed planning of project works which follow a sequential order.

Adaptive

Adaptive project management, also known as Agile Project Management, is suited for projects where there is a high degree of uncertainty and all the requirements are not detailed. Deliverables are produced in an iterative manner, with a focus on producing items of the most value to the customer before expanding on additional features with later iterations.

Hybrid

Hybrid project management is a combination of different project management methodologies in order to create an entirely new methodology which may be more suited for the project in question. This is often required because no two projects are the same and it is therefore vital to tailor the framework used in order to improve the chances of successful completion.

Within the construction industry, traditional or predictive project management is the most commonly used. However, within this particular project there is an aim to adapt a hybrid approach in order to improve response time to changes that may occur and mitigate delays that are often caused by the rigidity of the traditional method.

2.2.4 Project management

According to the PMBOK Body of Knowledge 7th Edition (2021), Project Management deals with the application of knowledge, skills, tools and techniques to project activities to meet the project requirements.

2.2.5 Project management knowledge areas and processes

Project Scope Management

“Project Scope Management includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. Managing the project scope is primarily concerned with defining and controlling what is and is not included in the project.” (PMI, 2017, p. 129)

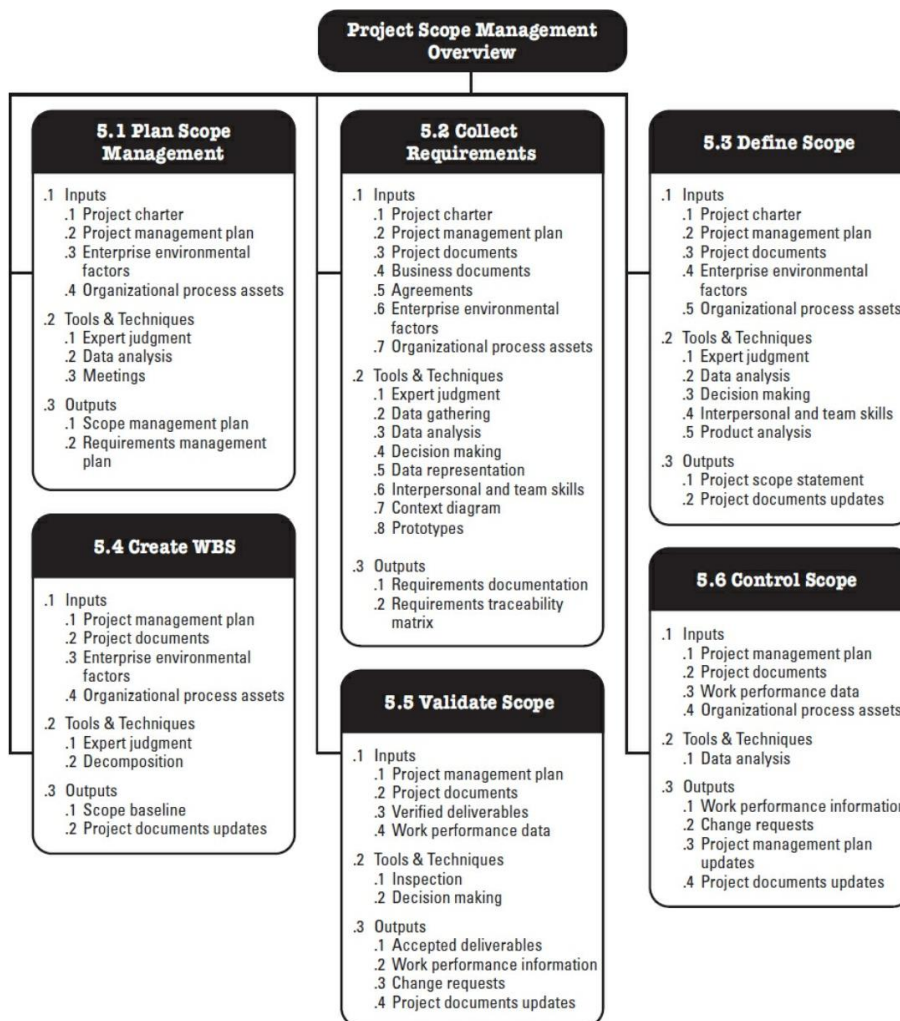


Figure 2 - Project Scope Management Overview (Source: PMI, 2017, p. 129)

Project Schedule Management

“Project Schedule Management includes the processes required to manage the timely completion of the project.” (PMI, 2017, p. 173)

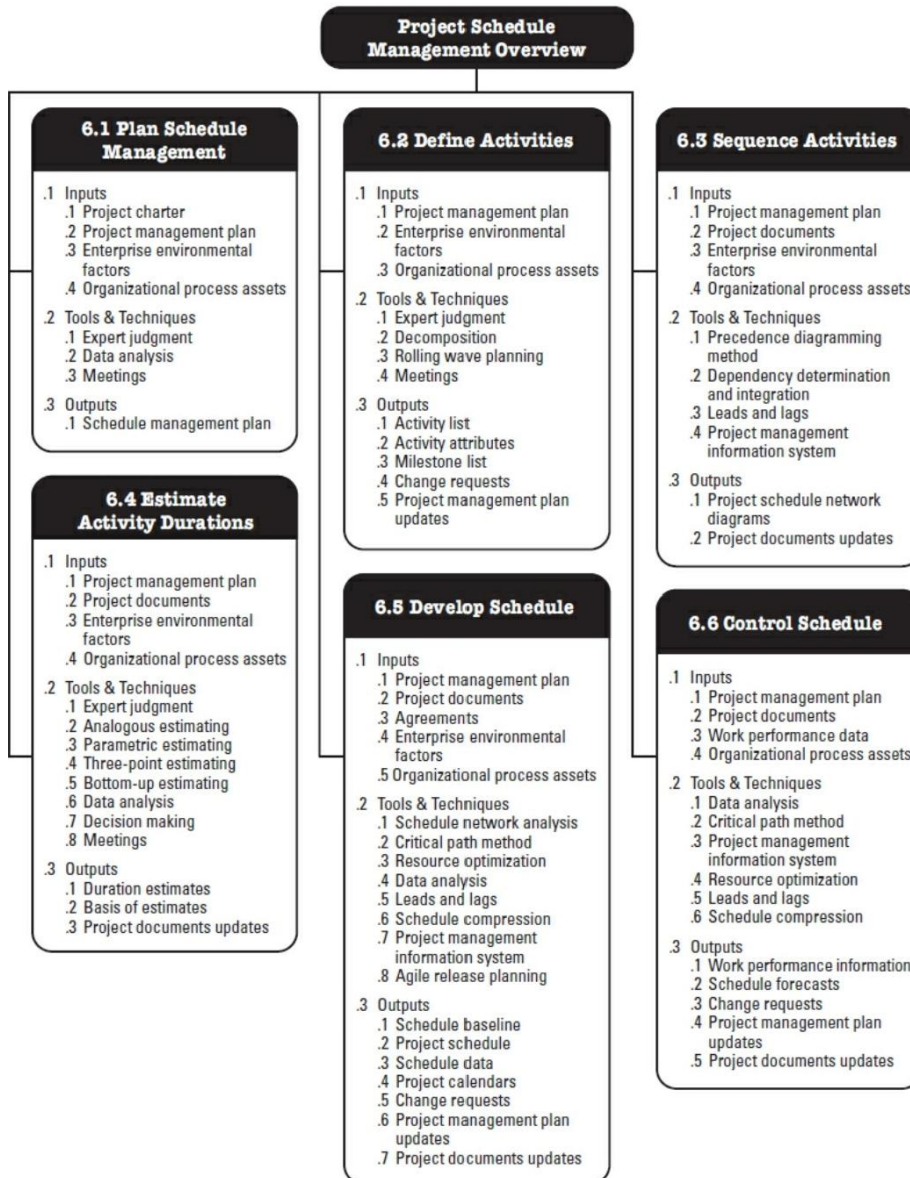


Figure 3 - Project Schedule Management Overview (Source: PMI, 2017, p. 174)

Project Cost Management

“Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.” (PMI, 2017, p.231)

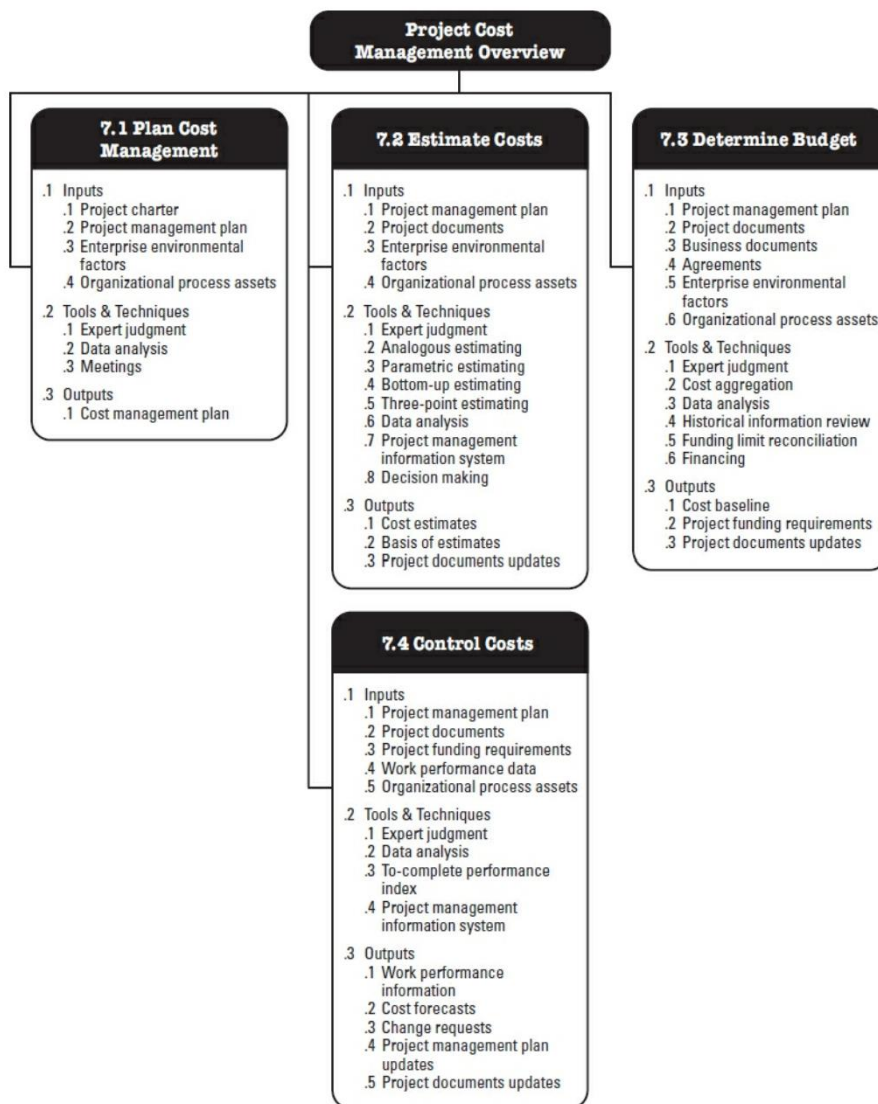


Figure 4 - Project Cost Management Overview (Source: PMI, 2017, p.231)

Project Resource Management

“Project Resource Management includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project. These processes help ensure that the right resources will be available to the project manager and project team at the right time and place.” (PMI, 2017, p. 307)

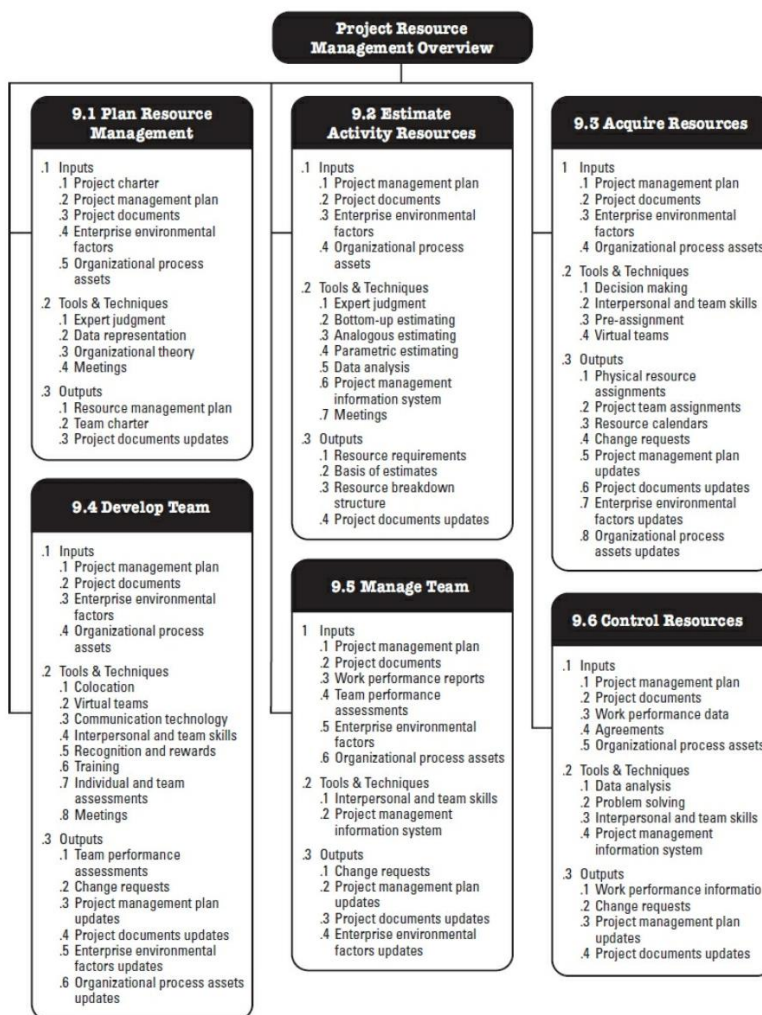


Figure 5 - Project Resource Management Overview (Source: PMI, 2017, p. 307)

Project Integration Management

“Project Integration Management includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups. In the project management context, integration includes characteristics of unification, consolidation, communication, and interrelationship.” (PMI, 2017, p. 69)

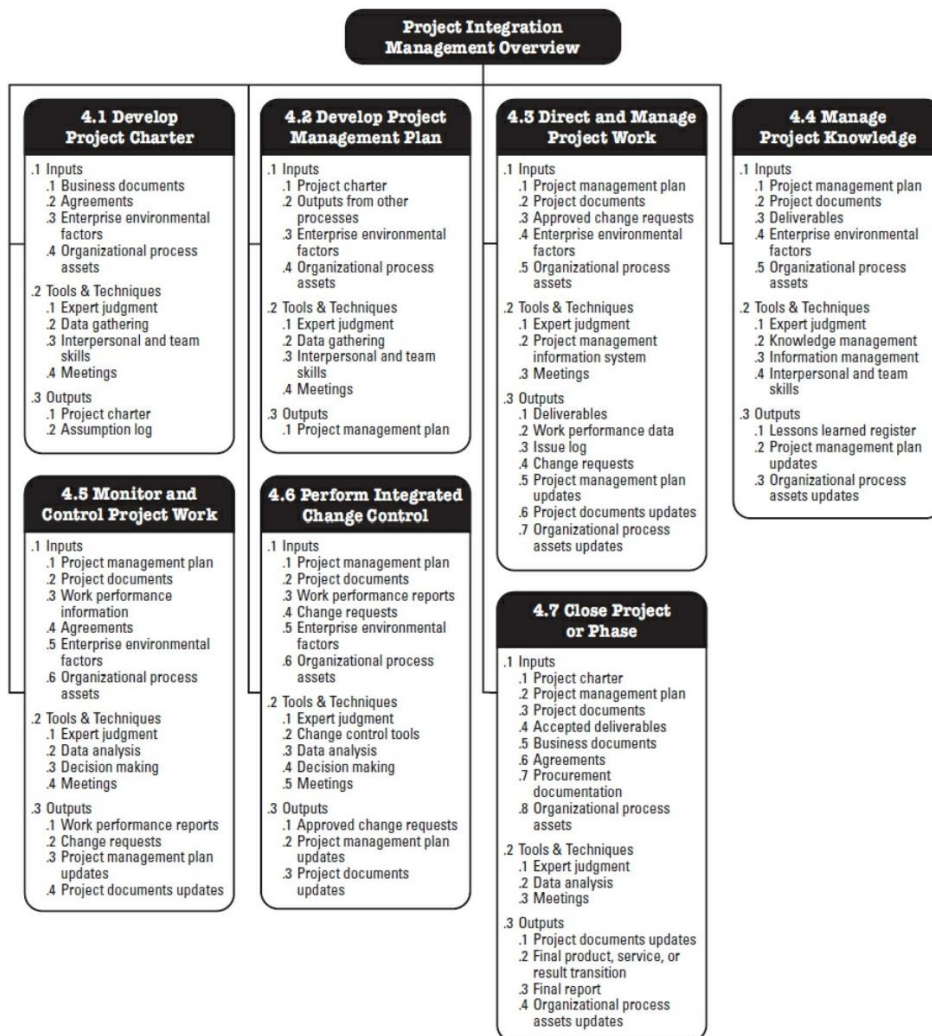


Figure 6 - Project Integration Management Overview (Source: PMI, 2017, p. 69)

Project Communication Management

Project Communications Management includes the processes necessary to ensure that the information needs of the project and its stakeholders are met through development of artifacts and implementation of activities designed to achieve effective information exchange. Project Communications Management consists of two parts. The first part is developing a strategy to ensure communication is effective for stakeholders. The second part is carrying out the activities necessary to implement the communication strategy. (PMI, 2017, p. 359)

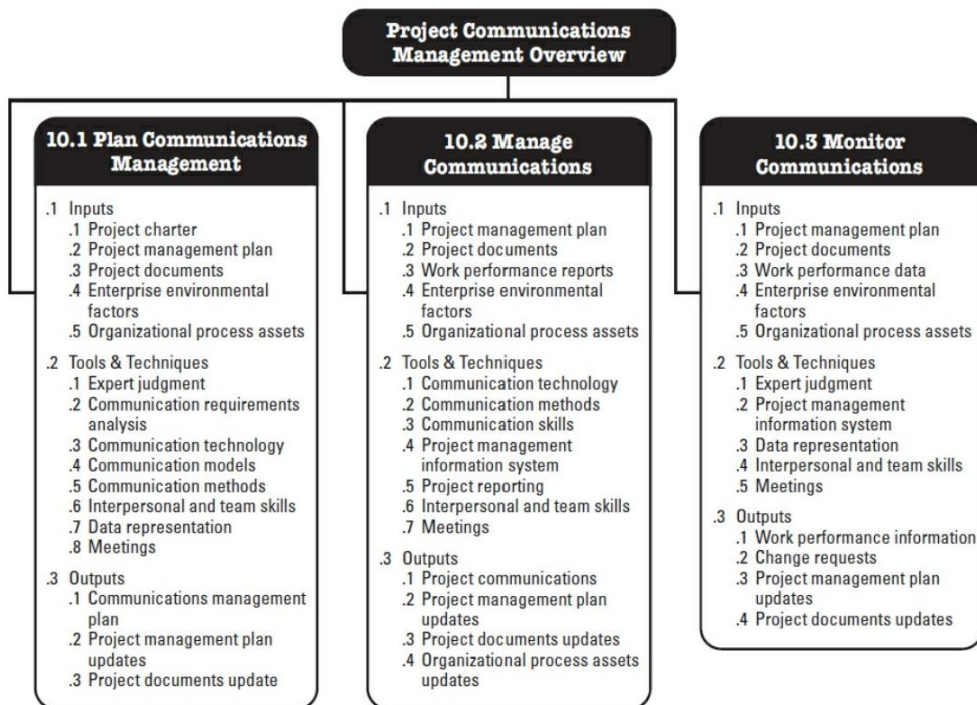


Figure 7 - Project Communication Management Overview (Source: PMI, 2017, p. 360)

Project Risk Management

“Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project. The objectives of project risk management are to increase the probability and/or impact of positive risks and to decrease the probability and/or impact of negative risks, in order to optimize the chances of project success.” (PMI, 2017, p. 395)

