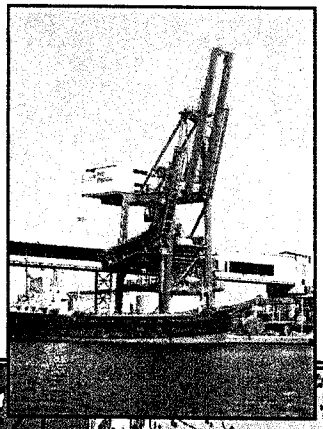
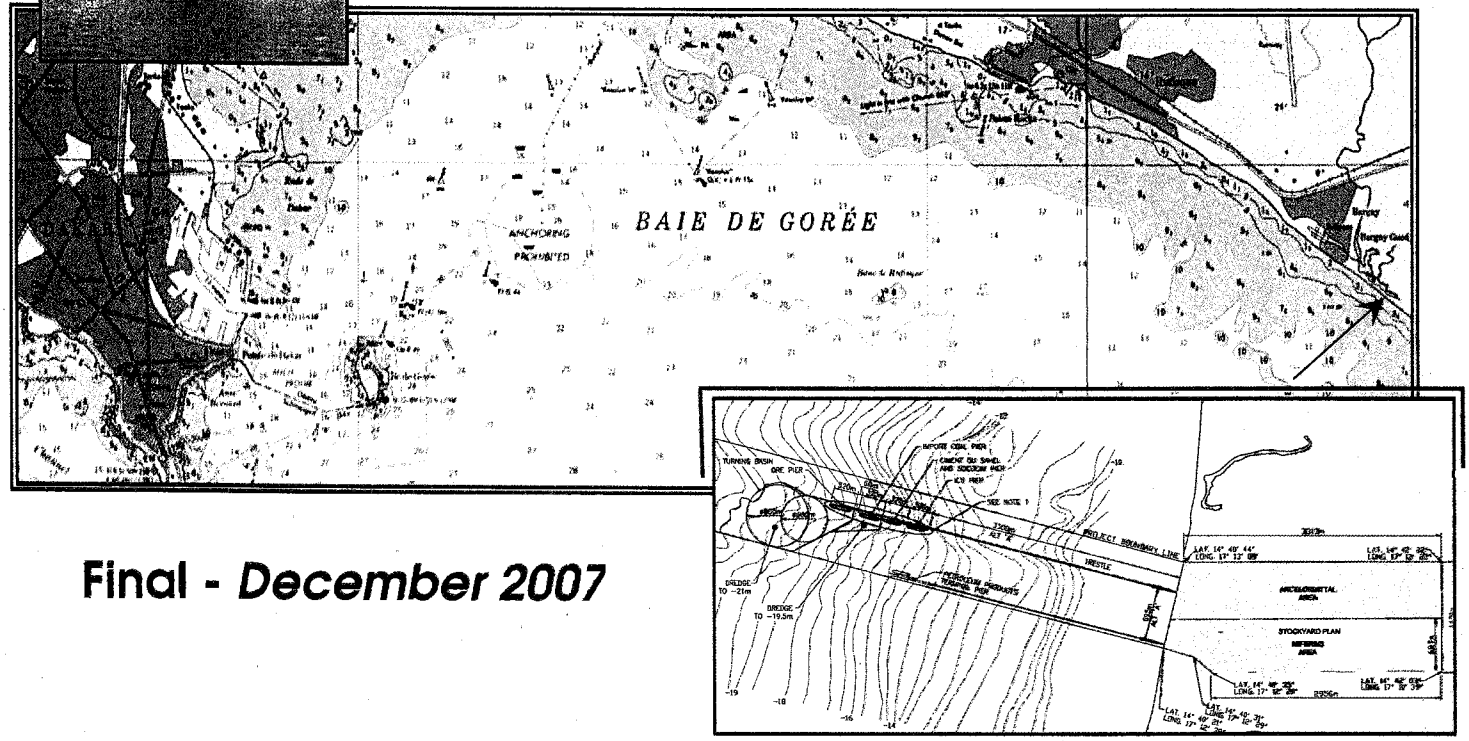


New Multi-Commodity Bulk Port Complex
Bargny - Sendou, Senegal



Final - *December 2007*

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Executive Summary

The proposed multi-commodity bulk terminal is a complex project with as many as 12 potential stakeholders exporting and importing a variety of commodities. The port will be constructed on a "greenfield" site that has no basic infrastructure in place. All utilities will have to be brought to the site and significant site preparations work will be required before material handling facilities can be constructed. Furthermore, the annual volume of cargo to be handled by the individual stakeholders is relatively small; unlike the ArcelorMittal project that will handle up to 20 million tonnes per year.

The overall financial viability of the project is dependent on:

- the overall investment costs necessary to establish the required facilities,
- the operating costs to run and maintain the facility, and
- the throughput forecasted by each stakeholder group.

The planning criterion for the multi-commodity port, as described in Chapter 3, separated the facilities between three groups of stakeholders, namely:

1. Senelec
2. SOCOCIM and CDS
3. ICS, SSPT, and Senegal Mines

The analysis assumed that each stakeholder group would create a Special Purpose Company (SPC) to finance, build, and operate its facilities. A terminal handling charge (THC) per ton of throughput was calculated for each group based on the investment required for the throughput forecasted and the cost to operate the facility at that throughput. The THC represents the fee that the SPC created to construct and operate the facility would have to charge the stakeholder to break even on its investment. This break-even fee is calculated by setting the present value of net cash flows generated by the project equal to zero (NPV = 0). The project therefore adds no monetary value to the stakeholders. The decision to build the project is based on other criteria, such as return on sales of commodities, which are not explicitly included in the calculation.

The financial analysis presented in Chapter 4 demonstrated the benefits of having the stakeholders pool resources and share equipment and facilities. This can be accomplished by the stakeholders getting together to form a Special Purpose Company whose objective is to finance, build, and operate efficient port operations to maximize the benefits of the project for all stakeholders.

Table 1 presents the capital expenditure and terminal handling charges that each stakeholder would be subject to if they pooled resources to construct and operate the proposed multi-commodity bulk port at Bargny-Sendou.

TABLE 1
Summary of CAPEX and THC by Stakeholder

Stakeholder Group	CAPEX	Annual Throughput	THC per tonne
	million USD	million tpy	USD
Senelec	$ 54.2	1.20	$ 8.77
SOCOCIM and Ciment du Sahel	$ 124.4	2.52	$ 7.17
ICS, SSPT, Senegal Mines	$ 106.5	1.085	$ 12.47
Total	$ 285.1	4.805	
Average terminal handling charge per tonne			$ 8.77

The terminal handling charges that each stakeholder must pay to use the facility will add to the cost of importing and exporting their commodities and, if these are too high, will jeopardize their competitiveness. For some stakeholders, the combination of low volume and the cost of constructing and operating new facilities on a greenfield site may result in terminal handling charges that are unsupportable.