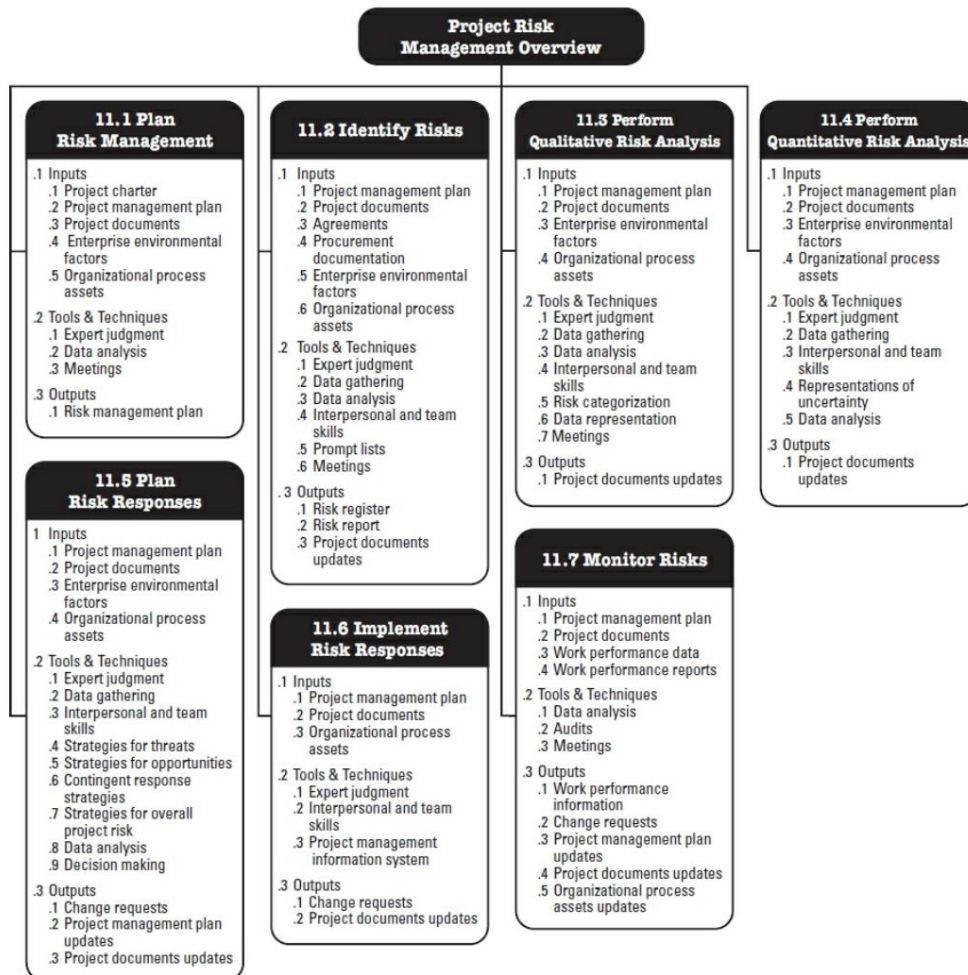


Figure 8 - Project Risk Management Overview (Source: PMI, 2017, p. 395)

Project Stakeholder management

“Project Stakeholder Management includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution.” (PMI, 2017, p. 503)

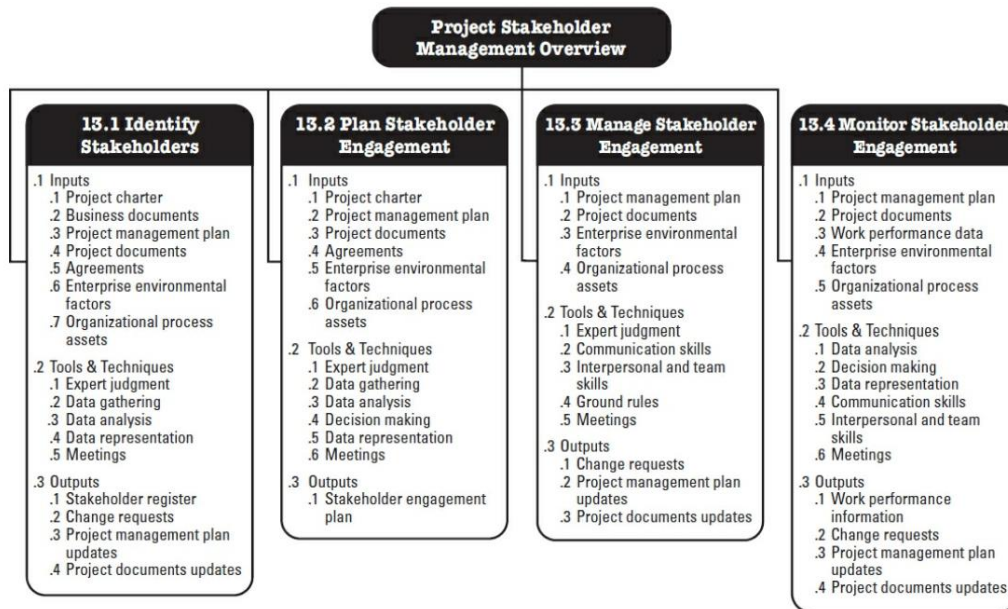


Figure 9 - Project Stakeholder Management Overview (Source: PMI, 2017, p. 503)

Project Quality Management

“Control Quality is the process of monitoring and recording results of executing the quality management activities in order to assess performance and ensure the project outputs are complete, correct, and meet customer expectations. The key benefit of this process is verifying that project deliverables and work meet the requirements specified by key stakeholders for final acceptance.” (PMI, 2017, p. 298)

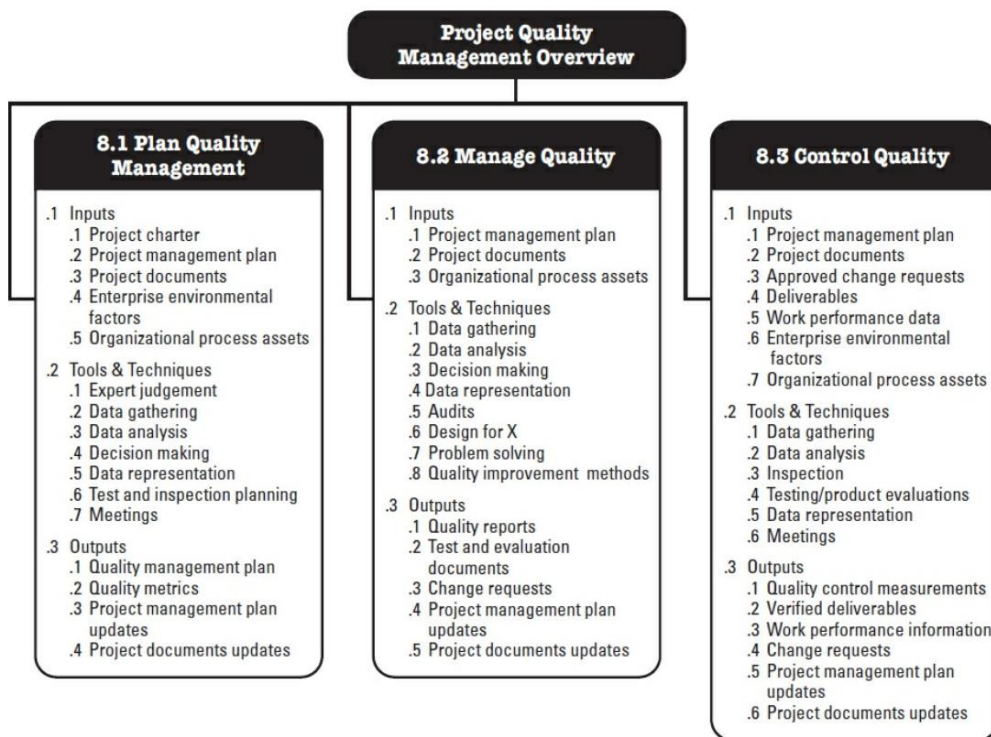


Figure 10 - Project Quality Management Overview (Source: PMI, 2017, p. 298)

Project Procurement Management

“Project Procurement Management includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team.” (PMI, 2017, p. 459)

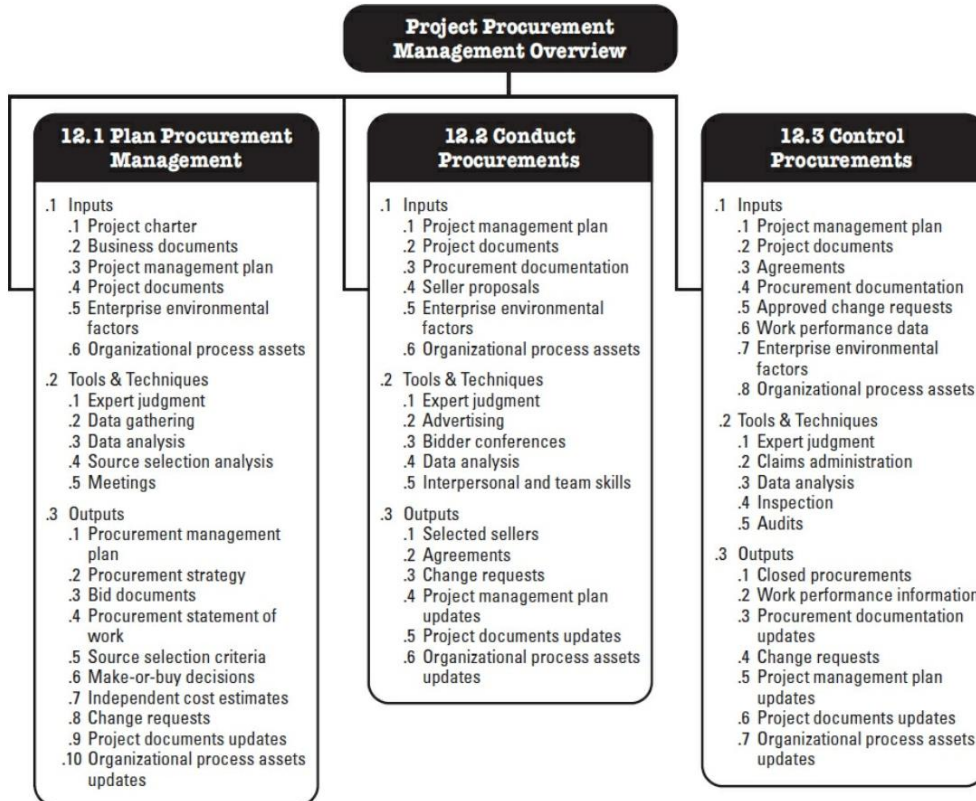


Figure 11 - Project Procurement Management Overview (Source: PMI, 2017, p. 459)

2.2.6 Project life cycle

The Project Management Institute (2017) states that a project management life cycle consists of 5 unique phases comprising of initiation, planning, execution, monitoring, and closure that combine to turn a project idea into a working product.

Within this particular project, the lifecycle will be identical as it is well suited for the composition of a construction project.

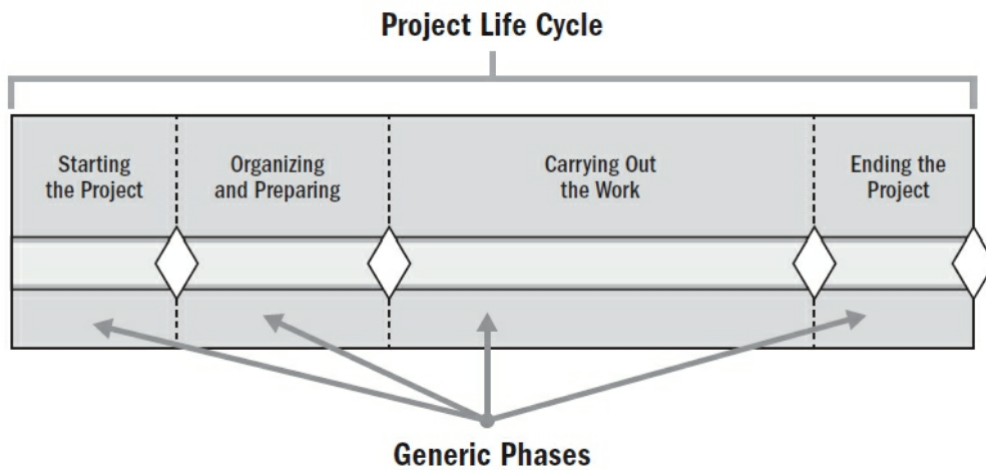


Figure 12 - Generic Depiction of a Project Life Cycle (Source: PMI, 2017, p. 547)

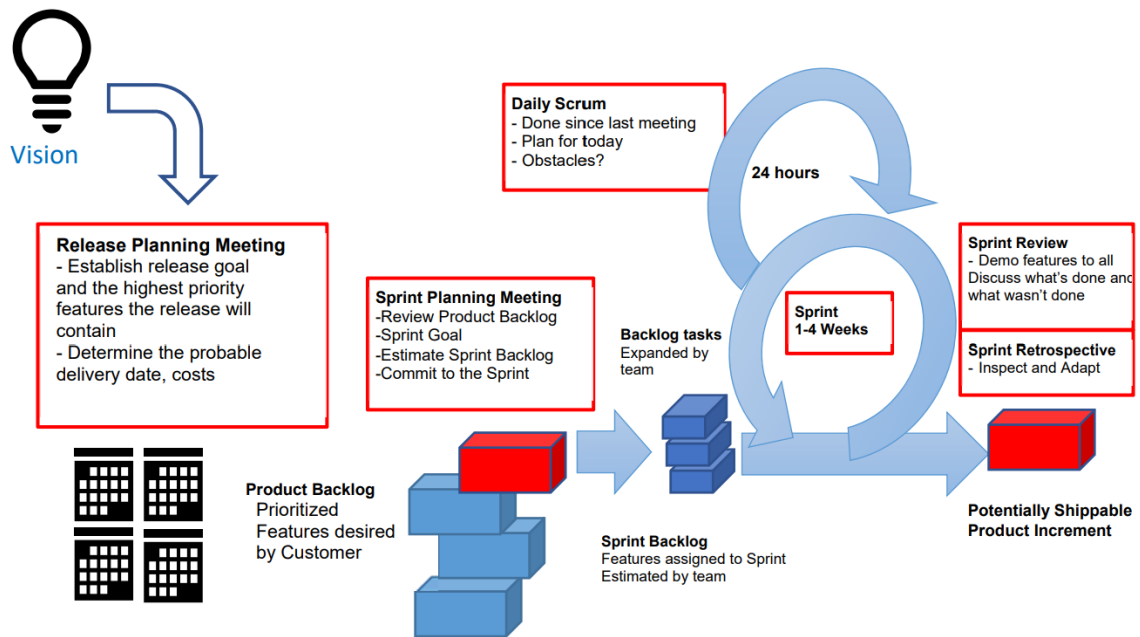


Figure 13 - Agile model demonstrating the iterative nature of an agile project (Adapted from Kibler, 2019)

2.2.7 Company strategy, portfolios, programs and projects

Company Strategy

To introduce cutting edge innovations to the construction industry through our highly skilled employees and years of specialized experience; in order to deliver the best quality and value to customers.

Portfolios

The Company's portfolios include the following areas:

- Commercial building construction; including reinforced concrete block buildings, steel frame buildings and warehouses
- Infrastructure projects; including bridge and pier construction
- Supply of Precast products which include precast pre-stressed concrete piles, T-Beams and Girders

Projects

Upcoming, on-going and completed company projects include:

- Construction of Warehouses located in San Pedro Belize
- Construction of numerous Piers located within Belize City
- Construction of the San Estevan Bridge in Belize
- Various design projects for commercial buildings and warehouses

2.2.8 Current situation of the problem or opportunity in study

Currently, within the construction industry, projects are managed using Traditional/Predictive project management methodologies, also known as waterfall project management. This method is suited for projects where there is a significant amount of information and details for planning. Through predictive methods, projects are planned with as much detail as possible from the beginning and there is an expectation that there should be minimal variations and changes within the project. This method allows for structure and predictability which are welcomed. However, it is well known that traditional methods falter where the full details are not understood, changes occur and the level of project complexity increases. That being said, as the years progress and projects become larger and more complex, it has been observed that many construction projects have become prone to failure. Failure being defined as extensive over-runs of time, cost and sometimes the deliverables are not used when completed. Due to this issue, there has been an elevated interest in alternative project management methodologies that may be able to account for the shortcomings of traditional project management. Researchers such as Kibler (2019) and Lalmi et al. (2021) have stated that hybrid methods may be necessary to address the problems within the construction industry; suggesting a combination of Traditional and Agile methods to respond to the increasing complexity of projects and the expected rate of changes within them.

2.2.9 Previous research done for the topic in study

Based on the understanding that the way construction projects are managed may be a crucial factor in their failures lately, discussions have progressed on a way forward. Although the topic is still new and emerging, researchers have begun to propose if and how traditional project management and agile project management could be combined to effectively compensate for the weaknesses of each individually.

Jasim (2018) and Sohi et al. (2015) both started by trying to answer fundamental questions such as suitability for adaptation and if it will aid with complex projects. Jasim (2018) carried out a study of the values and principles of Agile project management for their adaptation to the construction industry, concluding that it could be possible to apply four values and eleven of the twelve principles of Agile project management for managing construction projects. Sohi et al. (2015) studied whether lean and agile project management aid with project complexity and determined that it would in fact aid with complexity and improve project performance.

On the other hand, Kibler (2019) speaks about a Hybrid project management methodology for commercial construction projects, concluding that through tailoring, the best suited solution uses traditional project management as the main framework but applies agile processes within the Execution Phase and uses a combination of the two within the Project closing phase. Similarly, Lalmi et al. (2020) proposed a conceptual hybrid model for construction project management and surmises that by employing different elements of lean, agile and traditional project management that an ideal framework for construction can be

achieved. Ciric and Gracanin (2017) developed a study, exploring how agile project management could be applied beyond the software industry as that is the area it has been traditionally used. Observing that its application would be advantageous to construction projects.

3 METHODOLOGICAL FRAMEWORK

3.1 Information sources

According to Varshney, A. (2011) an Information Source is a source of information for somebody, this may be anything which informs a person about something or provide knowledge. These may be observations, people speeches, documents, pictures, organizations etc. Additionally, information sources can be divided into Primary and Secondary sources.

3.1.1 Primary sources

“Primary sources of information are the first published records of original research and development or description of new application or new interpretation of an old theme or idea. There are original documents representing unfiltered original ideas.” Varshney, A. (2011).

3.1.2 Secondary sources

“Secondary sources of information are those which are either compiled from or refer to primary sources of information. The original information having been casually modified selected or reorganized so as to serve a definite purpose for group of users. Such sources contain information arranged and organized on the basis of some definite plan. These contain organized repackaged knowledge rather than new knowledge.” Varshney, A. (2011).

Chart 1 Information sources (Source: R. Nurse, Author, 2023)

Objectives	Information sources	
	Primary	Secondary
To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success.	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
To develop a Quality Management Plan for managing and controlling quality within the project	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information

<p>To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.</p>	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
<p>To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.</p>	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
<p>To develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks.</p>	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
<p>To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.</p>	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
<p>To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order</p>	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information

to produce a product which adds value to those affected.	past similar projects	
To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information
To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects 	<ul style="list-style-type: none"> • Lecture Notes • Conference Papers • Journals • Historical data and information

3.2 Research methods

Research methods

The Good Research Guide, 7th edition (2021) states that a research methods “are tools for data collection – things like questionnaires, interviews, observations and documents.”

3.2.1 Quantitative method

“The use of objectivist and deductive methods, relying on hard provable (usually mathematical and statistical) data, largely associated with the physical sciences.” Research Methods, the Centre for Financial and Managerial Studies, University of London (2019)

3.2.2 Qualitative method

“The use of exploratory and often unstructured methods to examine social issues; associated with induction and interpretivism.” Research Methods, the Centre for Financial and Managerial Studies, University of London (2019)

3.2.3 Mixed Methods

“Mixed methods’ is a research approach whereby researchers collect and analyse both quantitative and qualitative data within the same study.” Shorten (2017)

Chart 2 Research Methods (Source: R. Nurse, 2023)

Objectives	Research methods		
	Qualitative	Quantitative	Mixed
To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project’s success.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Scope Management Plan.	The Quantitative method will be utilized to analyze the historical data and variables for development of the Scope Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Scope Management Plan.

To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Schedule Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Schedule Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Schedule Management Plan.
To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Cost Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Cost Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Cost Management Plan.
To develop a Quality Management Plan for managing and controlling quality within the project	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Quality Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Quality Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Quality Management Plan.
To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Resource Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Resource Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Resource Management Plan.
To elaborate a Communication Management Plan that ensures the project team and stakeholders all	The Qualitative method will be employed to gain a holistic perspective	The Quantitative method will be utilized to analyze the historical data for	A combination of the two methods will be used to determine relationships for

receive the necessary information for effective collaboration.	of the information for creation of the Communication Management Plan.	development of the Communication Management Plan.	creation of the Communication Management Plan.
To develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Risk Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Risk Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Risk Management Plan.
To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Procurement Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Procurement Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Procurement Management Plan.
To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Stakeholder Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Stakeholder Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Stakeholder Management Plan.
To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.	The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Integration Management Plan.	The Quantitative method will be utilized to analyze the historical data for development of the Integration Management Plan.	A combination of the two methods will be used to determine relationships for creation of the Integration Management Plan.

<p>To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.</p>	<p>The Qualitative method will be employed to gain a holistic perspective of the information for creation of the Sustainable Development Plan.</p>	<p>The Quantitative method will be utilized to analyze the historical data for development of the Sustainable Development Plan.</p>	<p>A combination of the two methods will be used to determine relationships for creation of the Sustainable Development Plan.</p>
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3.3 Tools

According to the Project Management Institute (2017). A tool can be defined as “Something tangible, such as a template or software program, used in performing an activity to produce a product or result.”

Tools utilized for the creation of this project included the following:

- Scope Management Plan Template – Outline for the development of the Scope Management Plan
- Schedule Management Plan Template - Outline for the development of the Schedule Management Plan
- Cost Management Plan Template - Outline for the development of the Cost Management Plan
- Project Management Plan Template - Outline for the development of the Project Management Plan
- Quality Management Plan Template - Outline for the development of the Quality Management Plan
- Resource Management Plan Template - Outline for the development of the Resource Management Plan
- Communication Management Plan Template - Outline for the development of the Communication Management Plan
- Risk Management Plan Template - Outline for the development of the Risk Management Plan
- Procurement Management Plan Template - Outline for the development of the Procurement Management Plan
- Stakeholder Management Plan - Outline for the development of the Stakeholder Management Plan
- Integration Management Plan Template - Outline for the development of the Integration Management Plan
- Sustainable Management plan Template - Outline for the development of the Sustainable Management Plan
- Project Management Scheduling Software – Software used to create the project schedule
- Activity List Template – Used to created the list of schedule activities
- Responsibility Assignment Matrix – To assign respabilities to the project team
- Communication Matrix – Matrix to outline project communication
- Stakeholder Engagement Assessment Matrix – Matrix to assess stakeholder engagement needs
- Stakeholder Prioritization Matrix – Matrix to prioritize project stakeholders

- Project Charter Template – Document to outline key project information
- Risk Register Template – Register to document project risks
- Requirements Traceability Matrix – Matrix to match deliverables with their requirements
- Work Breakdown Structure – Used to break down large projects into manageable pieces
- Work Breakdown Dictionary – Contains details of tasks, activities and deliverables
- Bottom up Estimation – Estimation technique to determine project costs by working from the details and combining for the overall costs
- Quality Activities Matrix Template – Matrix to outline how quality will be managed within the project
- Stakeholder Register Template – Register to document project stakeholders
- Stakeholder Assessment Matrix – Matrix to compare current engagement levels and desired engagement levels for Stakeholder
- P5 Impact Analysis – Tool to determine the impact on the sustainable development of the project

Chart 3 Tools (Source: R. Nurse, 2023)

Objectives	Tools
To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success.	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis • Meetings • Scope Management Plan Template • Requirements Traceability Matrix • Work Breakdown Structure • Work Breakdown Structure Dictionary
To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis • Meetings • Activity List • MS Projects • Schedule Management Plan Template

<p>To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.</p>	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis • Meetings • Bottom – Up Estimation • Cost Management Plan Template
<p>To develop a Quality Management Plan for managing and controlling quality within the project</p>	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Decision making • Data representation • Test and inspection planning • Meetings • Quality Activities Matrix Template • Quality Management Plan Template
<p>To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.</p>	<ul style="list-style-type: none"> • Expert Judgement • Data representation • Organizational Theory • Meetings • RACI • • Resource management Plan Template
<p>To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.</p>	<ul style="list-style-type: none"> • Expert Judgement • Communication requirements analysis • Communication technology • Communication models • Communication methods • Interpersonal and team skills • Data representation • Meetings • Communication Management Plan Template
<p>To develop a Risk Management Plan which improves the chances of project success by</p>	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis

<p>mitigating potential risks, while capitalizing on the impact of positive risks.</p>	<ul style="list-style-type: none"> • Meetings • Risk Register Template • Risk Management Plan Template
<p>To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.</p>	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Source selection analysis • Meetings • Procurement Management Plan Template
<p>To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.</p>	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Data representation • Meetings • Stakeholder Register Template • Stakeholder Assessment Matrix • Stakeholder Management Plan Template
<p>To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.</p>	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Data representation • Meetings • Interpersonal and team skills • Integration Management Plan Template • Project management information system
<p>To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.</p>	<ul style="list-style-type: none"> • Sustainable Management Plan Template • Expert Judgement • Data gathering • Data analysis • P5 Impact Analysis • Meetings

3.4 Assumptions and constraints

Assumptions

The Project Management Institute (2017) states that assumptions are factors that are considered to be real or true within the planning context; even without proof of this being the case.

Constraints

These are restrictions that the project manager and team must operate with to complete works. The first three constraints identified are schedule, scope and cost. These have been called the triple constraint. In recent years, the constraints of quality and risk have been added to the list.

Chart 4 Assumptions and constraints (Source: R. Nurse, 2023)

Objectives	Assumptions	Constraints
To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success.	The necessary information to fully determine the project scope is accessible.	<ul style="list-style-type: none"> Organizational structure of project sponsors Limited information from stakeholders may affect scope definition
To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.	Schedule will follow the typical construction process of a typical beam bridge	<ul style="list-style-type: none"> Must observe project working hours and holidays Hard deadline on activities
To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.	Global economic changes will not affect the cost management plan	<ul style="list-style-type: none"> Limited project budget Internal procedures of project sponsors
To develop a Quality Management Plan for managing and controlling quality within the project	Requirements will be easily collected from all	<ul style="list-style-type: none"> Limited requirements from stakeholders

Objectives	Assumptions	Constraints
	stakeholders to understand their expectations	<ul style="list-style-type: none"> Organizational structure of project sponsors
To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.	Resources will be available at the time they are needed.	<ul style="list-style-type: none"> Limited project resources Overallocation due to previous works
To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.	All stakeholders will have access to all forms of communication outlined	<ul style="list-style-type: none"> Lack of response from stakeholders Organizational structure of project sponsors
To develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks.	All risks will be identifiable	<ul style="list-style-type: none"> Limited data as project is not currently existing Effects of natural disasters may be severe
To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.	Local suppliers will be capable of supplying necessary materials	<ul style="list-style-type: none"> Capacity of local suppliers International shipping delays
To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.	It will be possible to identify all possible stakeholders for such a project	<ul style="list-style-type: none"> Lack of response from stakeholders Organizational structure of project stakeholders
To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.	Integration activities will facilitate improved cohesion of all other processes	<ul style="list-style-type: none"> Understanding of all involved in project with process interdependencies Organizational structure
To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.	Sustainable development approaches will be applicable to the construction process	<ul style="list-style-type: none"> Capacity of local suppliers to provide sustainable options Selection available in – country

3.5 Deliverables

In regards to project deliverables, The Project Management Institute (2017) expresses that these refer to all tangible and intangible outputs produced within the scope of the project.

Chart 5 Deliverables (Sources: R. Nurse, 2023)

Objectives	Deliverables
To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success.	Scope Management Plan
To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.	Schedule Management Plan
To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.	Cost Management Plan
To develop a Quality Management Plan for managing and controlling quality within the project	Quality Management Plan
To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.	Resource Management Plan
To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.	Communication Management Plan
To develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks.	Risk Management Plan
To create a Procurement Management Plan to administer the purchase or acquisition of products,	Procurement Management Plan

services or results necessary in order for the successful completion of the project.	
To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.	Stakeholder Management Plan
To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.	Integration Management Plan
To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.	Sustainable Management Plan

4 RESULTS

4.1 Integration Management Plan

4.1.1 Integration Management Introduction

This section will be comprise of the Project Charter and the Project Management Plan. It will speak to how the various processes and project management activities will be combined and utilized together.

4.1.2 Develop Project Charter

The project charter was created to describe the project and give readers an overall understanding. Additionally, according to PMI, the charter formally authorizes the existence of a project and allows the project manager the ability to mobilize resources. The project charter is outlined below.

Project Name: Construction of the San Estevan Bridge Project in Belize

Project Start Date: August 01, 2023

Project Finish Date: May 13, 2025

Project Objectives:**General Objective**

To plan and implement the construction of the San Estevan Bridge in Belize in order to increase accessibility within the area to the Belizean Citizens

Specific Objectives

1. To create the Project Management Plan for the construction of the bridge in order for effective project execution
2. The construction of (1) concrete beam bridge (100m) comprised of (2) reinforced concrete Abutments and (2) reinforced concrete Piers in order to facilitate an increased flow of traffic
3. The construction of (2) Bridge Approaches in order to connect the roadway to the new bridge
4. To ensure that the bridge Freeboard height is a minimum of 6.5m in order to allow sea vessels to pass beneath the bridge

Project purpose of justification:

The rural village of San Estevan is located in the Orange Walk district of Belize. Currently, if its residents wish to travel to the most northern district which is Corozal, they must either cross the river by using the small manually cranked Ferry which has a capacity of 2- 3 small vehicles at a time or drive south towards Orange Walk in order to connect to the Northern Highway and travel from there, which makes the journey much longer than necessary.

Through the construction of the San Estevan Bridge Project, the country would be able to connect the community of San Estevan to the main Northern Highway, allowing the residents easier access to facilities such as supermarkets, health care facilities and in the case of emergencies, alternative routes of egress.

Ultimately, the bridge would increase traffic flow by 75% percent due to 24/7 accessibility and increased capacity which would greatly improve the quality of life for those in the surrounding communities.

Description of Product of Service to be generated by the Project – Project final deliverables:

1. Project Management Plan
2. (1) 100m Beam Bridge
3. (2) Reinforced Concrete Abutments
4. (2) Reinforced Concrete Piers
5. (2) Bridge Approaches

Assumptions:

1. The project site will be handed over to the contractor in time for works to commence
2. There will be minimal changes from the project construction plans
3. Project fund disbursement will be carried out in a timely manner

Constraints:

1. Limited working space in the area for heavy equipment
2. Normal traffic will utilize ferry preventing quick movement of equipment from one side of the river to the other
3. Far distance for delivery of project materials

Risks:

1. Poor quality of construction
2. Extreme weather may cause project delays
3. Non-adherence to specifications
4. Supplier delays

Budget:

The project budget is estimated at \$8,562,957.49 BZD

Milestones and dates:

Milestone	Start date	End date
Bridge Construction	August 01, 2023	December 17, 2024
West Approach	July 02, 2024	December 05, 2024
East Approach	December 06, 2024	May 13, 2025
Project Management	September 12, 2023	May 13, 2025

Stakeholders:

The following are the project stakeholders:

1. Project Manager
2. Project Team
3. Government of Belize
4. External Project Sponsor
5. Citizens of Belize
6. Suppliers
7. Contractor

4.1.3 Project Management Plan

According to PMI (2017), this process defines, prepares and coordinates all plan components while integrating them into the overall project management plan.

a. Change Control

For any changes that may be necessary during the project, an integrated change control process will be followed.

- Change request is submitted
- The proposed change is assessed to determine its effect on the project
- Approval or rejection is given by the Project Manager and Project Sponsor
- The decision is recorded in the change log

- Project documents are updated

b. Lessons Learned

A lessons learned register will be utilized to capture vital information and foster continual improvement throughout the project.

c. Project Closure

PMI (2017) makes note that this process of finalizes all activities for the project, phase, or contract.

In order for the project to be closed, the following must be carried out:

- Final walkthrough and creation of a cut sheet with any defects to be remedied
- Signoff by Government representative and the Project Manager
- Handover certificate is provided
- Final payments are made

4.2 Scope Management Plan

4.2.1 Scope Management Introduction

The objective of Project Scope Management is to ensure that all the work to be done for the project is carried out and only that work. This is crucial as changes to the project scope will affect the overall time and cost of the project. Additionally, it aids the stakeholders to have a clear understanding of what is included and what is not. In order to avoid these over runs in time and budget, each item of works should be clearly defined and documented.

4.2.2 Collect Requirements

Collecting requirements allows the project team to ensure that the needs of all the stakeholders are considered. Without this, the project work could be completed without bringing value to the stakeholders.

Chart 6 Requirements Traceability Matrix (Source: R. Nurse, 2023)

ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	Verification
R1	Concrete should be able to withstand loads required for the usage of the structures	Structural Integrity	Ensure safety	Compressive strength tests
R2	Steel should be able to withstand loads as required	Structural Integrity	Ensure safety	Mill certificates
R3	Structures should be free of visual defects	Service Life	Workmanship	Inspection
R4	Backfilling should perform under loads without deformation	Structural Integrity	Ensure safety	Compaction tests

R5	Dimensions of structures should be within specified tolerance	Regulations	Ensure adherence to plans	Inspection, measurements
R6	Positions of installed elements should be within specified tolerances	Regulations	Ensure adherence to plans	Inspection, measurements
R7	Freeboard height should meet minimum height specified	Regulations	Accessibility for sea vessels	Inspection, measurements

4.2.3 Define Scope

Project Scope Statement

Project Description

The project entails the construction of a new bridge to replace the ferry located in San Estevan Village to cross the New River. The beam bridge would be comprised of (3) spans, supported by (2) Abutments and (2) Piers. There will also be approaches constructed on either side of the completed bridge. The entire structure would be constructed with reinforced concrete.

Project Deliverables

1. (2) Reinforced Concrete Abutments
2. (2) Reinforced Concrete Piers

3. (15) Prestressed Concrete Girders
4. (2) Approaches
5. (100 m) Concrete Bridge Deck
6. (200 m) Metal Handrails
7. (200 m) Concrete Crash Barriers
8. Project Management Plan

Acceptance Criteria

- All concrete structures meet the specified concrete design strengths
- Physical dimensions are within specified tolerances
- Structures are free of physical defects
- Plans are approved by the government project manager

Project Exclusions

- Backfilling and compacting for the approaches to be provided by earthworks contractor
- Relocation of Ferry and creation of diversion route to be used during construction to be carried out by the government.

Constraints

- Project to be carried out within budget of \$8 million
- Works to be completed within 18 months

Assumptions

- Quarries in the area will be able to meet demands for quantities of materials required for concrete pouring
- Ferry will be relocated by the government prior to the project start date.

4.2.4 Create WBS

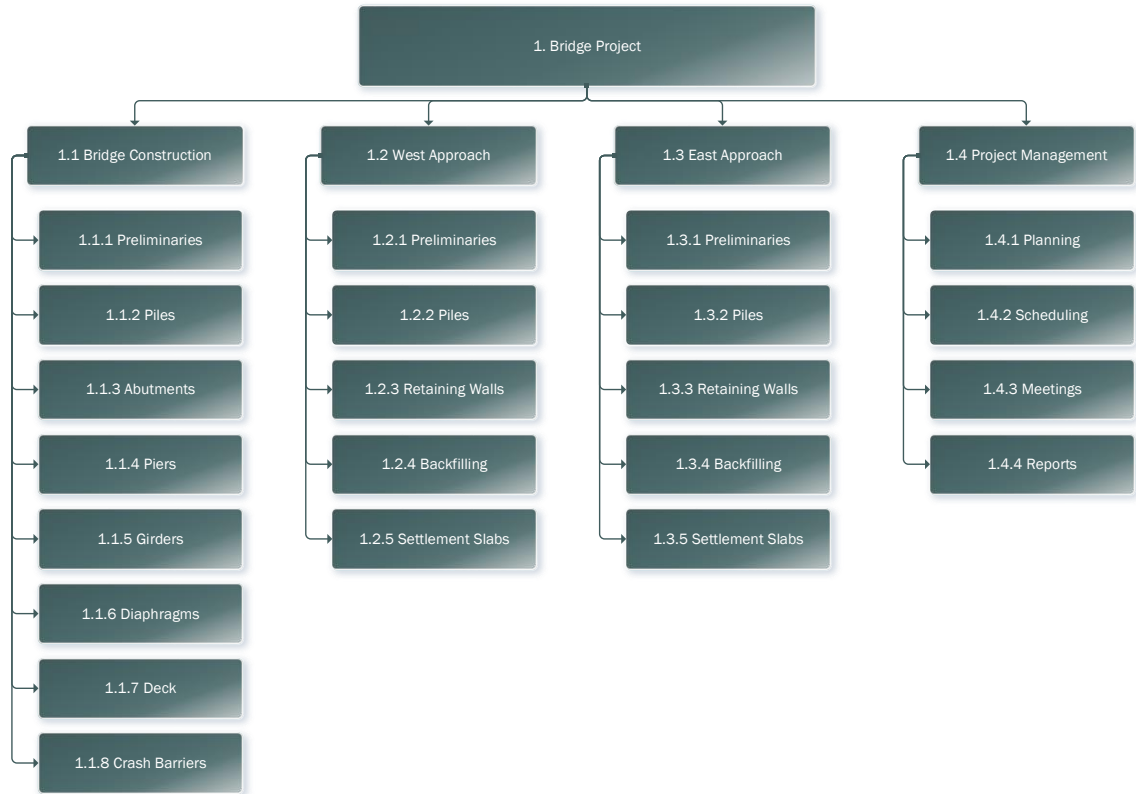


Figure 14 - Work Breakdown Structure (Source: R. Nurse, 2023)

4.2.5 WBS Dictionary

The PMBOK guide to project management knowledge 7th Edition states that the WBS dictionary provides detailed project information in regards to deliverables, activities and scheduling for each component within the work breakdown structure. The following WBS dictionary was created based on the WBS and provides the aforementioned project information.

Chart 7 WBS Dictionary (Source: R. Nurse, 2023)

Level	WBS Code	WBS Name	Description/ Definition	Budget (\$ BZD)	Resources
0	1.1	Bridge Construction	Construction of the main bridge structure including the foundation, substructure and superstructure	\$4,877,100.00	
2	1.1.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	\$543,700.00	Project Manager, Office Manager, Project Team
2	1.1.2	Piles	Fabrication of (106) bridge foundation concrete piles, transport and delivery, fabrication of templates for installation, installation, cutting to required levels	\$1,173,400.00	Site Engineer, Site Supervisor, Project Team
2	1.1.3	Abutments	Construction of (2) concrete bridge abutments with wing walls and stem walls	\$340,000.00	Site Engineer, Site Supervisor, Project Team
2	1.1.4	Piers	Construction of (2) concrete bridge piers, including	\$216,000.00	Site Engineer, Site Supervisor

			seismic blocks and plinths		, Project Team
2	1.1.5	Girders	Fabrication of (15) Prestressed concrete girders, transportation to site, insurances, police escort and installation	\$1,700,000.00	Site Engineer, Site Supervisor, Project Team
2	1.1.6	Diaphragms	Construction of concrete diaphragms to connect the girders. Including concrete, steel and formworks	\$124,000.00	Site Engineer, Site Supervisor, Project Team
2	1.1.7	Deck	Construction of the concrete bridge deck. Including all precast deck panels, steel, concrete and formwork	\$620,000.00	Site Engineer, Site Supervisor, Project Team
2	1.1.8	Crash Barriers	Fabrication of concrete crash barriers on both sides of the 100m bridge deck to ensure safety of vehicles and pedestrians	\$160,000.00	Site Engineer, Site Supervisor, Project Team
1	1.2	West Approach	Construction of the sloped roadway towards the bridge on the western side of the river	\$1,168,475.00	

2	1.2.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	\$150,000.00	Project Manager, Office Manager, Project Team
2	1.2.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	\$470,000.00	Site Engineer, Site Supervisor, Project Team
2	1.2.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	\$400,000.00	Site Engineer, Site Supervisor, Project Team
2	1.2.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	\$132,475.00	Site Engineer, Site Supervisor, Project Team
2	1.2.5	Settlement Slabs	Construction of concrete settlement slabs within the approach to prevent potential settlement of the backfilled materials	\$16,000.00	Site Engineer, Site Supervisor, Project Team

1	1.3	East Approach	Construction of the sloped roadway towards the bridge on the eastern side of the river	\$1,168,475.00	
2	1.3.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	\$150,000.00	Project Manager, Office Manager, Project Team
2	1.3.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	\$470,000.00	Site Engineer, Site Supervisor, Project Team
2	1.3.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	\$400,000.00	Site Engineer, Site Supervisor, Project Team
2	1.3.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	\$132,475.00	Site Engineer, Site Supervisor, Project Team
2	1.3.5	Settlement Slabs	Construction of concrete settlement	\$16,000.00	Site Engineer, Site

			slabs within the approach to prevent potential settlement of the backfilled materials		Supervisor, Project Team
1	1.4	Project Management	Application of project management processes and procedures throughout the duration of the project	\$232,000.00	
2	1.4.1	Planning	Planning project activities throughout the duration of the project	\$69,600.00	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor
2	1.4.2	Scheduling	Scheduling project activities throughout the duration of the project	\$127,600.00	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor
2	1.4.3	Meetings	Attending meeting with project stakeholders to update, inform and make project decisions	\$11,600.00	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor
2	1.4.4	Reports	Administration of project reports including daily logs,	\$23,200.00	Project Manager, Office Manager, Project

			weekly work programs and monthly work program updates		Team, Site Engineer, Site Supervisor
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4.2.6 Roles and Responsibilities

The roles and responsibilities for the project are defined below. By outlining them here the project team will have a reference to allow for better overall collaboration.