At first glance, the above charges appear to be quite high. However, there are other financial benefits to building the project that should be taken into account by each stakeholder group. These include, among others:

- Savings in land transportation costs resulting from using the new Port of Bargny-Sendou instead of the Port of Dakar
- Savings in the cost to transport the commodities by ship. These savings will be derived by using larger vessels at the Port of Bargny-Sendou, which cannot be accommodated at the Port of Dakar
- Savings in the cost of the ship at berth. These savings will be derived by loading/unloading each vessel in a shorter amount of time than possible at the Port of Dakar
- Savings in demurrage costs. The new port of Bargny-Sendou will be purpose built for the volumes anticipated. The equipment will be selected to minimize potential demurrage costs.
- Potential savings resulting from storing the commodities at the port instead of at the stakeholder manufacturing facilities.

There will also be economic benefits that accrue to the State that should be considered when evaluating this project. These include, among others:

- Savings in fuel subsidies
- Reduction in air pollution
- Reduction in traffic congestion

The project will contribute to reducing the notorious constant traffic congestion from Dakar to Rufisque by removing over 250 trucks per day from the road to the Port of Dakar. Reducing traffic congestion not only improves air quality but has a multiplier effect on fuel consumption.

The Government of Senegal should also evaluate the project's beneficial impact on the public and the national treasury and consider developing the project through a Public-Private-Partnership with the stakeholders. Governments typically participate in the development of projects that promote transportation and trade. Government participation in the following areas would be appropriate:

- Detailed feasibility studies
- Environmental Impact Studies
- Construction of basic infrastructure such as utilities and site preparation and offshore trestle

Government support could make the difference between participating or not participating in the project for some potential port users.

Certain commitments are required of the stakeholders prior to the detailed feasibility and environmental impact studies. These studies will be required before investors and lenders can make financial commitments. A stakeholder syndicate will be the most efficient and expedient path to finalizing project requirements and responsibilities.

Successful implementation of this project with many potential users will require vision, leadership, and a substantial amount of coordination – between stakeholders, the State and Mittal who owns the rights to the property. It would be logical for MIFERSO to take on the role of promoter and coordinator for the project. MIFERSO is best positioned to liaise between all parties and advocate for success of the project.

Figure 2 presents the required steps to implement the project. Figure 3 presents a potential financing structure for the project.

Figure 2
Implementation Milestones

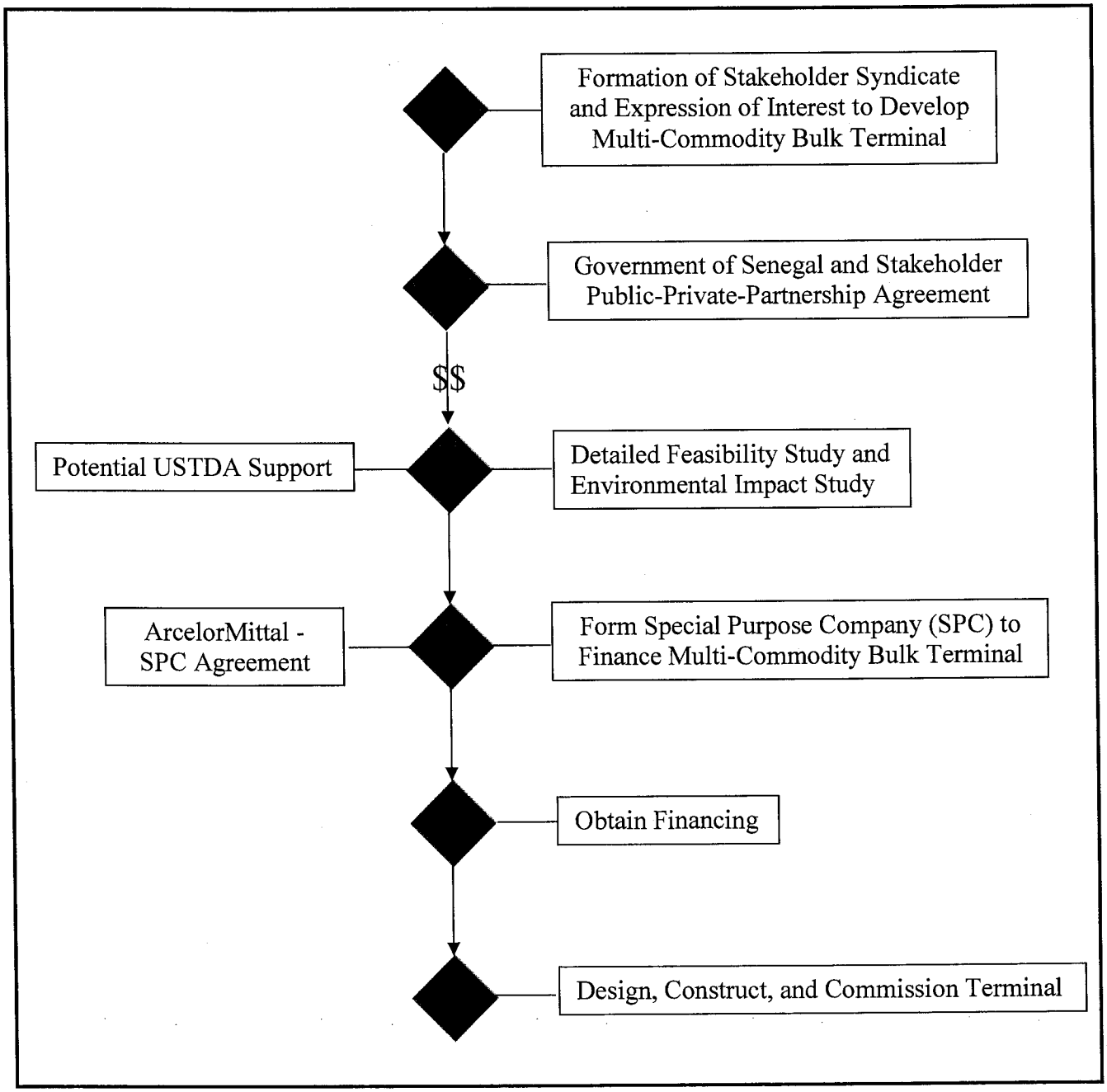
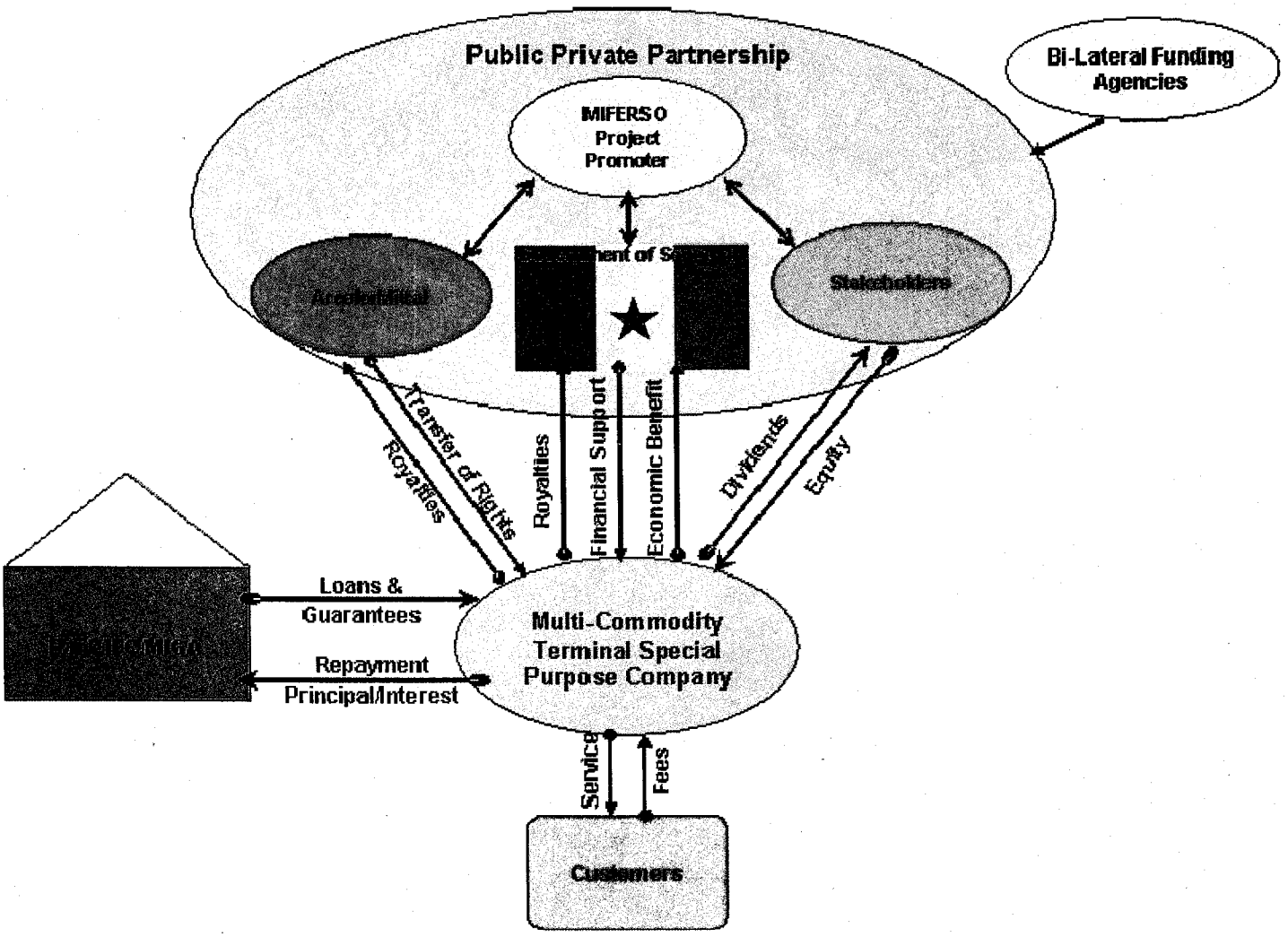


Figure 3
Financing Structure



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Appendices

Chapter 1

Introduction

"The purpose of this Feasibility Study of the new multi-commodity bulk port of Senegal is to address economic, financial, and regulatory issues around the construction and operation of the proposed multi-commodity, multi-tenant port. These economic, financial and regulatory issues must be clarified even before technical studies can be completed because the port's configuration will depend on its economic arrangement."

Section 1.2 of Request for Proposals

1.1 General Background

The proposed multi-commodity port complex is a portion of a larger development project for the export of iron ore. MIFERSO, an entity of the Ministry of Mines and Industry for the government of Senegal has been responsible for the promotion of the project. The principal elements of the iron ore export project include the development of iron ore mines located in the Falamé region of southeastern Senegal and a 750km railway connecting the mine to a new iron ore export terminal that will be located on a "greenfield" site in Bargny-Sendou, approximately 30km southeast of the nation's capital Dakar.

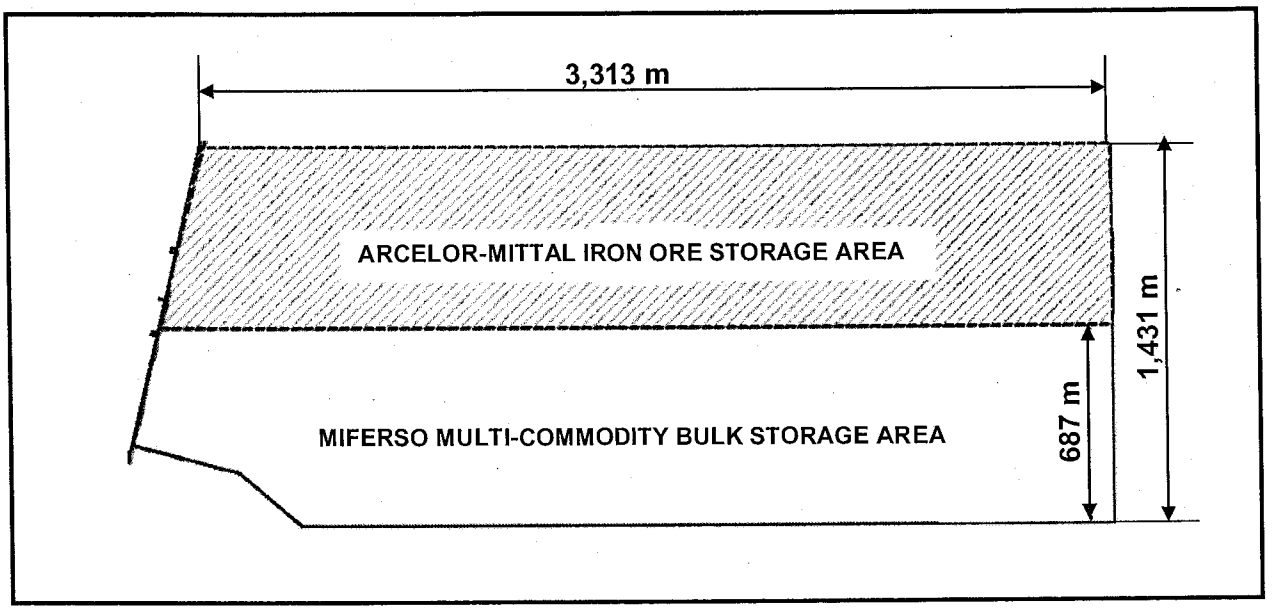
At the time of the grant agreement, MIFERSO believed that the development and financing for the project would be shared between several different parties, including the Government of Senegal. MIFERSO foresaw an opportunity to diversify the port operations by incorporating other stakeholders that either currently import/export bulk commodities at the Port of Dakar or that have development projects underway for the import/export of bulk commodities. The objective of diversifying port operations and not relying solely on iron ore exports was to strengthen the economic and financial justification for the new port while increasing Senegal's capacity to import needed bulk materials such as coal for energy generation and clinker for cement plants, as well as sulfur for fertilizer plants and petroleum products. In time all bulk commodities could be imported and exported from the proposed multi-commodity port, thereby greatly helping to decongest the City and Port of Dakar.

Handling dry bulk materials at the existing Port of Dakar is no longer recommended. The trucks and railcars that are used to transport the commodities must traverse the crowded and congested city to reach their destinations. Spillage and dust emissions are sources of pollution for the city's inhabitants. Furthermore, the Port of Dakar recently awarded a 25 year concession to DP World who is planning to invest 534 million U.S. dollars to upgrade the Port of Dakar and build a container terminal. Pressure to expand the Port of Dakar's container handling facilities leaves little room for the handling of additional bulk commodities.