Chart 8 Roles and Responsibilities (Source: R. Nurse, 2023)

Project Role	Responsibilities
Project Sponsor - Government of Belize	Main sponsor for the project
Project Manager	Management of the project and all its activities through the use of project management best practices
Site Engineer	Responsible for technical aspects of the construction and to ensure the plans are executed correctly
Site Supervisor	Responsible for oversight of workers and site equipment
Office Manager	Project administration such as ordering materials and liaising with suppliers
Project Team - Global Constructors Limited Team	Support and execution of project activities
Other Stakeholders - Surrounding Communities, Suppliers, Public Utilities	Provide feedback and support throughout the project

4.2.7 Validate Scope

Through scope validation the project deliverables are either accepted or rejected. This judgement should be as objective as possible. Therefore, measurable metrics should be employed. For this purpose, the criteria within the requirements traceability matrix will be utilized.

4.2.8 Control Scope

Scope control is vital to the successful completion of the project. Without proper scope control the project could be plagued with scope creep which adds work, time and cost to the project without any added value. To avoid this, the project scope should be continually monitored for variances and a robust change request procedure should be implemented.

4.3 Schedule Management Plan

4.3.1 Schedule Management Introduction

According to the PMBOK guide 7th edition, this plan presents the criteria and activities for developing, monitoring and controlling the schedule. This is used to ensure the timely completion of the project.

4.3.2 Schedule Management Approach

The schedule management plan will be created using information from similar past projects as well as knowledge and experience within the project area. Based on the past projects,

activities necessary to carry out the project will be defined. Using this knowledge and the work packages outlined in the WBS, the activities will be listed. Following this, the activities will be sequenced and the durations estimated. Once those tasks are completed the project schedule will be created using Microsoft Projects.

4.3.3 Define Activities

The activities were defined using expert judgement and information from past project. Additionally, predecessor and successor information was outlined in order to fully understand the interdependencies of the activities.

Chart 9 Activity List (Source: R. Nurse, 2023)

ACTIVITY LIST			ACTIVITY ATTRIBUTES		
ACTIVITY ID	ACTIVITY NAME	ACTIVITY DESCRIPTION	PREDECESSOR ACTIVITY IDs	SUCCESSOR ACTIVITY IDs	RESOURCE REQUIREMENTS
1.1.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance			Project Manager, Office Manager, Project Team

1.1.2	Piles	Fabrication of (106) bridge foundation concrete piles, transport and delivery, fabrication of templates for installation, installation, cutting to required levels	1.1.1	1.1.3	Site Engineer, Site Supervisor, Project Team
1.1.3	Abutments	Construction of (2) concrete bridge abutments with wing walls and stem walls	1.1.2	1.1.4	Site Engineer, Site Supervisor, Project Team
1.1.4	Piers	Construction of (2) concrete bridge piers, including seismic blocks and plinths	1.1.3	1.1.5	Site Engineer, Site Supervisor, Project Team
1.1.5	Girders	Fabrication of (15) Prestressed concrete girders, transportation to site, insurances, police escort and installation	1.1.4	1.1.6	Site Engineer, Site Supervisor, Project Team
1.1.6	Diaphragms	Construction of concrete diaphragms to connect the girders. Including concrete, steel and formworks	1.1.5	1.1.7	Site Engineer, Site Supervisor, Project Team

1.1.7	Deck	Construction of the concrete bridge deck. Including all precast deck panels, steel, concrete and formwork	1.1.6	1.1.8	Site Engineer, Site Supervisor, Project Team
1.1.8	Crash Barriers	Fabrication of concrete crash barriers on both sides of the 100m bridge deck to ensure safety of vehicles and pedestrians	1.1.7		Site Engineer, Site Supervisor, Project Team
1.2.1	Preliminaries	Camp establishment, mobilization, demobilization , setting out, quality control, insurances, site security, site clearance	1.1.4	1.2.2	Project Manager, Office Manager, Project Team
1.2.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	1.2.1	1.2.3	Site Engineer, Site Supervisor, Project Team
1.2.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	1.2.2	1.2.4	Site Engineer, Site Supervisor, Project Team

1.2.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	1.2.3	1.2.5	Site Engineer, Site Supervisor, Project Team
1.2.5	Settlement Slabs	Construction of concrete settlement slabs within the approach to prevent potential settlement of the backfilled materials	1.2.4	1.3.1	Site Engineer, Site Supervisor, Project Team
1.3.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	1.2.5	1.3.2	Project Manager, Office Manager, Project Team
1.3.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	1.3.1	1.3.3	Site Engineer, Site Supervisor, Project Team
1.3.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	1.3.2	1.3.4	Site Engineer, Site Supervisor, Project Team

1.3.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	1.3.3	1.3.5	Site Engineer, Site Supervisor, Project Team
1.3.5	Settlement Slabs	Construction of concrete settlement slabs within the approach to prevent potential settlement of the backfilled materials	1.3.4		Site Engineer, Site Supervisor, Project Team
1.4.1	Planning	Planning project activities throughout the duration of the project	1.1.1		Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor
1.4.2	Scheduling	Scheduling project activities throughout the duration of the project	1.1.1		Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor
1.4.3	Meetings	Attending meeting with project stakeholders to update, inform and make project decisions	1.1.1		Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor

1.4.4	Reports	Administration of project reports including daily logs, weekly work programs and monthly work program updates	1.1.1	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor
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4.3.4 Sequence Activities

Within this stage, the activities were placed in their corresponding order using the established relationships.

4.3.5 Estimate Activity Durations

Due to the nature of construction work, durations are typically estimated using a combination of expert judgement and past data. Depending on the degree of similarity between the projects, determinations are made. Factors may include size and scope. Based on these and other factors, decisions are made as to whether these tasks would require more or less time to complete.

4.3.6 Develop Schedule

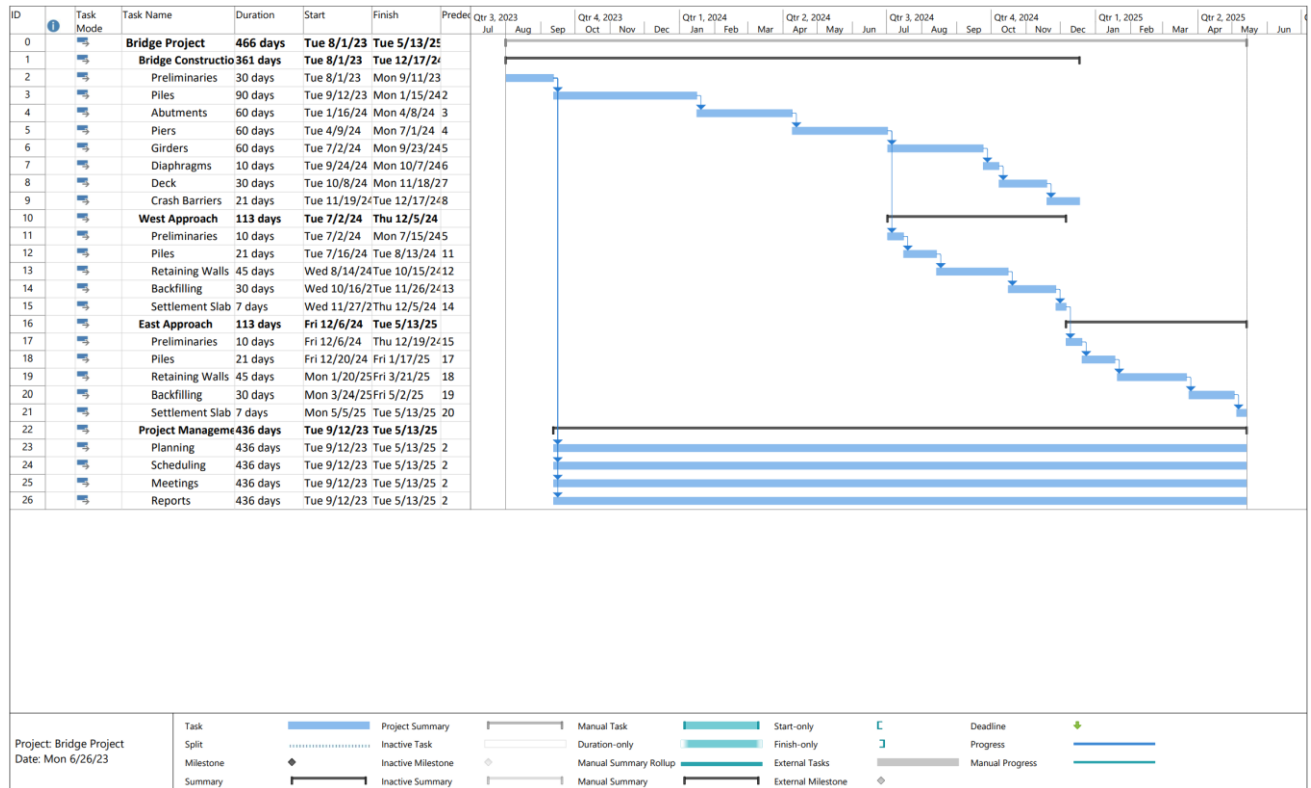


Figure 15 - Project Schedule (Source: R. Nurse, 2023)

4.3.7 Project Schedule Changes

This section is concerned with control of the Schedule. This means monitoring the status of the project in order to update the schedule and managing changes to the schedule baseline (PMI, 2017). This is crucial to ensure that the project timelines do not fall behind.

As with many projects, changes are expected. However, a strict procedure should be followed to make sure that all changes are necessary and will not negatively affect the project. To do this, the project team and project manager will carefully observe potential changes. At that point, the effects on scope, schedule and cost should be identified. If the effects are found to be acceptable, then the project manager approves the changes and makes the necessary changes to the schedule.

4.4 Cost Management Plan

4.4.1 Cost Management Introduction

This section is concerned with the financial aspects of the project. This includes outlining the methodology for estimates, the project budget and how project funds will be monitored and controlled throughout the project. This is crucial as mismanagement of funds can be detrimental to the successful completion of the project.

4.4.2 Estimate Costs

Cost were estimated through a combination of Bottom – Up Estimation and Expert judgement. This enabled project cost to be determined by using information from past projects and standard details for such structures. This means where possible typical details were used to estimate material and labor costs and where these were not available, past project information was utilized.

Chart 10 Cost Estimates (Source: R. Nurse, 2023)

Activity ID	Activity Name	Description	Resources	Unit	Rate	Qty	Amount
1.1.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	Project Manager, Office Manager, Project Team	Ls	\$543,700.00	1.00	\$ 543,700.00

1.1.2	Piles	Fabrication of (106) bridge foundation concrete piles, transport and delivery, fabrication of templates for installation, installation, cutting to required levels	Site Engineer, Site Supervisor, Project Team	No.	\$ 11,069.81	106.00	\$ 1,173,400.00
1.1.3	Abutments	Construction of (2) concrete bridge abutments with wing walls and stem walls	Site Engineer, Site Supervisor, Project Team	No.	\$170,000.00	2.00	\$ 340,000.00
1.1.4	Piers	Construction of (2) concrete bridge piers, including seismic blocks and plinths	Site Engineer, Site Supervisor, Project Team	No.	\$108,000.00	2.00	\$ 216,000.00
1.1.5	Girders	Fabrication of (15) Prestressed concrete girders, transportation to site, insurances, police escort and installation	Site Engineer, Site Supervisor, Project Team	No.	\$113,333.33	15.00	\$ 1,700,000.00
1.1.6	Diaphragms	Construction of concrete diaphragms to connect the girders. Including concrete, steel and formworks	Site Engineer, Site Supervisor, Project Team	No.	\$ 4,133.33	30.00	\$ 124,000.00

1.1.7	Deck	Construction of the concrete bridge deck. Including all precast deck panels, steel, concrete and formwork	Site Engineer, Site Supervisor, Project Team	m	\$ 6,200.00	100.00	\$ 620,000.00
1.1.8	Crash Barriers	Fabrication of concrete crash barriers on both sides of the 100m bridge deck to ensure safety of vehicles and pedestrians	Site Engineer, Site Supervisor, Project Team	m	\$ 800.00	200.00	\$ 160,000.00
1.2.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	Project Manager, Office Manager, Project Team	Ls	\$150,000.00	1.00	\$ 150,000.00
1.2.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	Site Engineer, Site Supervisor, Project Team	No.	\$ 1,807.69	260.00	\$ 470,000.00
1.2.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	Site Engineer, Site Supervisor, Project Team	m2	\$ 1,904.76	210.00	\$ 400,000.00

1.2.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	Site Engineer, Site Supervisor, Project Team	m ³	\$ 35.00	3785.00	\$ 132,475.00
1.2.5	Settlement Slabs	Construction of concrete settlement slabs within the approach to prevent potential settlement of the backfilled materials	Site Engineer, Site Supervisor, Project Team	Ls	\$ 16,000.00	1.00	\$ 16,000.00
1.3.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	Project Manager, Office Manager, Project Team	Ls	\$150,000.00	1.00	\$ 150,000.00
1.3.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	Site Engineer, Site Supervisor, Project Team	No.	\$ 1,807.69	260.00	\$ 470,000.00
1.3.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	Site Engineer, Site Supervisor, Project Team	m ²	\$ 1,904.76	210.00	\$ 400,000.00

1.3.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	Site Engineer, Site Supervisor, Project Team	m ³	\$ 35.00	3785.00	\$ 132,475.00
1.3.5	Settlement Slabs	Construction of concrete settlement slabs within the approach to prevent potential settlement of the backfilled materials	Site Engineer, Site Supervisor, Project Team	Ls	\$ 16,000.00	1.00	\$ 16,000.00
1.4.1	Planning	Planning project activities throughout the duration of the project	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor	Month	\$ 4,094.12	17.00	\$ 69,600.00
1.4.2	Scheduling	Scheduling project activities throughout the duration of the project	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor	Month	\$ 7,505.88	17.00	\$ 127,600.00
1.4.3	Meetings	Attending meeting with project stakeholders to update, inform and make project decisions	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor	Month	\$ 682.35	17.00	\$ 11,600.00

1.4.4	Reports	Administration of project reports including daily logs, weekly work programs and monthly work program updates	Project Manager, Office Manager, Project Team, Site Engineer, Site Supervisor	Month	\$ 1,364.71	17.00	\$ 23,200.00
Total				\$	7,446,049.99		

4.4.3 Determine Budget

PROJECT BUDGET CHART																									
ACTIVITY ID	ACTIVITY NAME	ACTIVITY DESCRIPTION	COST	Start	Finish	Duration (Months)	2023												2024						
							July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	
1.1.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	\$543,700.00	1-Aug-23	11-Sep-23	2.00		\$271,850.00	\$271,850.00																
1.1.2	Piles	Fabrication of (106) bridge foundation concrete piles, transport and delivery, fabrication of templates for installation, installation, cutting to required levels	\$1,173,400.00	12-Sep-23	15-Jan-24	5.00			\$234,680.00	\$ 234,680.00	\$ 234,680.00	\$ 234,680.00	\$ 234,680.00												
1.1.3	Abutments	Construction of (2) concrete bridge abutments with wing walls and stem walls	\$340,000.00	16-Jan-24	8-Apr-24	4.00							\$ 85,000.00	\$ 85,000.00	\$ 85,000.00	\$ 85,000.00									
1.1.4	Piers	Construction of (2) concrete bridge piers, including seismic blocks and plinths	\$216,000.00	9-Apr-24	1-Jul-24	4.00									\$ 54,000.00	\$ 54,000.00	\$ 54,000.00	\$ 54,000.00							
1.1.5	Girders	Fabrication of (15) prestressed concrete girders, transportation to site, insurances, police escort and installation	\$1,700,000.00	2-Jul-24	23-Sep-24	3.00												\$ 566,666.67	\$ 566,666.67	\$ 566,666.67					
1.1.6	Diaphragms	Construction of concrete diaphragms to connect the girders. Including concrete, steel and formworks	\$124,000.00	24-Sep-24	7-Oct-24	2.00													\$ 62,000.00	\$ 62,000.00					
1.1.7	Deck	Construction of the concrete bridge deck. Including all precast deck panels, steel, concrete and formwork	\$620,000.00	8-Oct-24	18-Nov-24	2.00															\$ 310,000.00	\$ 310,000.00			
1.1.8	Crash Barriers	Fabrication of concrete crash barriers on both sides of the 100m bridge deck to ensure safety of vehicles and pedestrians	\$160,000.00	19-Nov-24	17-Dec-24	2.00																\$ 80,000.00	\$ 80,000.00		
1.2.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	\$150,000.00	2-Jul-24	15-Jul-24	1.00													\$ 150,000.00						
1.2.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	\$470,000.00	16-Jul-24	13-Aug-24	2.00													\$ 235,000.00	\$ 235,000.00					

Figure 16 - Project Budget 1.1.1 - 1.2.2 (Source: R. Nurse, 2023)

1.2.3	Retaining Walls	Construction of concrete retaining walls (60m) on both sides of the approach to contain the backfilling material	\$400,000.00	14-Aug-24	15-Oct-24	3.00											\$ 133,333.33	\$ 133,333.33	\$ 133,333.33			
1.2.4	Backfilling	Backfilling and compacting of 3785 yd ³ of materials, including compaction in layers	\$132,475.00	16-Oct-24	26-Nov-24	2.00												\$ 66,237.50	\$ 66,237.50			
1.2.5	Settlement Slabs	Construction of concrete settlement slabs within the approach to prevent potential settlement of the backfilled materials	\$16,000.00	27-Nov-24	5-Dec-24	2.00														\$ 8,000.00	\$ 8,000.00	
1.3.1	Preliminaries	Camp establishment, mobilization, demobilization, setting out, quality control, insurances, site security, site clearance	\$150,000.00	6-Dec-24	19-Dec-24	1.00															\$ 150,000.00	
1.3.2	Piles	Fabrication of (260) approach foundation concrete piles, transport and delivery, installation, cutting to required levels	\$470,000.00	20-Dec-24	17-Jan-25	2.00															\$ 235,000.00	\$ 235,000.00

Figure 17 - Project Budget 1.2.3 - 1.3.2 (Source: R. Nurse, 2023)

As mentioned earlier, a combination of Bottom – Up Estimating and Expert Judgement were utilized to determine the project budget. Following this, projected monthly expenditure was determined based on when activities would be carried out and their durations in the overall project schedule. This was represented graphically on the S - Curve below .