After promoting the project for 30 years, the Government of Senegal and ArcelorMittal agreed in February 2007 to proceed with the development of the iron ore mine, railway, and port infrastructure. Per the concession agreement, ArcelorMittal will be responsible for developing and operating the iron ore terminal. With a projected development cost of US$2.2 billion, this will be the largest private investment project in Senegal's history.

The concession agreement grants development rights for the entire port area to ArcelorMittal who have agreed to allow other stakeholders develop bulk handling facilities within the confines of the port area. Figure 1-1 presents the area allocated to ArcelorMittal and the Miferso multi-commodity bulk terminal.

FIGURE 1-1
BULK STORAGE AREA ALLOCATION



A significant feature of this agreement is that other stakeholders will be allowed to share the trestle that will be constructed from the shoreline to the iron ore loading berth. Deep water required for berthing vessels can be found between 3 km to 4.5 km from shore, depending on the size of the vessel. Construction costs for the trestle will be significant and the opportunity to share this structure, that has to be built for the export of iron ore, is a great benefit to all stakeholders.

The multi-commodity bulk port at Bargny will be developed by multiple stakeholders and will require its own organizational structure to manage the development. This matter is discussed in greater detail in the subsequent chapters.

Study Background

MIFERSO obtained funding from the United States Trade and Development Agency (USTDA) to study the feasibility of developing a deepwater port for the Senegal: Multi-commodity Port Complex Project (STUDY).

The primary objectives of the study are to address economic, financial, and regulatory issues around the construction and operation of the proposed multi-commodity, multi-tenant port. To accomplish these objectives, this study has developed projections of reasonable range of future traffic at the proposed port, estimated physical port requirements and associated costs to handle the cargo forecasted, analyzed the port's financial feasibility, and evaluated environmental impacts.

Correspondingly, the sub-objectives of this study include the following:

1) Development of an initial port vision document(see Appendix A)
2) Traffic forecasts by commodity (see Chapter 2)
3) Analyze economic feasibility and risks (see Chapter 4)
4) Develop financing alternatives (see Chapter 5)
5) Investigate possible environmental issues associated with the project (see Chapter 7)
6) Assess developmental impacts (see Chapter 6)
7) Review regulatory conditions, analysis of port governance and development of an implementation plan (see Chapter 8)

1.3 Study Methodology

To meet the objectives of the study, the project was divided into three phases which are described in the following paragraphs. Two interim reports were prepared at the end of each of the first two phases. Presentations have been made to the Port Steering Committee to present the initial results and conclusions. This final report summarizes the analysis carried out by the consultant team during the entire study.

1.3.1 Phase I – Data Gathering and Vision Plan

Work on the project began in January 2007 with data collection visits to Senegal. Interviews were held with the appropriate Ministries and potential stakeholders. The potential stakeholders that were identified at that time and the import/export function that they required at the time include:

- ArcelorMittal
  - Exports: Iron Ore
- Industries Chimiques du Sénégal (ICS)
  - Imports: Sulfur, Urea, Potash, Ammonium Sulfate
  - Exports: Bulk fertilizer, with provision to export phosphate in the future
- SOCOCIM Industries
  - Imports : Gypsum, Slag, Coal
  - Exports : Clinker
- Les Ciments du Sahel (CDS)
  - Imports : Gypsum, Slag, Coal
  - Exports : Clinker
- Société Sénégalaise des Phosphates de Thiès (SSPT)
  - Exports: Attapulgites, with provision to export phosphate in the future
- Sénégal Mines
  - Exports: Attapulgites,
- Société d'Electricité du Sénégal (SENELEC)
  - Imports Coal
- Phosphates de MATAM
  - Provision to export phosphate in the future
- PETROSEN
  - Provision for stockpiling petroleum products

Preliminary cargo forecasts were gathered during this period and an initial Port Vision Document showing initial projections of commodities, general infrastructure requirements, and preliminary recommendation for the development and operation of the proposed new port was prepared. A workshop presentation was made to MIFERSO and project stakeholders in May 2007. A copy of the Vision Plan presentation is included in Appendix A.

The initial Vision Plan developed by TEC proposed an operational scheme for the multi-commodity bulk Port of Bargny. This initial scheme included a common stockyard area for all commodities, common use of the approach trestle to the berths, and common berths and material handling equipment for all commodities except iron ore. The storage yard and material handling equipment was organized on the basis of function, i.e., on the basis of whether the particular operation served an export function or an import function. The goal of sharing berths and material handling equipment between stakeholders was to reduce investment costs.

A requirement of the proposed scheme was that a single terminal operating structure be created for the handling of all commodities except iron ore. Figure 1.2 presents the proposed Vision Pier Plan and Figure 1.3 presents the proposed Vision Stockyard Plan.

For security reasons, ArcelorMittal requested that their iron ore stockyard area be separated from the other stakeholder's operations. For similar reasons, ICS also requested that their stockyard area and material handling equipment be segregated from the other stakeholders.

During these meetings, two additional potential future stakeholders in the project were identified. These are:

- Central African Mining and Exploration Company (CAMEC)
    - Imports: Coal
    - Exports: Alumina
- Energy Allied
    - Imports: Crude Oil
    - Exports: Petroleum Products

FIGURE 1.2
PROPOSED VISION PIER PLAN

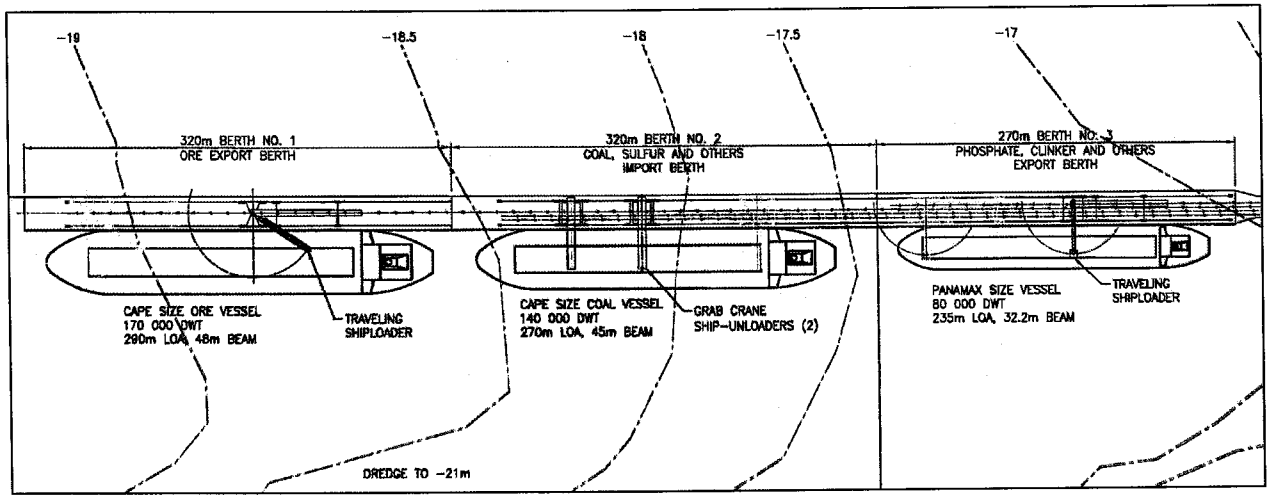
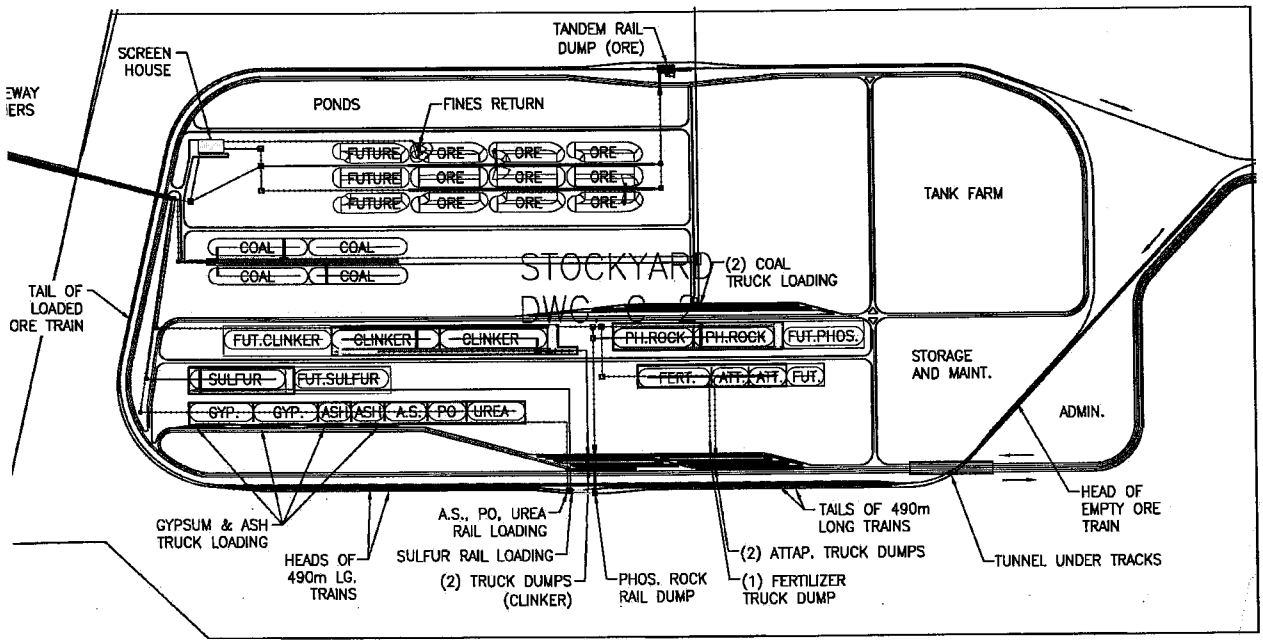


FIGURE 1.3
PROPOSED VISION STOCKYARD PLAN



1.3.2 Phase II – Regulatory Review, Economic Feasibility, Risk Analysis, Port Governance Financing Alternatives, Environmental Assessment, Developmental Impact Assessment, Sources of Supply, Implementation Plan, and Draft Final Report

The comments received from the potential stakeholders during the presentation in May led to the reorganization of the facilities based on commercial operations. As a result, the facilities and equipment required by the chemical company, the cement companies, and the power generation company were segregated from each other. This resulted in the addition of a berth and increasing the total conveyor lengths from that which was proposed in the initial Vision Plan. These revisions included the incorporation of potential facilities for CAMEC and Energy Allied.

Various operational options were assessed and evaluated. The purpose of this analysis was to provide a realistic and workable operating system to serve as a basis for estimating the probable cost of the project. In the end, the selection of operational methods and equipment will be made by the developer/operator. This decision will be based as much on personal preferences and experience as on technical analysis. In order to provide a sound basis for the physical planning and programming of future installations, an operations model is used to compute berth and storage requirements to meet the projected demand over the forecast period. This analysis is described in Chapter 3 of this report.

The Phase II Report, which included progress updates on the cargo forecasts, preliminary financial analysis, and preliminary engineering, was presented to MIFERSO and the project stakeholders in August 2007.

Interviews were again held with the appropriate Ministries and potential stakeholders. During these meetings, the Consultant was made aware of some significant developments that have an impact on the proposed operational plan as follows:

1. In July 2007, Indian fertilizer giant IFFCO entered into negotiations over the control of ICS. As a result of this, ICS's entire operating and business plan is being re-evaluated and commitments to the project cannot be made until this evaluation is completed.
2. The agreement between SENELEC and the China Metallurgical Group to build two 125-MW power plants fell through. The outcome of this is that SENELEC will likely begin

operations with only 400,000 tonnes of coal instead of the 1.2 million tonnes originally planned for.

3. Mineral Deposits Limited (MDL), an Australian mining company specialized in the mining of mineral sands, is potentially interested in participating in the project.
4. Because the total volumes of each group is relatively small, which is now made worse by item 2 above, the financial analysis calculated terminal handling costs that are relatively high. Faced with this fact, the stakeholders stated that they are now willing to consider pooling resources. In other words, the request made in May by some stakeholders to segregate their stockyard area and material handling equipment from the other stakeholders is no long necessary.

1.3.3 Phase III – Final Report

This report incorporates the comments and observations made in August and represents the culmination of the project effort. It incorporates all of the previous reports and presentations.

Chapter 2

Potential Stakeholders and their Commodities

2.1 Introduction

This chapter provides a brief description of the potential stakeholders for the project and, the commodities that they import and/or export. Several interviews with the stakeholders were made to understand the drivers for forecasting commodity throughputs at the proposed new port. All of the commodities that will go through the port are linked to the business plan of private companies and are therefore fixed by these companies.

2.2 Potential stakeholders and their commodities

Industries Chimiques du Sénégal (ICS) :

ICS has been a leading industrial enterprise of the country in terms of jobs, assets and turnover. It operates a phosphate rock mine and produces phosphoric acid at an industrial complex at DAROU (TAIBA), approximately 120 km by rail from the Port of Dakar. It also manufactures fertilizers (DAP, NPK, SSP/TSP) at an industrial complex located in MBAO, approximately 18 km from Dakar.

Presently, all of the phosphate rock that is mined is converted to approximately 1,200,000 tonnes of phosphoric acid per year, which is transported by rail from the mine to MBAO (+/- 100 km), stockpiled in pools, and then transferred by an underwater pipeline to an offshore buoy located 3,5 km from the shoreline. The offshore buoy can accommodate vessels up to 14m draft.

This process requires the importation of 600,000 tonnes of sulfur and 100,000 tonnes of urea, potash, and ammonium sulfate through the Port of Dakar.

Sulfur is imported via ships from a number of locations worldwide. The facility in Dakar can receive vessels up to 35,000DWT on the high tide. The sulfur is unloaded by a traveling grab bucket ship unloader and transferred by conveyor to an open stockpile. It takes between 5 to 6

days to unload a 30,000 to 35,000DWT ship. The available draft at the berth is 10.4 m. ICS would like to be able to receive vessels up to 60,000DWT at the new port of Bargny.

Sulfur is reclaimed from the stockpile by front-end-loader and loaded onto a conveyor via two fixed hoppers. The conveyor transports the sulfur to a train loader. The train loader consists of a simple pant-leg chute for loading railcars. The railcars are positioned under the train loading chute by a yard locomotive. Two types of railcars are in use with capacities of 40 tonnes and 35 tonnes each.