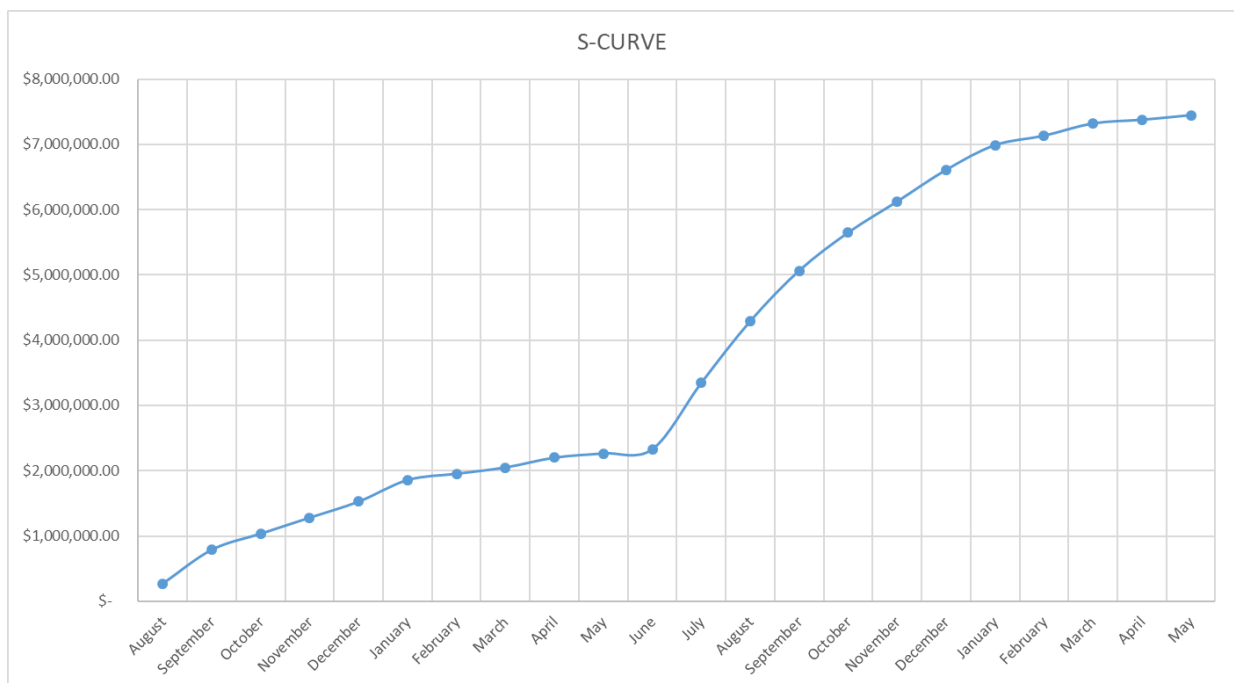


Figure 19 - S – Curve (Source: R. Nurse, 2023)

4.4.4 Control Costs

Project cost control involves monitoring and controlling the project budget by way of the integrated change control process. This process allows for the review of all change requests. At this point the requests are analyzed to determine the outcomes for the project and a determination made and documented. Without this process, funds can be mismanaged and used in ways that negatively affect the overall project.

For this project, Earned Value Management will be used to manage the project costs. With this technique indicators for scope, cost and schedule can be used to measure project performance and progress. Indicators include Cost variance (CV), Schedule variance (SV), Cost performance index (CPI) and Schedule performance index (SPI). These are constantly monitored throughout the project to determine if the actual cost, scope and schedule are as planned. If not, they can also be used to determine how much adjustment must be made to get back on track.

4.4.5 Cost Variance Response

The cost variance response process defines the control thresholds for the project and what actions will be taken if the project triggers a control threshold. As a part of the response process, the project management team typically presents options for corrective action to the Project Sponsor.

Chart 11 Cost Variance Response Process (Source: R. Nurse, 2023)

Performance Measure	Yellow Condition	Red Condition
Schedule Performance Index (SPI)	Between 0.9 and 0.8 or Between 1.1 and 1.2	Less Than 0.8 or Greater than 1.2
Cost Performance Index (CPI)	Between 0.9 and 0.8 or Between 1.1 and 1.2	Less Than 0.8 or Greater than 1.2
Indicators	Response	
Yellow (Alert)	Project Manager to perform analysis and strengthen cost control and spending	
Red (Critical)	Project Manager to perform project cost performance overview, determine corrective actions and present to Sponsor for approval	

Responses Based on EVM**Yellow Condition**

Upon reviewing the indicators for the reporting period, if the control thresholds of CPI or SPI are between 0.8 and 0.9 or between 1.1 and 1.2, or if the SPI or CPI has a variance of between 0.1 and 0.2 since the prior reporting period, the Project Manager must report to the Project Sponsor and explain the causes.

Red Condition

Upon reviewing the indicators for the reporting period, if the control thresholds of CPI or SPI are less than 0.8 or greater than 1.2, or if the SPI or CPI has a variance of greater than

0.2, the Project Manager must report the causes and provide the Project Sponsor with a Cost Variance Corrective Action Plan to regain acceptable Project performance.

4.4.6 Cost Change Control Process

The cost change control process involves the following steps to ensure that requests are justified and add value to the Project.

1. Receive the request
2. Record the request
3. Assess the request
4. Make a recommendation
5. Accept or reject the request

4.5 Quality Management Plan

4.5.1 Quality Management Plan Introduction

This section details the processes for integrating the organization's quality policies in order to meet stakeholder objectives. It expands on the aspects of planning, managing and controlling project and product quality requirements (PMI, 2017).

4.5.2 Quality Management Approach

The quality management approach for this project is aimed at ensuring that the proper regulations, standards and procedures and specifications are followed in order to ensure a quality product which will perform as required; ensuring the safety of the end users. In order to do this, quality requirements are outlined, metrics specified and means of verification are stated. This allows for clarity of the process and accountability.

4.5.3 Customer Prioritization

Chart 12 Customer Prioritization (Source:R. Nurse, 2023)

Customer Prioritization	Government of Belize	External Funding	Contractor	Citizens of Belize	Benny's Superstore	Row Total	Relative Decimal Value
Government of Belize		5	10	1/10	10	25.10	0.27
External Funding	1/5		10	1/10	10	20.30	0.22
Contractor	1/10	1/10		1/10	10	10.30	0.11
Citizens of Belize	10	10	10		10	40.00	0.42
Supplier	1/10	1/10	1/10	1/10		0.40	0.01
					Grand Total	96.10	

Based on the customer prioritization, the level of importance is as below:

- Citizens of Belize
- Government of Belize
- External Funding
- Contractor
- Supplier

4.5.4 Quality Requirements

- Access
- Sustainable
- Environmentally friendly
- Regulatory compliant
- Within budget
- Design compliant
- Structurally sound

4.5.5 Requirements Prioritization

Table 13 Requirements Prioritization (GOB) (Source: R. Nurse, 2023)

Requirements Prioritization (GOB)	Access	Sustainable	Environmentally Friendly	Regulatory Compliant	Within Budget	Design Compliant	Structurally Sound	Row Total	Relative Decimal Value
Access		5	1/5	1/10	1/10	1/5	1/10	5.70	0.04
Sustainable	1/5		1	1/5	1/10	1/5	1/10	1.80	0.02
Environmentally Friendly	5	1		1/10	1/10	1/5	1/10	6.50	0.05
Regulatory Compliant	10	5	10		5	5	1	36.00	0.25
Within Budget	10	10	10	1/5		5	1/10	35.30	0.25
Design Compliant	5	5	5	1/5	1/5		1/5	15.60	0.11
Structurally Sound	10	10	10	1	10	5		46.00	0.32
							Grand Total	146.90	

Chart 14 Requirements Prioritization (External Funding) (Source: R. Nurse 2023)

Requirements Prioritization (External Funding)	Access	Sustainable	Environmentally Friendly	Regulatory Compliant	Within Budget	Design Compliant	Structurally Sound	Row Total	Relative Decimal Value
Access		1/5	1/5	1/10	1/10	1/10	1/10	0.80	0.01
Sustainable	5		1	1/5	5	5	1/10	16.30	0.12
Environmentally Friendly	5	1		1/10	1/5	5	1/10	11.40	0.08
Regulatory Compliant	10	5	10		1/5	5	1	31.20	0.22
Within Budget	10	1/5	5	5		5	1/10	25.30	0.18
Design Compliant	10	1/5	1/5	1/5	1/5		1/10	10.90	0.08
Structurally Sound	10	10	10	1	10	10		51.00	0.35
							Grand Total	146.90	

Chart 15 Requirements Prioritization (Contractor) (Source: R. Nurse, 2023)

Requirements Prioritization (Contractor)	Access	Sustainable	Environmentally Friendly	Regulatory Compliant	Within Budget	Design Compliant	Structurally Sound	Row Total	Relative Decimal Value
Access		1/5	1/5	1/10	1/10	1/10	1/10	0.80	0.01
Sustainable	5		1	1/10	1/10	1/10	1/10	6.40	0.05
Environmentally Friendly	5	1		1/10	1/10	1/10	1/10	6.40	0.05
Regulatory Compliant	10	10	10		5	5	1/5	40.20	0.28
Within Budget	10	10	10	1/5		1/5	1/10	30.50	0.21
Design Compliant	10	10	10	1/5	5		1/10	35.30	0.25
Structurally Sound	10	10	10	5	10	10		55.00	0.38
							Grand Total	174.60	

Chart 16 Requirements Prioritization (Citizens of Belize) (Source: R. Nurse, 2023)

Requirements Prioritization (Citizens of Belize)	Access	Sustainable	Environmentally Friendly	Regulatory Compliant	Within Budget	Design Compliant	Structurally Sound	Row Total	Relative Decimal Value
Access		1	5	5	5	5	1/10	21.10	0.15
Sustainable	1		1	5	10	5	1/10	22.10	0.16
Environmentally Friendly	1/5	1		5	5	5	1/10	16.30	0.12
Regulatory Compliant	1/5	1/5	1/5		5	5	1/10	10.70	0.08
Within Budget	1/5	1/10	1/5	1/5		1	1/10	1.80	0.02
Design Compliant	1/5	1/5	1/5	1/5	1		1/10	1.90	0.02
Structurally Sound	10	10	10	10	10	10		60.00	0.41
							Grand Total	133.90	

Chart 17 Requirements Prioritization (Supplier) (Source: R. Nurse, 2023)

Requirements Prioritization (Supplier)	Access	Sustainable	Environmentally Friendly	Regulatory Compliant	Within Budget	Design Compliant	Structurally Sound	Row Total	Relative Decimal Value
Access		1	5	5	5	5	1/10	21.10	0.15
Sustainable	1		1	5	10	5	1/10	22.10	0.16
Environmentally Friendly	1/5	1		5	5	5	1/10	16.30	0.12
Regulatory Compliant	1/5	1/5	1/5		5	5	1/10	10.70	0.08
Within Budget	1/5	1/10	1/5	1/5		1	1/10	1.80	0.02
Design Compliant	1/5	1/5	1/5	1/5	1		1/10	1.90	0.02
Structurally Sound	10	10	10	10	10	10		60.00	0.41
							Grand Total	133.90	

Chart 18 Customer Weighted Requirements Prioritization (Source: R. Nurse, 2023)

Customer-Weighted Requirements Prioritization	GOB	External Funding	Contract or	Citizens of Belize	Benny's	Row Total	Relative Decimal Value
Access	1/93	0	0	1/16	0	0.08	0.08
Sustainable	0	1/38	0	1/15	0	0.11	0.11
Environmentally Friendly	1/74	1/57	0	1/20	0	0.09	0.09
Regulatory Compliant	5/74	3/62	2/65	1/30	0	0.18	0.18
Within Budget	5/74	3/76	1/43	0	0	0.14	0.14
Design Compliant	1/34	1/57	2/73	0	0	0.08	0.08
Structurally Sound	7/81	1/13	1/24	5/29	0	0.38	0.37
				Grand Total		1.06	

Based on the requirements prioritization, the level of significance is as below:

- Structurally Sound
- Regulatory Compliant
- Within Budget
- Sustainable
- Environmentally friendly
- Design Compliant
- Access

4.5.6 Roles and Responsibilities

Chart 19 Project Quality Roles and Responsibilities (Source: R. Nurse, 2023)

Role	Responsibilities
Client (Government of Belize)	Oversight of project execution to ensure their requirements are met
Project Sponsor (External Funding)	Projects meets desired standards and is completed within time and budget
Project Execution (Contractor)	Execution of project works and required testing

4.5.7 Factors related to quality

Chart 20 Key Factors related to quality (Source: R. Nurse, 2023)

Factor	Factor Definition
Safe and sound construction	Construction materials used meet the design specifications
Building Code compliance	Construction is carried out according to country building codes
Successful completion within budget	Project is completed within the allocated budget without losses in quality
Satisfied customers	End users of the structure are satisfied with the comfort when using the bridge
Accessibility	Those end users on foot are able to access and cross safely

4.5.8 Quality Metrics

The quality metrics aim to measure the attributes defined for quality within the project. This allows for an objective and fair review. If quality is not made to be measurable, the project can encounter numerous conflicts as stakeholders have disagreements about what is acceptable.

Chart 21 Metrics and quality baseline (Source: R. Nurse, 2023)

Quality Objective	Metric	Metric definition	Expected outcome/result	Measurement frequency	Responsible
Building materials should achieve required strengths	Concrete strength of 4000 psi	All concrete should be a minimum of 4000psi	Structures will be structurally sound	Continuously monitored throughout the project	Contractor
Building Codes	Building codes	Country building codes will be followed throughout the construction	Compliance with codes	Continuous	Contractor
Completion within budget	Budget of \$8,562,957.49 million bzd	Project should be completed within budget without effect on quality	Project scope completed with budget allocated	Continuous	Sponsor
Accessibility	2 sidewalks to be	Sidewalks should have	Walking users will be able to	Continuous	Contractor

	constructed and 200 m of crash barriers	minimum width of 5.5ft and slope of 3%. Crash barriers should be 3ft high.	easily cross the bridge		
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4.5.9 Quality Activities

Quality activities are simply the activities that will be carried out from the commencement of the project, through to its completion to ensure quality within the project. This ensures that there are proper checks and balances.

Chart 22 Quality Activities Matrix (Source: R. Nurse, 2023)

Deliverable	Requirement	Manage and Control activities	Frequency	Responsible
Abutments	Building material specifications and codes	Manage:	Monthly	Contractor
		Control:	Monthly	GOB
Piers	Building material specifications and codes	Manage:	Monthly	Contractor
		Control:	Monthly	GOB
Bridge Deck	Building material specifications and codes	Manage:	Monthly	Contractor
		Control:	Monthly	GOB
Approaches	Building standards and codes for accessibility	Manage:	Monthly	Contractor
		Control:	Monthly	GOB
Improvements to sustainability	80 % of project materials to be locally sourced	Manage:	Monthly	Contractor
		Control:	Monthly	GOB

4.5.10 Quality Documents

Inspection request form

REQUEST FOR INSPECTION



TO: Gutierrez & Associates Architects
gutarch@yahoo.com

Inspection # 003
 DATE 17-Dec-20
 DATE NEEDED
 PROJECT NAME Smart Hospitals - SI - Cayo
 PROJECT # Pending

Inspection Description

We would like to request an inspection for Friday 18th, December, 2020 at 9:00 am. The inspection will be of the Pump Hut Pad Footing Reinforcement.

Page 1

ATTACHMENTS

SUBMITTED BY Rico Nurse
 engineer@maheias.com
 Maheias United

RESPONSE TO INSPECTION

Approval to proceed to the next operation following inspection;

Approved

Not approved

Notes:

RESPONSE BY (Name, Title)
 Company

DATE:

Compressive strength results form

Compressive Testing of Concrete Cylinders				JOB NUMBER				
<i>Client</i>	San Ignacio - Sewage							
<i>Reference</i>	DELIVERED SAMPLES							
<i>Project</i>	Pile Caps							
<i>Location</i>	San Ignacio							
<i>Date of Casting</i>	November 28th 2020							
<i>Date of Testing</i>	November 8th 2020							
SAMPLE #	CLIENT REF.	DATE OF CASTING	DATE OF TESTING	AGE IN	PEAK LOAD	GROSS AREA	CYL STRENGTH	AVERAGE STRENGTH
1		28/11/2020	08/12/2020	10	104,000	28.27	3679	
2		28/11/2020	08/12/2020	10	100,000	28.27	3537	
<i>REMARKS</i>								
<i>TECHNICIAN</i>								

30.

Cost Variation Form

Date: November 12th, 2021

Cost Variation #043

ITEM	DESCRIPTION	QTY	UNIT	Rate	Total
	<u>Main Building Repair Works</u>				
1	Furniture repairs Refurbishment of reception desk in the maternity ward, including sanding, staining and clear coat	1	LS	USD 440.00	USD 440.00
Total Cost Variation					USD 440.00

4.5.11 Continuous Improvement Plan

Chart 23 Continuous Improvement Chart (Source: R. Nurse, 2023)

Process Description – Plan, do, check, act cycle for rehabilitation activities
1. Plan: Plan methodologies to be used for repair activities, including products to used
2. Do: Carry out activities according to plans that were set forth
3. Check: Check the results over a period of time to determine effectiveness
4. Act: Make adjustments to the methodology and products based on observed results

Following the utilization of the Stakeholder prioritization and L- Shaped Matrix, it was determined that the End- Users (Citizens of Belize) were the most critical stakeholders within the project. This was expected as they will ultimately be the ones to use the bridge on a daily basis.

Considering all stakeholders, the most crucial requirements were determined to be the ensuring that the bridge is structurally sound and Regulatory compliant; both of which link directly to the safety of the structure.

Through continuous improvement by use of the Plan-Do-Check-Act cycle the project team will be able to determine the effectiveness of construction methodologies throughout the project. This will be an iterative process as issues may arise during the project and alternatives methods may become necessary. Ultimately, this will improve the effective and quality of project work.

4.6 Resource Management Plan

4.6.1 Resource Management Introduction

This involves the processes to identify, acquire and manage the resources needed for the successful completion of the project (PMI, 2017, p.307). This allows the project team to have what is needed to execute the work when needed.

4.6.2 Resource Management Approach

This plan will cover the processes that deal with the creation and management of the project team. Additionally, it will present the roles and responsibilities of each member, how team members are chosen and how development of said team members will be carried out.

Furthermore, the plan will speak to the acquisition and management of physical resources; namely construction materials and equipment. It is vital that these resources be used as effectively as possible to keep the project within budget. Through this consideration conflicts between various tasks that may need similar pieces of equipment can also be resolved before hand.

4.6.3 Roles and Responsibilities

The organizational structure for the project is outlined as below:

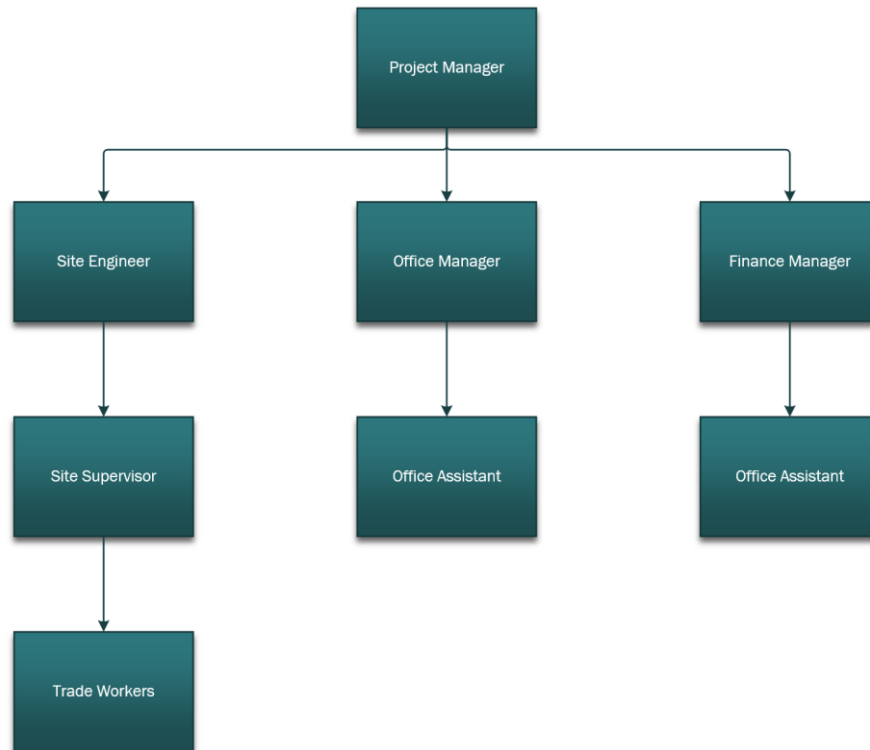


Figure 20 - Project Team Organizational Structure

Chart 24 Project Resource Management Roles and Responsibilities (Source: R. Nurse, 2023)

Roles	Responsibilities
Project Manager	Updating of project documents, planning, scheduling, reporting, coordination with stakeholders
Site Engineer	Oversight of construction, compliance, technical supervision
Site Supervisor	Oversight of trade workers and daily site activities
Trade Workers	Execution of construction works
Office Manager	Administration, ordering of materials, coordination with suppliers
Office Assistant	Assist the office manager with day to day tasks
Finance Manager	Monitoring and controlling of project finances and purchasing
Finance Assistant	Assist the finance manager with day to day tasks

Project Organizational Chart/ RACI Matrix

The RACI Chart, also known as the Responsibility Assignment Matrix illustrates accountability within the project by linking project team members with tasks and assigning varying levels of responsibility.

Chart 25 Responsibility Assignment Matrix (Source: R. Nurse 2023)

TASK NAME	PROJECT TEAM MEMBER							
	Project Manager	Site Engineer	Site Supervisor	Trade Workers	Office Manager	Office Assistant	Finance Manager	Finance Assistant
Preliminaries	R	C	C	I	C	I	I	I
Piles	R	R	A	A	I	I	I	I
Abutments	R	R	A	A	I	I	I	I
Piers	R	R	A	A	I	I	I	I
Girders	R	R	A	A	I	I	I	I
Diaphragms	R	R	A	A	I	I	I	I
Deck	R	R	A	A	I	I	I	I
Crash Barriers	R	R	A	A	I	I	I	I
Preliminaries	R	R	A	A	I	I	I	I
Piles	R	R	A	A	I	I	I	I
Retaining Walls	R	R	A	A	I	I	I	I
Backfilling	R	R	A	A	I	I	I	I
Settlement Slabs	R	R	A	A	I	I	I	I
Preliminaries	R	R	A	A	I	I	I	I
Piles	R	R	A	A	I	I	I	I
Retaining Walls	R	R	A	A	I	I	I	I
Backfilling	R	R	A	A	I	I	I	I
Settlement Slabs	R	R	A	A	I	I	I	I
Planning	R	C	C	I	C	I	C	I
Scheduling	R	C	C	I	C	I	C	I
Meetings	R	C	C	I	C	I	C	I
Reports	R	C	C	I	C	I	C	I
R = Responsible A = Accountable C = Consult I = Inform								

4.6.4 Acquisition of Team Members

Team members will be comprised of existing members within the Global Constructors Organization. These will be experienced members within the organization, who have years of experience with similar projects. They will take on the roles of the Project Manager, Site Engineer, Site Supervisor, Office Manager and Finance Manager. For the positions of the office assistants, a fair process will be followed with equal opportunities for those who may

apply for the position. In regards to Trade workers, these works will be carried out under sub-contracts. Contracts will be established between Global Constructors and the sub-contractors. These contracts will comprise of a written contract with all clauses specified, scope of works stated, contract value, payment schedule, bill of quantities and project schedules.

4.6.5 Team Development

Team development will be a continual process throughout the project as new team members work together. There will be daily stand up meetings with trade workers in the mornings before works commence to ensure everyone is of the same understanding and any concerns can be brought to the fore front. Additionally, the more experienced members of the team will do their best to assist the less experienced members in order to facilitate the entire team's improvement as a whole.

4.6.6 Team Safety and Welfare

Health and safety will be the responsibility of the management staff on-site, namely the Site Engineer and the Site Supervisor. They will ensure that everyone on site adheres to the proper safety procedures and wears the appropriate personal protective equipment (PPE).

4.6.7 Recognition and Rewards

Internally there will be financial incentives for completion of the project ahead of schedule.

4.6.8 Physical Resources

Physical resources will be managed to ensure that they are in good working condition and receive timely maintenance. In terms of equipment, it is well noted that down time for vital pieces of equipment such as cranes and concrete trucks during the project can cause significant project delays. In the case of construction materials, once delivered to the site they will be kept in storage and managed by the warehouse keeper. The warehouse keeper will keep inventories of materials and records of how much is used per day to reconcile for weekly and monthly inventories.

4.7 Communication Management Plan

4.7.1 Communication Management Introduction

The Communication management plan will lay out how information and communication among stakeholders will be carried out for effective project coordination. With each project there are various stakeholders who are affected. That being said, it is important to understand who they, what information is of significance to them and how it will be disseminated.

4.7.2 Audiences

- The major audiences within the project are as follows:
- The Government of Belize

- External Funding
- Contractor
- The Belizean Citizens
- Suppliers

4.7.3 Communication Delivery Methods and Technologies

Throughout the project the primary modes of communication will be face to face meetings, letters, emails, phone calls, emails, WhatsApp messages, presentations, skype/ zoom calls.

4.7.4 Communication Escalation Process

This escalation process will be used to highlight bottlenecks that may be hindering project progress in an effort to resolve issues efficiently.

Chart 26 Escalation Chart (Source: R. Nurse, 2023)

Role	Triggers When
Project Manager	Delays in approvals Delays with required documents
Government of Belize	Delayed response from contractor
External Funding	Untimely project updates
Contractor	Approvals from oversight to proceed

4.7.5 Monitors Communication

To ensure the effectiveness of communication throughout the project, observations, meetings and open dialogue will be had with the stakeholders continually. This will ensure that everyone is satisfied and offer an opportunity for concerns to be voiced.

Chart 27 Communication Matrix (Source: R. Nurse, 2023)

Communication	Purpose	Medium	Frequency	Audience
Project team meetings	Coordination of activities	Meeting	Weekly	Project Manager, Project Team
Technical meetings	Make decisions on technical matters	Meeting	Bi - Weekly	Project Manager, Project Team, Project Sponsors, Stakeholders
Monthly project status meetings	Update on project status	Meeting	Monthly	Project Manager, Project Team, Project Sponsors, Stakeholders
Project status reports	Update on project progress	Email	Monthly	Project Sponsors, Stakeholders
Request for information	Request project information	Email	As needed	Project Team, Project Sponsors, Stakeholders

4.8 Risk Management Plan

4.8.1 Risk Management Introduction

Risks are defined as uncertain events or conditions; that if they occur, have a positive or negative effect on a project's objective. Every project is different and there are various characteristics which affect the level of risk from project to project. These include, project complexity, uniqueness, assumptions and constraints, people, requirements of stakeholders, changes and environment. Due to all of this, it can be seen that how these risks are managed is of the utmost importance. According to PMI, the objectives of project risk management are to increase the probability and or/ impact of positive risks and to decrease the probability and/ or impact of negative risks, in order to optimize the chances of project success.

4.8.2 Identify Risks

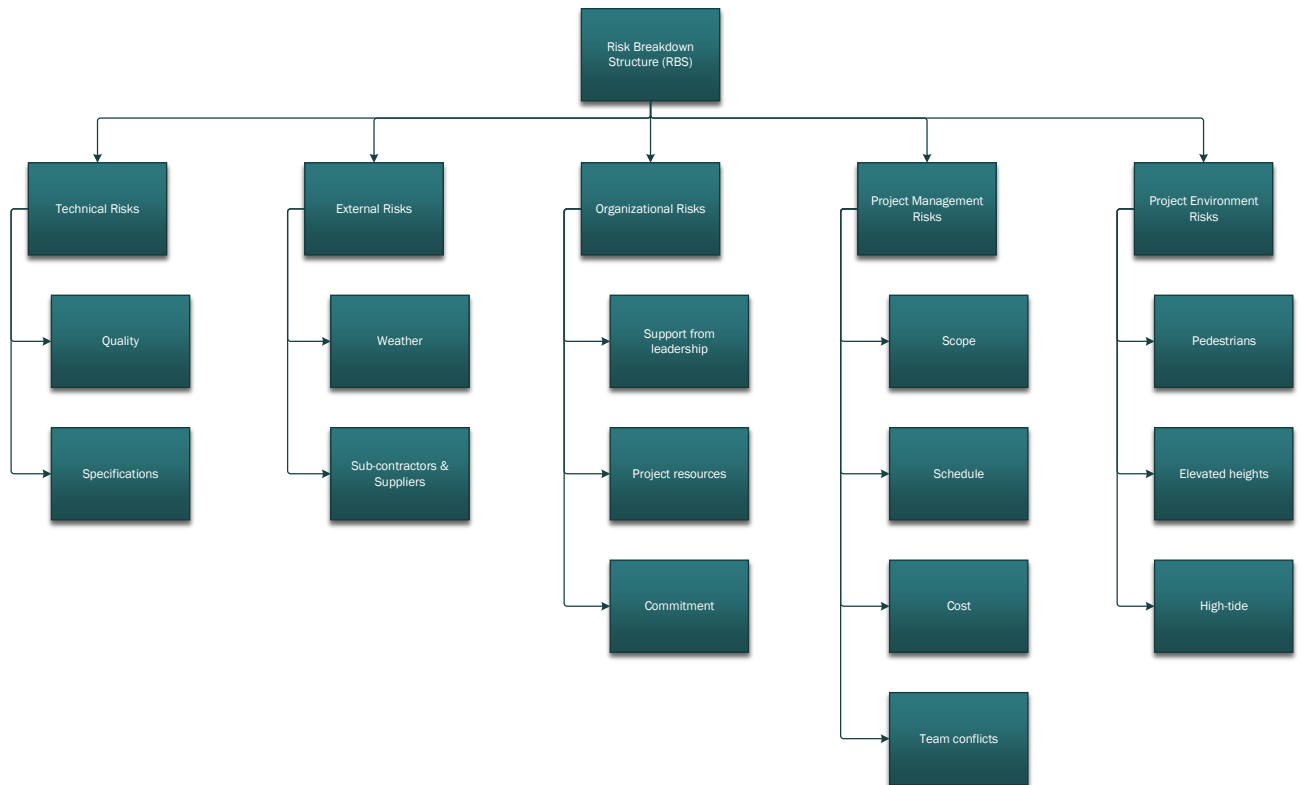


Figure 21 - Risk Breakdown Structure (RBS) (Source:R. Nurse, 2023)

Chart 28 Probability and Impact Scale (Source: R. Nurse, 2023)

		TIME	COST	Scalability (+/-) Impact on project objectives		
				Scalability	Probability	(+/-) Impact on project objectives
						QUALITY
Very High	> 70%	> 6 months	> \$1M	Very significant impact on overall cost and time		
High	51 - 70%	3-6 months	\$501 - \$1M	Significant impact on overall cost and time		
Medium	31 - 50%	1-3 months	\$101K - \$500K	Some impact on cost and time		
Low	11 - 30%	1-4 months	\$50K - \$100K	Minor impact on overall cost and time		
Very Low	1 - 10%	1 week	< \$50K	Minor impact on cost and time		
Nil	< 1%	No change	No change	No change to planned cost and time		

4.8.3 Probability and Impact matrix

In order to determine the likelihood of risks occurring within the Project, a qualitative risks assessment is necessary. Below, a probability and impact matrix is presented to facilitate this. Risks are identified as the negative or positive effect of uncertainty on objectives. Uncertainty originates by internal and external factors, which affect whether objectives are achieved and to what extent they are achieved. Within the matrix, each cell has been given one of the four (4) colors – red, orange, yellow and green. The colors represent the urgency of risk response planning and determine the following reporting levels:

Red (very high risk/very significant): A very high risk with a score more than 0.29 are critical and top priorities. Such risks have high chances of adverse effects on the Project if they should occur. They can present urgent and/or permanent threat of loss (reputational, financial, or otherwise) which is non-recoverable. In these cases, mitigative strategies should be put in place to eliminate or reduce their effects.

Orange (high risk/significant): For risks within the range of high risks, which is between 0.11 to 0.28. While these risks must be addressed, it is understood that they are not as significant as the risks within “red” range. Therefore, the goal is to ensure that impacts are minimized.

	Threats					Opportunities					
Very High 0.9	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05	Very High 0.9
High 0.7	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04	High 0.7
Med 0.5	0.03	0.05	0.1	0.2	0.4	0.4	0.2	0.1	0.05	0.03	Med 0.5
Low 0.3	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02	Low 0.3
Very Low 0.1	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01	Very Low 0.1
	Very Low	Low	Moderate	High	Very High	Very High	High	Moderate	Low	Very Low	
	0.05	0.1	0.2	0.4	0.8	0.8	0.4	0.2	0.1	0.05	
		Negative Impact						Positive Impact			

Figure 22 - Probability and Impact Matrix (Source: R. Nurse, 2023)

Chart 29 Risk Register (Source: R. Nurse, 2023)

Code	Cause	Risk Description	Reference	WBS	Probability	Impact	Rank (P x I)	Response	Preventive Actions
RA001	Poor workmanship	Poor quality of construction	During lifecycle of project	1.1, 1.2, 1.3	0.5	0.8	0.4	Mitigate	Supervision and inspection to ensure quality
RA002	Ambiguity	Non-adherence to specifications	Project planning	1.4	0.3	0.8	0.24	Mitigate	Be specific in project documents
RA003	Rainy season	Extreme weather	During lifecycle of project	1.1, 1.2, 1.3	0.9	0.4	0.36	Mitigate	Carry out critical path works in dry season
RA004	Third party issues	Delays by Sub-contractors & Suppliers	During lifecycle of project	1.1, 1.2, 1.3	0.5	0.4	0.2	Mitigate	Strict contracts and timelines with sub-contractors and suppliers
RA005	Overallocation	Lack of Support from leadership	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.5	0.8	0.4	Mitigate	Meetings with leadership to ensure involvement
RA006	Late ordering	Late delivery of project resources	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.5	0.4	0.2	Mitigate	Strict procurement management
RA007	Other commitments	Lack of commitment	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.3	0.8	0.24	Mitigate	Ensure contractor is not over booked with other works
RA008	Ambiguity	Scope creep	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.5	0.4	0.2	Mitigate	Be specific in project documents
RA009	Poor coordination	Falling behind schedule	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.9	0.4	0.36	Mitigate	Strict time management
RA010	Market fluctuations	Increase in project cost	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.7	0.4	0.28	Mitigate	Establish material rates at the start of the project
RA011	New teams	Team conflicts	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.7	0.4	0.28	Mitigate	Coordination meetings
RA012	Unclear safety paths	Pedestrians in the working area	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.3	0.05	0.015	Mitigate	Fencing and signage
RA013	Lack of PPE	Danger of working at elevated heights	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.5	0.2	0.1	Accept	Ensure workers wear PPE
RA014	Working hours	High-tide	During lifecycle of project	1.1, 1.2, 1.3, 1.4	0.7	0.1	0.07	Accept	Carry out works in water at low tide
							Project General Risk:	0.24	
							High		

4.9 Procurement Management Plan

4.9.1 Procurement Management Introduction

This plan outlines how procurement of materials and services will be carried out throughout the project. According to PMI (2017), project procurement management includes the management and procurement processes required to develop and administer agreements such as the various types of contracts that will be used throughout the project for purchases and sub-contracts.

4.9.2 Procurement Management Approach

The procurement will be directly managed by the Project Manager with the collaboration of the Office Manager and Finance Manager. Material purchases and labor contracts will be carried out according to the work schedule to ensure good project cash flow.

Chart 30 Procurement Roles and Responsibilities (Source: R. Nurse, 2023)

Role	Responsibility
Project Manager	Assignment of resources Preparation of bid proposals Assessment of bids Vendor selection and awarding contracts Approval of payments
Office Manager	Creation of labor contract documents Record keeping
Finance Manager	Payments

Financial record keeping

4.9.3 Procurement Definition

The bill of materials below outlines the materials needed for the execution of the project.

Chart 31 Bill of Materials (Source: R. Nurse, 2023)

Item	Description	Units	Quantity	Justification
Preliminaries				
1	20' x 15' Pre-fabricated building	No.	2	Site Office and lab
2	Chain link fence	Ft	600	Site security
3	500 gal Water Tank	No.	2	Store water for drinking and pouring concrete
Piles				
4	Cement	Bags	4240	Concrete mixing for piles
5	Sand	Loads	16	Concrete mixing for piles
6	Gravel	Loads	32	Concrete mixing for piles
7	Prestressing Cables	Rolls	20	Reinforcement for structure
Abutments				
8	Steel	Lengths	600	Reinforcement for structure
9	Cement	Bags	1330	Concrete mixing for structure
10	Sand	Loads	6	Concrete mixing for structure
11	Gravel	Loads	12	Concrete mixing for Abutments
12	1/2" Construction Plywood	No.	130	Formworks for structure

13	2'x4'x 10' Lumber	No.	250	Formworks for structure
14	3" Wire Nails	Lbs	10	Formworks for structure
15	Ospho	Gals	16	Cleaning steelwork
16	Construction plastic	Rolls	1	To separate steel from earth
17	Plastic spacers	Boxes	5	To provide required coverage for steel
Piers				
18	Steel	Lengths	800	Reinforcement for structure
19	Cement	Bags	1820	Concrete mixing for structure
20	Sand	Loads	8	Concrete mixing for structure
21	Gravel	Loads	16	Concrete mixing for structure
22	1/2" Construction Plywood	No.	100	Formworks for structure
23	2'x4'x 10' Lumber	No.	250	Formworks for structure
24	3" Wire Nails	Lbs	10	Formworks for structure
25	Ospho	Gals	16	Cleaning steelwork
26	Construction plastic	Rolls	2	To separate steel from earth
27	Plastic spacers	Boxes	5	To provide required coverage for steel
Girders				
28	Cement	Bags	3600	Concrete mixing for structure
29	Sand	Loads	14	Concrete mixing for structure
30	Gravel	Loads	27	Concrete mixing for structure
31	Steel	Lengths	1500	Reinforcement for structure
32	Prestressing Cables	Rolls	20	Reinforcement for structure
Diaphragms				

33	Steel	Lengths	150	Reinforcement for structure
34	Cement	Bags	210	Concrete mixing for structure
35	Sand	Loads	1	Concrete mixing for structure
36	Gravel	Loads	2	Concrete mixing for structure
37	1/2" Construction Plywood	No.	20	Formworks for structure
38	2'x4'x 10' Lumber	No.	50	Formworks for structure
39	3" Wire Nails	Lbs	3	Formworks for structure
40	Ospho	Gals	4	Cleaning steelwork
41	Plastic spacers	Boxes	1	To provide required coverage for steel
Deck				
42	Steel	Lengths	1050	Reinforcement for structure
43	Cement	Bags	2720	Concrete mixing for structure
44	Sand	Loads	10	Concrete mixing for structure
45	Gravel	Loads	20	Concrete mixing for structure
46	1/2" Construction Plywood	No.	130	Formworks for structure
47	2'x4'x 10' Lumber	No.	50	Formworks for structure
48	3" Wire Nails	Lbs	10	Formworks for structure
49	Ospho	Gals	24	Cleaning steelwork
50	Plastic spacers	Boxes	15	To provide required coverage for steel
Piles				
51	Cement	Bags	9304	Concrete mixing for structure
52	Sand	Loads	35	Concrete mixing for structure

53	Gravel	Loads	70	Concrete mixing for structure
54	Prestressing Cables	Rolls	40	Reinforcement for structure
Retaining Walls				
55	Steel	Lengths	3200	Reinforcement for structure
56	Cement	Bags	1820	Concrete mixing for structure
57	Sand	Loads	8	Concrete mixing for structure
58	Gravel	Loads	16	Concrete mixing for structure
59	1/2" Construction Plywood	No.	250	Formworks for structure
60	2'x4'x 10' Lumber	No.	400	Formworks for structure
61	3" Wire Nails	Lbs	50	Formworks for structure
62	Ospho	Gals	24	Cleaning steelwork
63	Plastic spacers	Boxes	10	To provide required coverage for steel
Backfilling				
64	Common fill material	Loads	550	Backfilling material for the approaches
65	Gravel	Loads	120	Backfill material adjacent to walls for drainage
Settlement Slabs				
66	Steel	Lengths	250	Reinforcement for structure
67	Cement	Bags	420	Concrete mixing for structure
68	Sand	Yd3	2	Concrete mixing for structure
69	Gravel	Yd3	4	Concrete mixing for structure
70	1/2" Construction Plywood	No.	10	Formworks for structure
71	2'x4'x 10' Lumber	No.	25	Formworks for structure

72	3" Wire Nails	Lbs	3	Formworks for structure
73	Ospho	Gals	16	Cleaning steelwork
74	Construction plastic	Rolls	2	To separate steel from earth
75	Plastic spacers	Boxes	2	To provide required coverage for steel

4.9.4 Type of Contract

A Fixed Price Contract will be used to carry out the Project. This is common for construction projects because many of the variables are known and the designs, drawings and other Project documents provide a clarity which is used for detailed planning. With that being said, there should not be a high degree of change within the Project; making the Fixed Price Contract ideal.