The railcars are then transported to the process plant complex at DAROU; near the mine. The average train length is 30 cars. The maximum train length is 37 cars. The train length is limited to 37 railcars because the mainline consists of a single track with by-pass sidings located along the length of the track. The length of the by-pass sidings is what limits the train length. Sulfur trains can leave the port only between the hours of 10:00 and 16:00 and between 22:00 and 04:00 because the mainline is shared by commuter trains to the city of Rufisque, which have priority over cargo trains.

Urea, potash, and ammonium sulfate arrive in 10,000DWT to 25,000DWT vessels and are unloaded by the same system described above for unloading sulfur. This material is stockpiled in a covered warehouse at the port and is transported to MBAO by truck. Average truck size is $20m^3$, which corresponds to 20t to 25t.

About 200,000 to 250,000 tonnes of fertilizer is exported through the Port of Dakar. Approximately ½ is exported in bulk by vessel and ½ is bagged and exported to Mali, Benin, Togo, Burkina Faso and Côte Ivoire by either rail, truck or ship.

ICS also has a phosphate export facility complete with a warehouse, rail/truck dump, and traveling shiploader at the Port of Dakar. These facilities are essentially idle because all of the phosphate mined by ICS is converted to phosphoric acid. Sénégal Mines makes use of truck dump and traveling shiploader to export 50,000 tonnes per year of attapulgite. While ICS has not exported phosphate rock in recent times, it wishes to keep this option open should the market change in the future making the export of phosphate rock more advantageous than converting it to phosphoric acid. All facilities are owned and operated by ICS.

ICS has two strategic reasons for moving its operations from the Port of Dakar to the new Port of Bargny. The first is linked to the transportation of dusty dry bulk chemicals through the highly congested city of Dakar and the resulting distress that has on the city's population. Truck traffic contributes to the congestion, delays, and frustration currently faced by every commuter in the city. This situation is aggravated by the resulting pollution from truck traffic in the form of diesel exhaust, dust emissions, and spillage.

The second strategic reason is related to safety. Because of the strong demand for petroleum product storage at the Port of Dakar, and the limited space available at the Port, petroleum product storage tanks have been erected in close proximity to the sulfur handling facilities. Should a fire occur, the risk of serious damage to people and property is significant. This would not be an unprecedented event. A fire in the sulfur carrying conveyor gallery occurred several years ago. While this fire was contained, it has significantly raised the concern of the petroleum product stakeholders, ICS and the Port of Dakar.

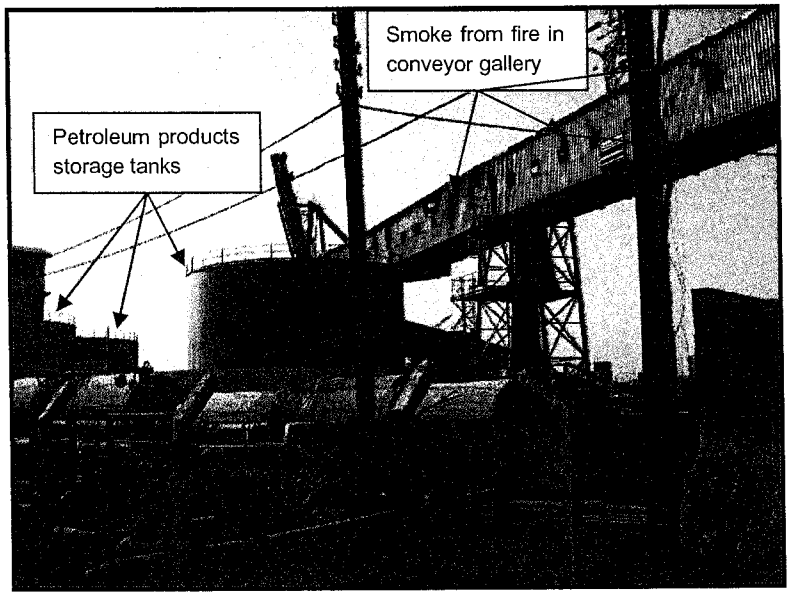


Figure 2.1: Fire damage ICS sulfur conveyor gallery at Port of Dakar

The economic drivers for establishing terminal facilities at the proposed new port are linked to the differential cost between Dakar and Bargny for the following cost items:

- trucking costs
- shipping costs related to ship size and time at port
- terminal handling charges

Terminal handling charges include the cost to amortize capital investments, operating and maintenance costs, and profit. Given that the existing facilities at Dakar are about 25 years old and new facilities will be required at the new Port of Bargny, the amortization component of terminal handling charges at the new Port of Bargny will likely contribute to terminal handling charges that will be much more than what they now pay in Dakar. This is discussed in greater detail in Chapter 4,

ICS requested that the material handling equipment at the new multi-commodity port be able to handle the existing throughputs at the Port of Dakar, with provision to increase these in the future. These throughputs are indicated in Table 2-1 below. During the May meeting, ICS also requested that these facilities be segregated from the other stakeholders.

TABLE 2.1

Projected Commodity Throughputs for ICS

	BASE				FUTURE			
	IMPORT		EXPORT		IMPORT		EXPORT	
Company	Commodity	Volume (t)	Commodity	Volume (t)	Commodity	Volume	Commodity	Volume (t)
Industries Chimiques du Sénégal (ICS)	Sulfur	600,000	Fertilizer	125,000	Sulfur	600,000	Fertilizer	125,000
	Urea	33,300			Urea	33,300		
	Potash	33,300			Potash	33,300		
	Ammonium sulfate	33,300			Ammonium sulfate	33,300		
							Phosphate	400,000
Totals	**Imports**	**700,000**	**Exports**	**125,000**	**Imports**	**700,000**	**Exports**	**525,000**

According to ICS, phosphoric acid production increased by 92% between 1999 and 2004, reaching a level of 569,000 tonnes in 2004. However, in recent years ICS has been badly affected by the impact of high oil and sulfur prices. This, coupled with a large debt resulting from building a new facility to increase its capacity for phosphoric acid production to 660,000 t/y, contributed to a dramatic drop in production of phosphate (by 52.7%) and fertilizers (by 82%) in 2006

In July 2007, Indian fertilizer giant IFFCO assumed control of ICS. As a result of this, ICS's entire operating and business plan is being re-evaluated and commitments to the project cannot be made until this evaluation is completed.

Société Sénégalaise de Phosphates de Thies (SSPT)

Société Sénégalaise de Phosphates de Thies (SSPT) mines attapulgite, which is a type of clay that has high absorptive capacity. Its absorbent properties support its use in cat litters and for containing liquid spillages, while its rheological properties make it suitable for drilling muds.

SSPT presently exports 200,000 tonnes of attapulgite through the Port of Dakar. Approximately 70% of this volume is transported from the mine to the Port of Dakar by truck and stored in a warehouse. The 70km trip takes approximately two hours. SSPT estimates that the travel time from the mine to Bargny would be approximately 30 to 40 minutes. SSPT has recently invested nearly US$5 million in new material handling equipment and warehouse at the Port of Dakar. It plans to increase its export capacity to 400,000 tonnes in the near future. SSPT is owned by Groupe Tolsa from Spain and is the European leader in the production of specialty clays.