4.9.5 Decision Criteria

Throughout the Project, vendors will be required to meet the specified Project specifications.

The criteria is listed below:

- Be able to provide delivery within specified timelines
- Provide material certificates upon request
- High quality standards
- Reasonable prices

4.9.6 Procurement Change Control Process

The change control process will follow the specified Project change control process. That is, change requests will be submitted with justification for review. An assessment will take place

to identify the potential impacts on the Project. Following assessment, approval or rejection will be provided and records updated.


4.10 Stakeholder Management Plan

4.10.1 Stakeholder Management Introduction

With projects there can be a number of people, organizations and communities who all have a keen interest in the project. The Stakeholder Management Plan will carry out the identification of those who would be affected by the project. Additionally, how the project itself can be affected by these persons will be explored. Once that has been carried out, the methods for collaboration will be laid out in an effort to foster effective team work among all of the stakeholders for a successful project completion.

4.10.2 Stakeholder Identification

Chart 32 Stakeholder Register (Source: R. Nurse, 2023)

						
Project Name	Bridge project	San Estevan Bridge Project - Stakeholder Analysis				
Main Sponsor	Government of Belize					
ID	Stakeholders	Functional Areas	Roles - Responsibility	Main Expectations	Major Requirements	Impact (Low-Me
1	Government of Belize	Investor	Financial Sponsor	Increased accessibility to citizens	Structurally sound and capable of withstanding natural disasters	High/High
2	External Sponsors	Investor	Financial Sponsor	Timely disbursement of project funds	Procedures and protocols are followed	High/High
3	Contractor	Building Construction	Project Implementation	Timely disbursement of project funds	Payments are made in a timely manner	High/High
4	Citizens of Belize	End User	User of Product/Customer	kept informed about project completion	Effectively and efficiently design final product	Low/Low
5	Suppliers	Building Construction	Supplier of materials	Timely requests for project supplies	Payments are made in a timely manner	Low/High

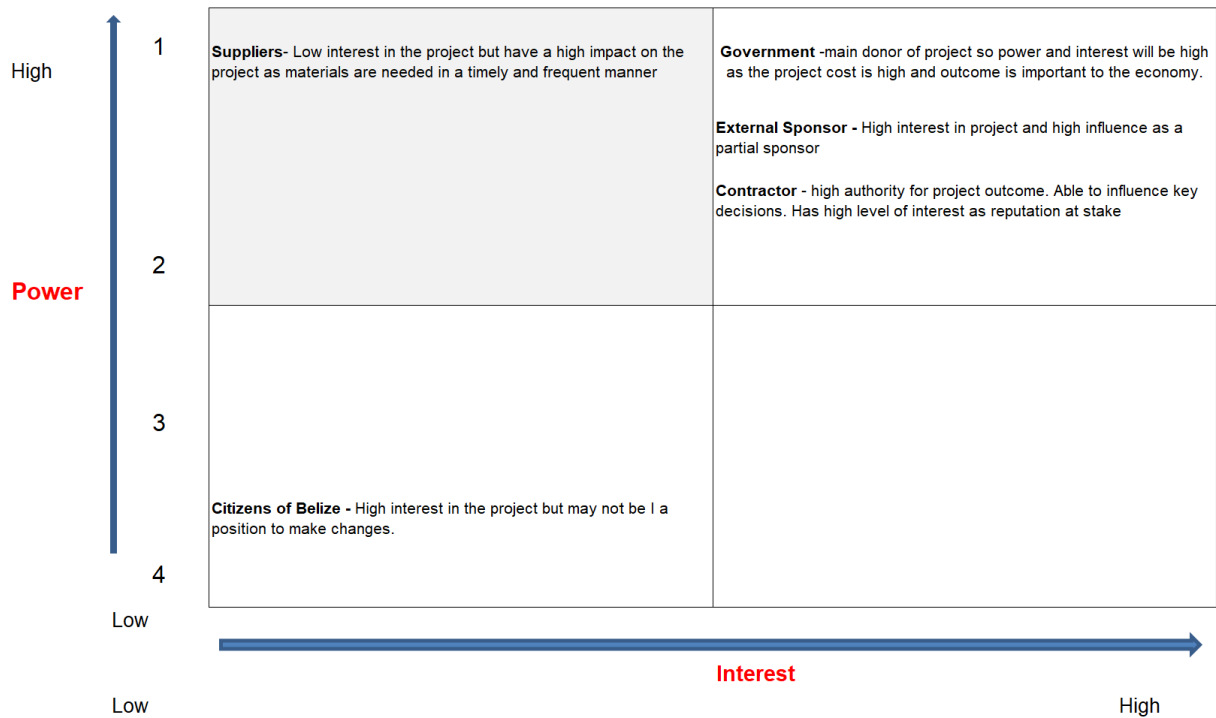


Figure 23 - Stakeholder Power/ Interest Matrix

4.10.3 Stakeholder Management Assessment Matrix

The Stakeholder Power/ Interest Matrix was used as an input to create the Stakeholder Management Assessment Matrix. The purpose of this is to understand where the Stakeholders' level of engagement lies, in an attempt to plan ways to increase their engagement for better project support. The current level of engagement is denoted by "C" and the desired level by "D".

Chart 33 Stakeholder Assessment Matrix (Source: R. Nurse, 2023)

ID	Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
1	Government of Belize					CD
2	External Sponsor				CD	
3	Contractor					CD
4	Supplier			C	D	
5	Citizens of Belize				CD	

4.10.4 Stakeholder Engagement Matrix

Based on the observation of the Power/ Interest grid as well as the Stakeholder Management Assessment Matrix, the Stakeholder Engagement Matrix can be developed to provide guidance on the best methods of engagement for each Stakeholder.

Chart 34 Stakeholder Engagement Matrix (Source: R. Nurse, 2023)

ID	Stakeholder	Project Phase	Engagement Approach	Engagement Tools	Frequency
1	Government of Belize	All	Consult, Collaborate	Letters, Emails, Meetings, WhatsApp	Very Frequent
2	External Sponsor	All	Consult, Collaborate	Letters, Emails, Meetings, WhatsApp	Very Frequent
3	Contractor	All	Consult, Collaborate	Letters, Emails, Meetings, WhatsApp	Very Frequent
4	Citizens of Belize	Planning	Dialogue	Meetings, Posters, Information Pamphlets	Less Frequent
5	Supplier	Planning & Implementation	Dialogue	Emails, WhatsApp, Letters	Frequent

4.11 Sustainable Development Plan

4.11.1 Sustainability Management Introduction

This section is to ensure that the project is managed in a sustainable manner. It will discuss the approach, roles and responsibilities, budgeting and reporting practices. This is significant as efforts to integrate sustainability must be done proactively from the initiation of the project.

4.11.2 Approach

4.11.2.1.1 Identifying Sustainability Impacts

- Team members will complete the P5 Impact Assessment
- There will be a special effort within each monthly meeting to review sustainability impacts.
- Key performance indicators for relevant topics from P5 will be documented.

4.11.2.1.2 Responding to Sustainability Impacts

- Efforts will be made to avoid unacceptable impacts
- The Project Sustainability Management Plan will be kept up to date throughout the project
- Responses will be prepared to all items with a high positive or negative impact scores

4.11.3 Roles and Responsibilities

Project Manager

- Allocate necessary resources to carry out sustainability management plan activities
- Develop the Sustainability Management Plan and share with the project team and stakeholders
- Develop and update the P5 Impact analysis
- Advocate for equality within the project

Project Team

- Perform the impact responses as assigned
- Assist with the P5 Impact analysis
- Identify potential sustainability impacts

Sustainability Impact Owner

- Monitor risk trigger and cues to update the Project manager
- Monitor risks for changes in probability and impact
- Update risk response strategy if necessary

4.11.4 Budget

The budget should include the following items for Sustainability Management:

- Allocations in the project management budget for creation of sustainability documents and reports
- Meetings with stakeholders to have a dialogue and receive suggestions on impact responses
- Allocations for alternative materials which may be more sustainable

Chart 35 Key Performance Indicators (Source: R. Nurse, 2023)

P5 Domain	Category	Key Performance Indicator	Metric
Product and Process	Lifespan of product	Citizen satisfaction should be above 60%	Percent
Product and Process	Servicing of product	Feedback from users	Percent
Product and Process	Effectiveness of project processes	Time to complete tasks	Time
Product and Process	Efficiency of project processes	Time to complete tasks	Time
Product and Process	Fairness of project processes	Percentage of team satisfaction	Percent

People (Social)	Labor practices and decent work	Employee job satisfaction	Percent
People (Social)	Society and customers	Positive feedback	Percent
People (Social)	Human rights	Number of human rights being adhered to	Amount
People (Social)	Ethical behavior	Number of ethics in practice	Amount
Planet (Environment)	Transport	Amount of miles traveled for deliveries	Amount
Planet (Environment)	Energy	Amount of energy expended	Amount
Planet (Environment)	Land, Air, and Water	Amount of pollutants	Amount
Planet (Environment)	Consumption	Amount of resources consumed	Amount
Prosperity (Economic)	Business Case analysis	ROI	Amount
Prosperity (Economic)	Business agility	Time to adapt to change	Time
Prosperity (Economic)	Economic stimulation	Amount of economic activity generated	Amount

Chart 36 P5 Impact Analysis (Source: R. Nurse, 2023)

	Employment	Gender Equality	Carbon Emissions	Local Procurement
Bridge Construction	(-2 medium/positive)	(+1 Low/Negative)	(+3 High/Negative)	(-3 High/Positive)
East Approach	(-2 medium/positive)	(+1 Low/Negative)	(+3 High/Negative)	(-3 High/Positive)
West Approach	(-2 medium/positive)	(+1 Low/Negative)	(+3 High/Negative)	(-3 High/Positive)
Project Management	(-2 medium/positive)	(-3 High/Positive)	(-1 Low/Positive)	(-3 High/Positive)
Scores	-8	0	+8	-12

5 CONCLUSIONS

1. With the creation of the Integration Management Plan, the manner in which the other processes would be combined was elaborated.
2. Within the Scope Management Plan, the scope for the project was outlined. This allows the Project Team to fully understand the work to be done and ensure that nothing is left out. Additionally, it gives clarity to the Stakeholders in an effort to avoid Scope Creep.
3. The creation of the Schedule Management Plan gave an opportunity to define the activities to be carried out, their durations and the sequence in which they would be carried out.
4. The Cost Management Plan gave a better insight into the financial aspect of the project. The budget was estimated and the expected timelines for disbursement of funds displayed.
5. Quality Management Plan is a crucial aspect of the project. With the production of this plan, the manner in which quality would be ensured was stated. Additionally, quality requirements were outlined in an effort to make certain of stakeholder satisfaction.
6. With the Resource Management Plan, an understanding of the resources required and how they would be managed was established.
7. The Communication Management Plan stated how project communication was be carried out to ensure that all stakeholders would be able to participate in a meaningful way.
8. The Risk Management Plan was created in an effort to fully identify the project risks and produce strategies to minimize potential negative impacts and maximize potential positive impacts.
9. The Procurement Management Plan was created to allow the Project Team to effectively manage the procurement of products and services throughout the project.

10. The Stakeholder Management Plan is vital in identifying the project stakeholders and defining how they would be engaged for effective collaboration.
11. The Sustainability Management Plan gives an opportunity to integrate sustainable practices into the project management processes.

6 RECOMMENDATIONS

1. The Project Manager should pay special attention to Integration Management to ensure that all the processes function together cohesively.
2. The Project Team should review the Scope Management Plan to fully understand all the project work included within the project and what is excluded.
3. The Project Manager should invest a high degree of effort in the Change Control process as construction projects can be rigid due to the utilization of Traditional Project Management practices. This means that quick responses to change are necessary to make the project work more agile.
4. The Project Manager and Project Sponsors should carefully review potential project changes and determine the overall effects to the project budget.
5. The Site Engineer and the Project Manager should take note of the stakeholder priorities within the Quality Management Plan to make sure that they are delivered to the required standards.
6. The Project Manager and Project Team will have to carry out proper Resource Management as indicated in the plan to ensure that the correct equipment and materials are available in order to execute work when needed.
7. The Project Team should be as collaborative as possible and distribute project information as needed and in the correct manner to the stakeholders.
8. The Project Manager should monitor identified risks throughout the project and follow up on responses as outlined.
9. The Project Team should make certain that project procurement is carried out as outlined in the Procurement Management Plan.
10. The Project Manager should liaise with the various stakeholders to make certain that their concerns are heard and that they are being engaged appropriately.
11. The Project Team should continually look for areas to improve the integration of sustainable practices within the construction process.

7 VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

Execution of the project aligns with the Sustainable Development Goals. These goals aspire for no poverty, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice and strong institutions and partnerships for the goals. Through the creation of a hybrid project management plan for the construction of the San Estevan Bridge in Belize, the project will ultimately benefit from improved management which will reduce waste and the impact on the environment. When the project is managed in an agile manner, decisions can be made more efficiently, which allows for the distribution of materials and personnel where they are needed. Additionally, creation of the plan allows for considerations of gender equality and equal opportunity to be planned from project initiation and managed throughout the project life cycle.

BIBLIOGRAPHY

- Project Management Institute. (2021). A Guide to the Project Management Body of Knowledge, (*PMBOK® Guide*) - Seventh Edition, Project Management Institute, Inc., 2021.
- Project Management Institute. (2017). A guide to the Project Management Body of Knowledge (*PMBOK guide*) (6th ed.). Project Management Institute.
- Albuquerque, F., Torres, A. S., & Berssaneti, F. T. (2020). Lean product development and agile project management in the construction industry. *Revista de Gestão*, 27(2), 135-151. <https://doi.org/10.1108/REG-01-2019-0021>
- Arefazar, Y., Nazari, A., Hafezi, M. R., & Maghool, S. A. H. (2022). Prioritizing agile project management strategies as a change management tool in construction projects. *International Journal of Construction Management*, 22(4), 678-689. <https://doi.org/10.1080/15623599.2019.1644757>
- Ciric, D., & Gracanin, D. (2021). Agile Project Management Beyond Software Industry.
- Gledson, B. J. (2016). Hybrid project delivery processes observed in constructor BIM innovation adoption. *Construction Innovation*, 16(2), 229-246. <https://doi.org/https://doi.org/10.1108/CI-04-2015-0020>
- Kibler, C. (2019). Hybrid Project Management Methodology for Commercial Construction Projects (Publication Number Dissertation/Thesis) ProQuest Dissertations
- Lalmi, A., Fernandes, G., & Souad, S. B. (2021). A conceptual hybrid project management model for construction projects. *Procedia Computer Science*, 181, 921-930. <https://doi.org/https://doi.org/10.1016/j.procs.2021.01.248>
- Mohammed, S. R., & Jasim, A. J. (2018). Examining the Values and Principles of Agile Construction Management in Iraqi Construction Projects. *Journal of Engineering*, 24(7), 114-133. <https://doi.org/10.31026/j.eng.2018.07.08>
- Nguyen, P. H. D., & Robinson Fayek, A. (2022). Applications of fuzzy hybrid techniques in construction engineering and management research. *Automation in Construction*, 134, 104064. <https://doi.org/https://doi.org/10.1016/j.autcon.2021.104064>
- Sohi, A. J., Hertogh, M., Bosch-Rekveltdt, M., & Blom, R. (2016). Does Lean & Agile Project Management Help Coping with Project Complexity? *Procedia - Social and Behavioral Sciences*, 226, 252-259. <https://doi.org/https://doi.org/10.1016/j.sbspro.2016.06.186>

APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED FINAL GRADUATION PROJECT (FGP)

1. Student name

Rico Akeem Nurse

2. FGP name

Project management plan for the construction of the San Estevan Bridge Project in Belize

3. Application Area (Sector or activity)

Construction

4. Student signature

Rico Akeem Nurse

5. Name of the Graduation Seminar facilitator

Roger Valverde Jimenez

6. Signature of the facilitator

7. Date of charter approval

8. Project start and finish date

9 th , January, 2023	24 th , July, 2023
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9. Research question

What elements must be included in a project management plan for the construction of the San Estevan Bridge Project to allow for a hybrid execution.

10. Research hypothesis

Is it possible to develop a project management plan for the construction of the San Estevan Bridge with elements of a hybrid approach.

11. General objective

To develop a Project management plan for the construction of the San Estevan Bridge Project using a hybrid approach

12. Specific objectives

1. To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.
2. To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will contribute to the project's success.
3. To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.
4. To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.
5. To develop a Quality Management Plan for managing and controlling quality within the project
6. To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.
7. To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.
8. To develop a Risk Management Plan which improves the chances of project success by mitigating potential risks, while capitalizing on the impact of positive risks.
9. To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.
10. To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.

11. To create a Sustainable Development Plan to assess the relationship and impact of the project and its end product in regenerative and sustainable development.

13. FGP purpose or justification

The rural village of San Estevan is located in the Orange Walk district of Belize. Currently, if its residents wish to travel to the most northern district which is Corozal, they must either cross the river by using the small manually cranked Ferry which has a capacity of 2- 3 small vehicles at a time or drive south towards Orange Walk in order to connect to the Northern Highway and travel from there, which makes the journey much longer than necessary.

Through the construction of the San Estevan Bridge Project, the country would be able to connect the community of San Estevan to the main Northern Highway, allowing the residents easier access to facilities such as supermarkets, health care facilities and in the case of emergencies, alternative routes of egress.

Ultimately, the bridge would increase traffic flow by 75% percent due to 24/7 accessibility and increased capacity which would greatly improve the quality of life for those in the surrounding communities.

14. Work Breakdown Structure (WBS). In table form, describing the main deliverable as well as secondary, products or services to be created by the FGP.

<ul style="list-style-type: none"> 1. Graduation seminar <ul style="list-style-type: none"> 1.1 FGP Deliverables <ul style="list-style-type: none"> 1.1.1 Charter 1.1.2 WBS 1.1.3 Chapter II. Introduction 1.1.4 Chapter II. Theoretical Framework 1.1.5. Chapter III. Methodological Framework 1.1.6. Executive Summary 1.1.7. Appendices <ul style="list-style-type: none"> 1.1.7.1. Bibliography 1.1.7.2. Schedule 1.2. Graduation Seminar Approval 2. Tutoring Process <ul style="list-style-type: none"> 2.1. Tutor <ul style="list-style-type: none"> 2.1.1. Tutor assignment 2.1.2. Communication 2.2. Adjustments of previous chapters (if needed) 2.3. Chapter IV. Development (Results) <ul style="list-style-type: none"> 2.3.1. Signed Charter 2.3.2. Scope Management Plan 2.3.3. Schedule Management Plan 2.3.4. Cost Management Plan 2.3.5. Quality Management Plan 2.3.6. Resource Management Plan 2.3.7. Communications Management Plan 2.3.8. Stakeholder Engagement Plan 2.3.9. Procurement Management Plan 2.3.10. Risk Management Plan 2.3.11 Integration Management Plan 2.3.12 Sustainable Development Plan 2.4. Chapter V. Conclusions 2.5. Chapter VI. Recommendations 3. Reading by reviewers <ul style="list-style-type: none"> 3.1. Reviewers' assignment request <ul style="list-style-type: none"> 3.1.1. Assignment of two reviewers 3.1.2. Communication 3.1.3. FGP Submissions to reviewers 3.2. Reviewers' work <ul style="list-style-type: none"> 3.2.1. Reviewer 1
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- 3.2.1.1. FGP Reading
- 3.2.1.2. Reader 1 report
- 3.2.2. Reviewer 2
 - 3.2.2.1. FGP Reading
 - 3.2.2.2. Reader 2 report
- 4. Adjustments and Modifications
 - 4.1. Report for reviewers
 - 4.2. FGP Update
 - 4.3. Second review by reviewers
- 5. Presentation to Board of Examiners
 - 5.1. Final review by board
 - 5.2. FGP grade report

15. FGP budget

Printing (Paper & ink) – \$75 usd

Binding - \$15 usd

Gas - \$60 usd

Shipping – \$335 usd

Total cost - \$485 usd

16. FGP planning and development assumptions

- 1) The researcher will be able to dedicate 15 hours per week to the project.
- 2) There will be constant communication between the project facilitators and the project writer.
- 3) Hybrid approaches to project management can be applied to construction projects.
- 4) Information for similar bridge construction projects will be readily available.