Sénégal Mines

Sénégal Mines is a private company that started its attapulgite mining activities in 2000. It exported 50,000 tonnes of attapulgite in 2006. Its goal is to export 100,000 tonnes per year. The material is transported from the mine to the Port of Dakar by truck and stored in a warehouse. They presently use ICS's phosphate shiploading facilities at the Port of Dakar.

The projected commodity throughputs for the attapulgite exporters are listed in Table 2.2 below.

TABLE 2.2

Projected Commodity Throughputs for Attapulgite Exporters

	BASE		FUTURE	
	EXPORT		EXPORT	
Company	Commodity	Volume (t)	Commodity	Volume (t)
Societe Senegalese de Phosphates de Thies (SSPT)	Attapulgites	200,000	Attapulgites Phosphate	400,000 100,000
Sénégal Mines	Attapulgites	60,000	Attapulgites	100,000
Total		260,000		600,000

SOCOCIM Industries

SOCOCIM Industries (SOCOCIM) is the eighth-largest company in Senegal. In 1999, SOCOCIM became a subsidiary of the International Group VICAT, a leading company in the building materials sector that is listed on the French stock exchange. SOCOCIM's plant, which is located in Rufisque, has a capacity of 1.8 million tons per year, making it the largest cement plant in West Africa. Approximately 15% of their production is exported. Expansion to 3 million tons is underway and is expected to be completed by mid-2009.

SOCOCIM presently imports approximately 200,000 tpy of coal, 50,000 to 60,000 tpy of gypsum, and from 100,000 to 300,000 tpy of clinker through the Port of Dakar. This material is trucked to their facility located approximately 28 km from the port. Once the expansion project is completed, they will move from importing clinker to being in a position to export up to 700,000 tpy of cement clinker.

Les Ciments du Sahel (CDS)

Les Ciments du Sahel (CDS) is privately owned and consists of a relatively new cement plant located in Kirene, Senegal. The plant was constructed in 2002 with a nominal production capacity of 600,000 tonnes per year. CDS is also currently expanding their facility, which will raise its production by 1.35 million tons to meet an increase in demand in Senegal and the sub-region. Completion is expected in 2010.

CDS presently imports approximately 200,000 tpy of coal, 50,000 to 60,000 tpy of gypsum, and from 100,000 to 300,000 tpy of clinker through the Port of Dakar. This material is trucked to their facility located approximately 80 km from the port. Once the expansion project is completed, they will move from importing clinker to being in a position to export up to 1,000,000 tpy of cement clinker.

The projected commodity throughputs for the cement plants are listed in Table 2.3.

Table 2.3

Projected Commodity Throughputs for Cement Companies

	IMPORT		EXPORT	
Company	**Commodity**	**Volume (t)**	**Commodity**	**Volume (t)**
Ciments du Sahel	Gypsum	90,000	Clinker	1,000,000
	Slag	20,000		
	Coal	300,000		
SOCOCIM	Gypsum	90,000	Clinker	700,000
	Slag	20,000		
	Coal	300,000		
Total Volume	**Imports**	**820,000**	**Exports**	**1,700,000**

Société d'Electricité du Sénégal (SENELEC)

The Electricity Company of Sénégal (SENELEC – La Société d'Electricité du Sénégal) was established in 1983 when the two companies, Electricity of Sénégal and the Sénégalaise Electricity Distribution Company, merged. SENELEC is responsible for the generation, transmission and distribution, as well as the import and export, of electricity throughout the country. At the time of the kick-off meeting, SENELEC was negotiating an agreement with China Metallurgical Group to build two 125 MW power plants. Construction was expected to begin soon and completion was expected within three years. These 2x125 MW power plants were expected to consume 800,000 tonnes of coal. A concession for another 125-MW coal fired plant requiring another 400,000 tonnes was also in the bidding stage. They therefore requested facilities to **import 1,200,000 tonnes of coal**. However, during the May meeting, TEC was informed that the deal with China Metallurgical Group fell through and Senelec will likely begin operations with only 400,000 tonnes of coal.

Phosphates de Matam

Significant phosphate deposits exist in the region of Matam located northeast of Dakar near the Mauritanian border. Mine exploration studies were made in 1984 that proposed the production of 1.5 Million tonnes of phosphate rock over a period of 25 years. A USTDA feasibility study, focused on analyzing potential transportation modes from the mine to an export or process facility is currently being undertaken by EESD, LLC.

At this writing, there is no timetable for awarding a concession and it is not known whether the phosphate rock would be shipped to existing ICS process plant in Darou for transformation to phosphoric acid, or whether it would be exported as phosphate rock.

Commercial decisions regarding the development, processing and export of this material is likely to be several years away. For planning purposes, we are assuming that all of the **1.5 million tonnes** would eventually be handled at the Port of Bargny and therefore, the facilities required for this, are shown.

Société des Petroles du Sénégal (PETROSEN)

PETROSEN is the state oil company of Senegal. The role of the company lies in the management of exploration, production, transport and refining, and the sale and distribution of petroleum products. PETROSEN is concerned with the promotion of the petroleum industry in Senegal through the creation of an attractive political and financial environment encompassing financial climate, state participation arrangements, private oil company capital, and bilateral and multilateral cooperation.

PETROSEN is exploring the possibility of establishing a regional petroleum products storage terminal. There has also been some discussion about relocating the existing petroleum products terminal in Dakar. For these reasons, PETROSEN requested that 100 hectares of land be made available for creation of a tank farm to store petroleum products.

Energy Allied International

Energy Allied International is a Houston based international projects developer specializing in energy and infrastructure projects worldwide. They have been mandated by the Government of Senegal to determine the feasibility of expanding refinery operations in Senegal by constructing a new stand-alone refinery operation independent of the existing SAR Refinery. This new refinery will be designed with much more flexibility to process 60,000 barrels per day of a wider range of light sweet and heavy sour crude available in the West Africa market. Provision to construct a petroleum products berth to receive ocean going tankers has been requested. Product storage facilities are to be located adjacent to the refinery.

Central African Mining and Exploration Company (CAMEC)

The Central African Mining and Exploration Company (CAMEC) has a Joint Venture Agreement with Mali Mining House ('MMH') for the exploration and development of bauxite deposits on the Senegal Guinea border and are exploring the possibility of constructing an alumina plant with the potential of exporting 3 million tonnes per year of alumina. This process would also require the import of 500,000 tonnes of coal.

CAMEC has several alternatives for the export of the alumina, which include using a Guinean port or a Senegalese port. A decision on whether to move forward on this project is several years away. For planning purposes, we are assuming that all of the alumina and coal would eventually be handled at the Port of Bargny and we have shown the facilities required for this.

Mineral Deposits Limited's (MDL)

MDL's principal activities are mining and processing heavy mineral sands producing rutile, zircon, and ilmenite. MDL has for many years been an Australian based producer. As their Australian operations reached the end of their lives, the company expanded its traditional business into new projects and are now involved in the Grande Côte Zircon Project (GCZP) that extends over a length of some 50 kilometres along the northern coastline or Grande Côte of Senegal situated some 60km north east of Dakar.