17. FGP constraints

- 1) Some research papers and journals may not be accessible due to cost restrictions.
- 2) The project must be completed within 5 months.
- 3) The project must be completed within the budget of \$485 usd
- 4) Human resources for creation of the various project management plans are limited to the project manager.

18. FGP development risks

- 1) Any illnesses that may affect the health of the project writer might delay deliverables.
- 2) Postal services may experience shipping delays which affect delivery of documents.
- 3) Technical difficulties with equipment and internet could cause project delays.
- 4) The project timeline may experience changes due to the availability of facilitators.

19. FGP main milestones

Deliverable	Finish estimated date
Charter	January 15 th
WBS	January 22 nd
Chapter III. Theoretical Framework	February 5 th
Chapter III. Methodical Framework	February 12 th
Chapter II. Introduction	February 19 th
Executive Summary	February 26 th
Bibliography	February 12 th
Schedule	February 12 th
Graduation Seminar Approval	February 12 th
Tutoring Process	May 21 st
Reading by reviewers	June 2 nd
Adjustments	June 16 th
Presentation to the Board of examiners	June 23 rd
Final review by board	June 23 rd
FGP grade report	July 24 th

20. Theoretical framework

20.1 Estate of the “matter”

It is well known that traditional methods falter where the full details are not understood, changes occur and the level of project complexity increases. That being said, as the years progress and projects become larger and more complex, it has been observed that many construction projects have become prone to failure. Due to this issue, there has been an elevated interest in alternative project management methodologies that may be able to account for the shortcomings of traditional project management.

20.2 Basic conceptual framework

Project management, Hybrid methodologies, Agile Construction Management, Sustainable design and construction.

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop the Scope Management Plan to effectively outline all the work required for the project and only that work which will	Scope Management Plan	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects • Lecture Notes • Conference Papers 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgment • Data Analysis 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure

contribute to the project's success.		<ul style="list-style-type: none"> •Journals •Historical data and information 		<ul style="list-style-type: none"> • Meetings • Scope Management Plan Template 	of project sponsors
To develop the Schedule Management Plan which will define the methodology to be carried out to manage the project for a timely completion.	Schedule Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis • Meetings • Schedule Management Plan Template 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors
To create a Cost Management Plan that will allow for management of project funds in order to complete the project within budget.	Cost Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis • Meetings • Cost Management Plan Template 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors
To develop a Quality Management Plan for managing and controlling quality within the project	Quality Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Decision making • Data representation • Test and inspection planning • Meetings 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors

				<ul style="list-style-type: none"> Quality Management Plan Template 	
To design a Resource Management Plan to facilitate the execution of project works by ensuring that the necessary resources are available when required.	Resource Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data representation • Organizational Theory • Meetings • Resource management Plan Template 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors
To elaborate a Communication Management Plan that ensures the project team and stakeholders all receive the necessary information for effective collaboration.	Communication Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Communication requirements analysis • Communication technology • Communication models • Communication methods • Interpersonal and team skills • Data representation • Meetings • Communication Management Plan Template 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors
To develop a Risk Management Plan which improves the chances of	Risk Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data Analysis 	<ul style="list-style-type: none"> • Limited data as project is not currently existing

project success by mitigating potential risks, while capitalizing on the impact of positive risks.		past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information		<ul style="list-style-type: none"> Meetings Risk Management Plan Template 	<ul style="list-style-type: none"> Organizational structure of project sponsors
To create a Procurement Management Plan to administer the purchase or acquisition of products, services or results necessary in order for the successful completion of the project.	Procurement Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Source selection analysis • Meetings • Procurement Management Plan Template 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors
To design a Stakeholder Management Plan that allows for the identification and management of stakeholders impacted by the project in order to produce a product which adds value to those affected.	Stakeholder Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Data representation • Meetings • Stakeholder Management Plan Template 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors
To design an Integration Management Plan which outlines the processes for coordination of the various project management activities within the project.	Integration Management Plan	<ul style="list-style-type: none"> •PMBOK Guide, 6th Edition, 2017 •Project documents of past similar projects •Lecture Notes •Conference Papers •Journals •Historical data and information 	<ul style="list-style-type: none"> • Qualitative • Quantitative • Mixed 	<ul style="list-style-type: none"> • Expert Judgement • Data gathering • Data analysis • Data representation • Meetings • Interper 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors

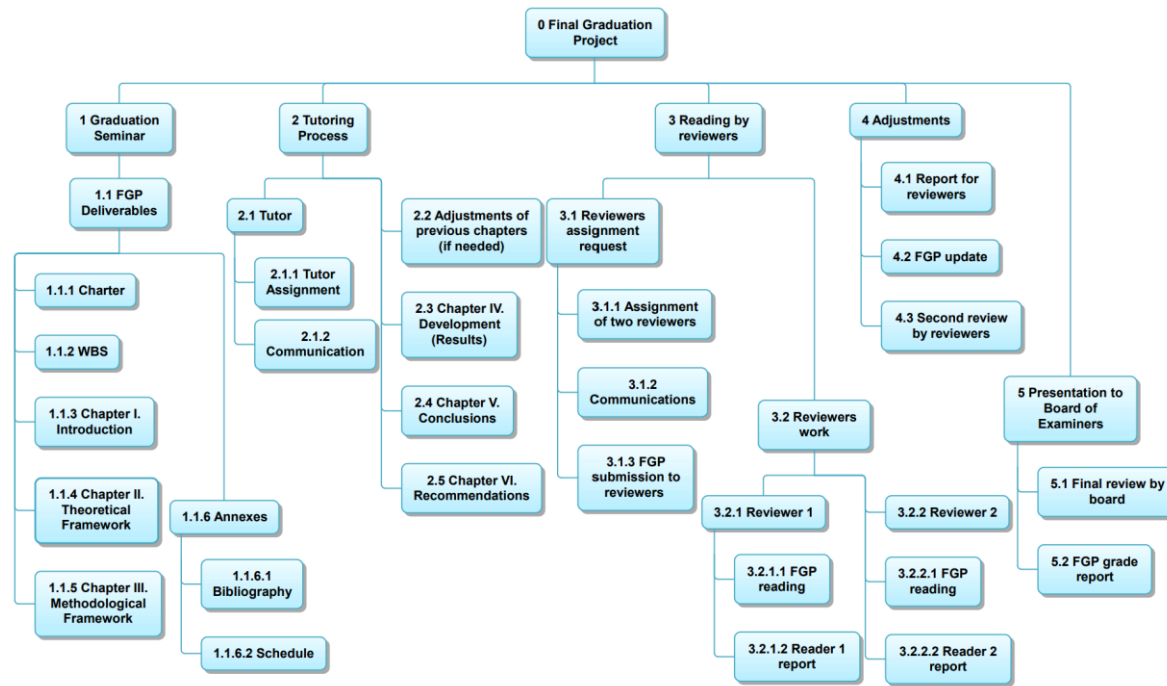
<p>1 To develop a report that documents the analysis of different clinics constructions standards to define its basic elements.</p>					
				<p>sonal and team skills</p> <ul style="list-style-type: none"> • Integration Management Plan Template • Project management information system 	
<p>To create a Sustainable</p>	<p>Sustainable Management Plan</p>	<ul style="list-style-type: none"> • PMBOK Guide, 6th Edition, 2017 • Project documents of past similar projects • Lecture Notes • Conference Papers • Journals • Historical data and information 	<p>Mixed</p> <ul style="list-style-type: none"> • Qualitative • Quantitative 	<ul style="list-style-type: none"> • Sustainable Management Plan Template • Expert Judgement • Data gathering • Data analysis • Meetings 	<ul style="list-style-type: none"> • Limited data as project is not currently existing • Organizational structure of project sponsors

22. Validation of the work in the field of the regenerative and sustainable development.

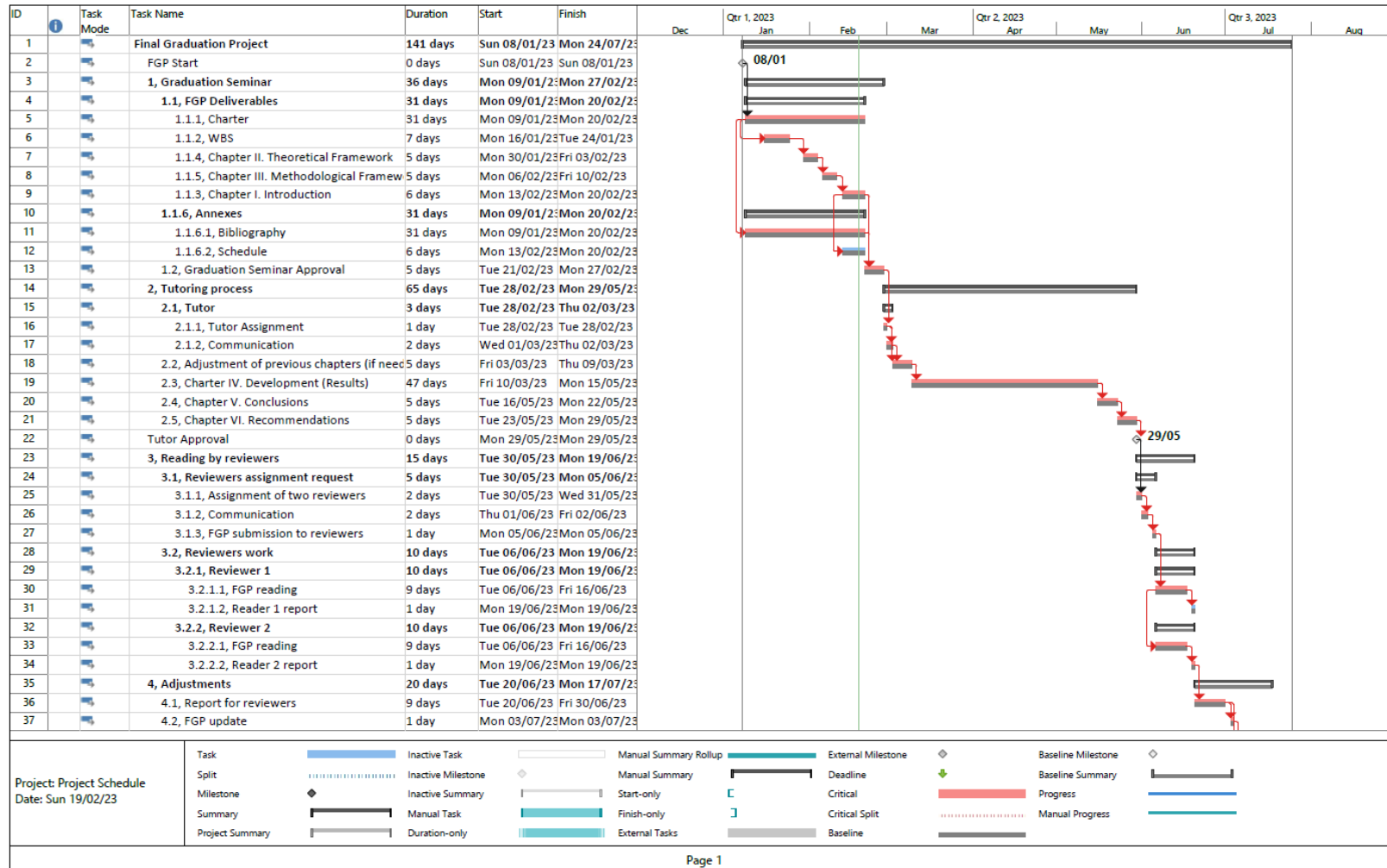
Through the creation of a hybrid project management plan for the construction of the San Estevan bridge in Belize, the project will ultimately benefit from improved management which will reduce waste and the impact on the environment. When the project is managed in an agile manner, decisions can be made more efficiently, which allows for the distribution of materials and personnel where they are needed. Additionally, creation of the plan allows for considerations of gender quality and equal opportunity to be planned from project initiation and managed throughout the project life cycle.

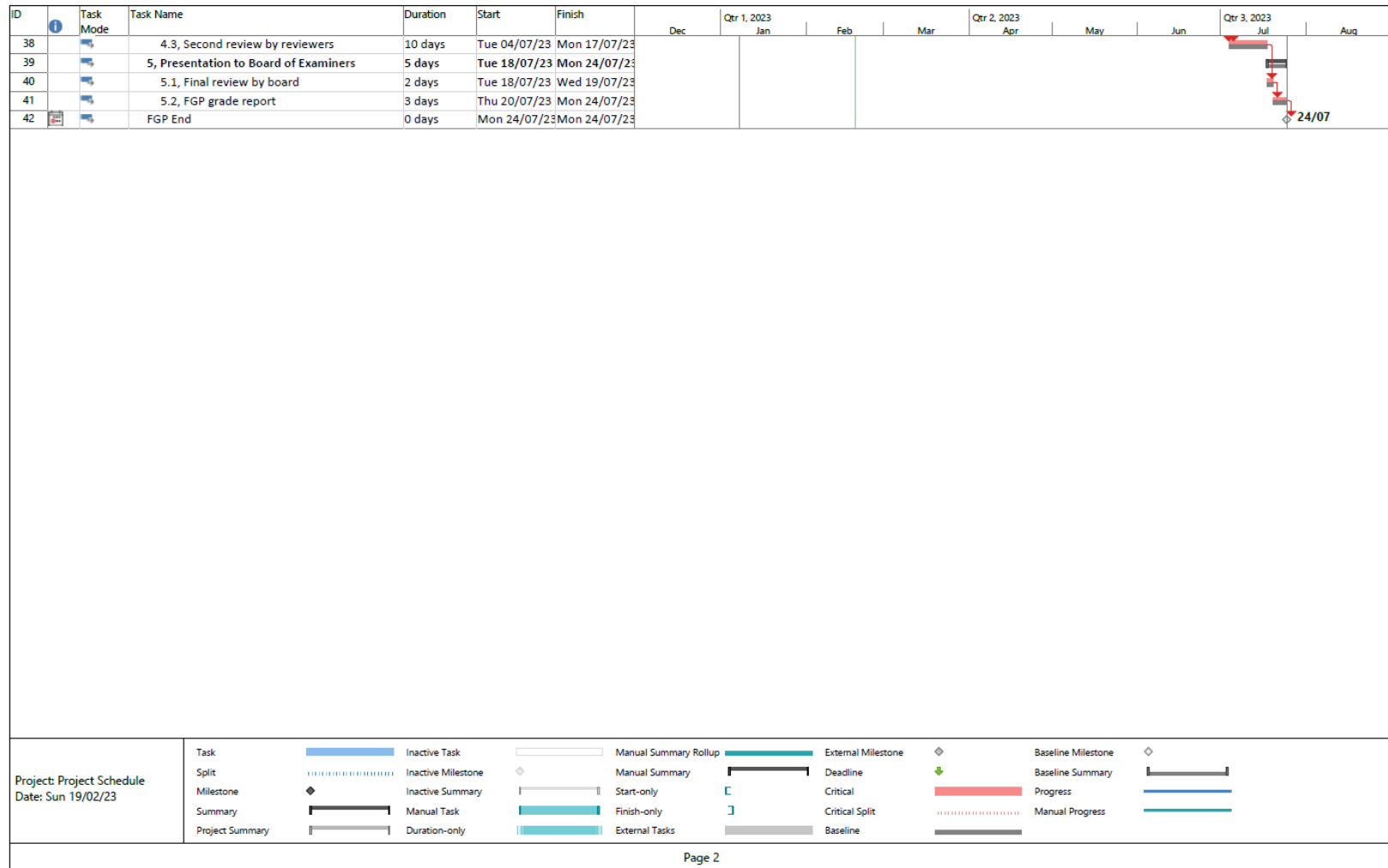
In order to measure the contributions to the sustainable development goals, Key performance indicators could be monitored such as the distribution of gender planned within the personnel documents, usage of materials versus what was planned originally and overall project performance through monitoring of time, scope and quality.

Appendix 2: FGP WBS



Appendix 3: FGP Schedule





Appendix 4: Preliminary bibliographical research

- Project Management Institute. (2017). *A guide to the Project Management Body of Knowledge (PMBOK guide)* (6th ed.). Project Management Institute.
- Albuquerque, F., Torres, A. S., & Berssaneti, F. T. (2020). Lean product development and agile project management in the construction industry. *Revista de Gestão*, 27(2), 135-151. <https://doi.org/10.1108/REGE-01-2019-0021>
- Arefazar, Y., Nazari, A., Hafezi, M. R., & Maghool, S. A. H. (2022). Prioritizing agile project management strategies as a change management tool in construction projects. *International Journal of Construction Management*, 22(4), 678-689. <https://doi.org/10.1080/15623599.2019.1644757>
- Ciric, D., & Gracanin, D. (2021). *Agile Project Management Beyond Software Industry*.
- Gledson, B. J. (2016). Hybrid project delivery processes observed in constructor BIM innovation adoption. *Construction Innovation*, 16(2), 229-246. <https://doi.org/https://doi.org/10.1108/CI-04-2015-0020>
- Kibler, C. (2019). *Hybrid Project Management Methodology for Commercial Construction Projects* (Publication Number Dissertation/Thesis) ProQuest Dissertations
- Lalmi, A., Fernandes, G., & Souad, S. B. (2021). A conceptual hybrid project management model for construction projects. *Procedia Computer Science*, 181, 921-930. <https://doi.org/https://doi.org/10.1016/j.procs.2021.01.248>
- Mohammed, S. R., & Jasim, A. J. (2018). Examining the Values and Principles of Agile Construction Management in Iraqi Construction Projects. *Journal of Engineering*, 24(7), 114-133. <https://doi.org/10.31026/j.eng.2018.07.08>
- Nguyen, P. H. D., & Robinson Fayek, A. (2022). Applications of fuzzy hybrid techniques in construction engineering and management research. *Automation in Construction*, 134, 104064. <https://doi.org/https://doi.org/10.1016/j.autcon.2021.104064>
- Sohi, A. J., Hertogh, M., Bosch-Rekveltdt, M., & Blom, R. (2016). Does Lean & Agile Project Management Help Coping with Project Complexity? *Procedia - Social and Behavioral Sciences*, 226, 252-259. <https://doi.org/https://doi.org/10.1016/j.sbspro.2016.06.186>

Appendix 5: Philologist Review Report

Chanelle Kristine Lizarraga
#5 Jamaica Street
Orange Walk Town
Orange Walk District
Belize

June 8th, 2023

Academic Advisor
Master's Degree in Project Management
Universidad para la cooperación Internacional (UCI)

Dear Academic Advisor,

This letter serves to certify that this Final Graduation Project submitted by Mr. Rico Akeem Nurse, more particularly described as, "Project Management Plan for the Construction of the San Estevan Bridge in Belize." as a partial requirement for the Masters in Project Management (MPM) Degree has been reviewed and proof-read. Mr. Nurse has made all the suggested amendments and corrections to the beforementioned document, and it is my professional opinion that it meets the literary and linguistic standards expected of a student for a degree in the Master's level.

Sincerely,



Chanelle K. Lizarraga
Certified Translator

Chanelle Kristine Lizarraga
#5 Jamaica Street
Orange Walk Town
Orange Walk District
Belize.

May 25th, 2023

Academic Advisor
Master's degree in project management
Universidad para la Cooperación Internacional (UCI)

Re: Declaration as a Certified Translator

To Whom it May Concern:

This letter serves as a declaration for my certification in both the English and Spanish languages. Having successfully completed five (5) years of study in neighbouring Mexico for a bachelor's degree in international relations, and having taken an Equivalency exam at the Autonomous University of Quintana Roo (UAQROO) for both of the beforementioned languages, I can now provide skilled services as a Certified Translator.

Sincerely,



Chanelle K. Lizarraga
Certified Translator