Zircon is a hard and tough mineral with good thermal conductivity and stability over a large temperature range. Zircon is widely used in the ceramics industry for the production of floor and wall tiles and sanitary ware for homes and commercial buildings as well as an opacifer in ceramic glazes. Rutile and ilmenite are sources of titanium dioxide (TiO_2) which has a major use in the production of white pigments. All of the light and bright colors in use in the world – from fabrics such as white shirts to whitegoods used in domestic kitchens, and paints used for interior and exterior applications in domestic dwellings and commercial buildings – use some amount of TiO_2 pigment.

80,000 tons of Zircon will be transported in containers. However, approximately 20,000 tonnes of rutile and 600,000 tonnes of ilmenite will be produced as a by-product of the zircon mining operation.

2.3.3 Summary of Commodity Forecasts

A summary of the commodity forecasts used for planning purposes is provided in Table 2.4.

TABLE 2.4

Summary of Commodity Forecasts for the Multi-commodity Bulk Port of Bargny

	BASE				FUTURE			
	IMPORT		EXPORT		IMPORT		EXPORT	
Company	Commodity	Volume (t)	Commodity	Volume (t)	Commodity	Volume (t)	Commodity	Volume (t)
Industries Chimiques du Sénégal (ICS)	Sulfur	600,000	Fertilizer	125,000	Sulfur	600,000	Fertilizer	125,000
	Urea	33,300			Urea	33,300		
	Potash	33,300			Potash	33,300		
	Ammonium sulfate	33,300			Ammonium sulfate	33,300		
							Phosphate	400,000
Ciments du Sahel	Gypsum	90,000	Clinker	1,000,000	Gypse	90,000	Clinker	1,000,000
	Slag	20,000			Slag	20,000		
	Coal	300,000			Coal	300,000		
SOCOCIM	Gypse	90,000	Clinker	700,000	Gypse	90,000	Clinker	700,000
	Slag	20,000			Slag	20,000		
	Coal	300,000			Coal	300,000		
SENELEC	Coal	1,200,000			Coal	800,000		
Societe Senegalese de Phosphates de Thies (SSPT)			Attapulgites	200,000			Attapulgites	400,000
			Phosphate				Phosphate	100,000
Sénégal Mines			Attapulgites	60,000			Attapulgites	100,000
Phosphates de Matam							Phosphate	1,500,000
CAMEC					Coal	500,000	Alumina	3,000,000
Mineral Deposits Limited (MDL)			Rutile	20,000			Rutile	20,000
			Ilmenite	600,000			Ilmenite	600,000
Total	**Import**	**2,719,900**	**Export**	**2,705,000**	**Import**	**2,819,900**	**Export**	**7,945,000**

Chapter 3

Operational Analysis and Organizational Structure

3.1 Introduction

TEC Inc prepared an initial Vision Plan that proposed an operational scheme for the multi-commodity bulk Port of Bargny. This initial scheme proposed a common stockyard area for all commodities, common use of the approach trestle to the berths, and common berths and material handling equipment for all commodities except iron ore. The goal of sharing berths and material handling equipment between all stakeholders except iron ore was to reduce investment costs.

Presentation of the Vision Plan was made in May 2007. For security reasons, ArcelorMittal requested that the iron ore stockyard area be separated from the other stakeholder's operations. For similar reasons, ICS also requested that their stockyard area and material handling equipment be segregated from the other stakeholders.

The comments received from the potential stakeholders during the presentation in May led to the reorganization of the facilities based on commercial operations. As a result, the facilities and equipment required by ICS and the attapulgite exporting companies, the cement companies, and the power generation company were segregated from each other. This resulted in the addition of a berth and increasing the total conveyor lengths from that which was proposed in the initial Vision Plan. These revisions also included the incorporation of potential facilities for CAMEC and Energy Allied. The agreed upon annual throughput for each stakeholder and commodity is shown on Table 3.1. These criteria were used to develop a Master Plan for the port.

During the review meetings held in August 2007 for presentation of the Draft Final Report, TEC learned the following:

- Senelec will only begin operations with 400,000 tonnes of coal
- ICS is being restructured, which limits its ability to commit to the project
- MDL is interested in taking a stake in the project
- The stakeholders are now willing to pool resources to reduce capital investments.

TABLE 3.1

Summary of Commodity Forecasts for the Multi-commodity Bulk Port of Bargny

	BASE				FUTURE			
	IMPORT		EXPORT		IMPORT		EXPORT	
Company	Commodity	Volume (t)	Commodity	Volume (t)	Commodity	Volume (t)	Commodity	Volume (t)
Industries Chimiques du Sénégal (ICS)	Sulfur	600,000	Fertilizer	125,000	Sulfur	600,000	Fertilizer	125,000
	Urea	33,300			Urea	33,300		
	Potash	33,300			Potash	33,300		
	Ammonium sulfate	33,300			Ammonium sulfate	33,300		
							Phosphate	400,000
Ciments du Sahel	Gypsum	90,000	Clinker	1,000,000	Gypse	90,000	Clinker	1,000,000
	Slag	20,000			Slag	20,000		
	Coal	300,000			Coal	300,000		
SOCOCIM	Gypse	90,000	Clinker	700,000	Gypse	90,000	Clinker	700,000
	Slag	20,000			Slag	20,000		
	Coal	300,000			Coal	300,000		
SENELEC	Coal	1,200,000			Coal	800,000		
Societe Senegalese de Phosphates de Thies (SSPT)			Attapulgites	200,000			Attapulgites	400,000
			Phosphate				Phosphate	100,000
Sénégal Mines			Attapulgites	60,000			Attapulgites	100,000
Phosphates de Matam							Phosphate	1,500,000
CAMEC					Coal	500,000	Alumina	3,000,000
Total	Import	2,719,900	Export	2,085,000	Import	2,819,900	Export	7,325,000

3.2 Facility requirements

3.2.1 Ship berthing plan

As mentioned in Chapter 1, a significant feature of the concession agreement with ArcelorMittal is that other stakeholders will be allowed to share the trestle that will be constructed from the shoreline to the iron ore loading berth. Deep water required for berthing vessels can be found between 3 km to 4.5 km from shore, depending on the size of the vessel. Construction costs for the trestle will be significant and the opportunity to share this structure, that has to be built for the export of iron ore, is a great benefit to all stakeholders.

Four dry bulk ship berths, located in line with the offshore trestle, were proposed in the Master Plan as follows:

- Berth No.1 – Reserved for iron ore – ArcelorMittal
- Berth No.2 – Reserved for Senelec coal imports of 1.2 million tons designed for vessels up to 140,000 DWT.
- Berth No.3 – Reserved for cement company products for exporting 1.7 million tons of clinker and importing 0.82 million tons of gypsum, slag and coal. In the future, CAMEC could also use this berth to import 0.5 million tons of coal
- Berth No.4 – Reserved for ICS and attapulgite exporters for the export of 0.125 million tons of fertilizer, and 0.260 million tons of attapulgite and imports of 0.7 million tons of sulfur, urea, potash and ammonium sulfate. For the future, an additional export of 0.240 million tons of attapulgite and 0.5 million tons of phosphate was planned for.

Two alternatives are proposed for the Energy Allied petroleum products berths. One alternative is to construct a separate berthing platform, with piping running either on a trestle or underwater sealine. The other alternative proposed is to construct the berthing platform beyond the iron ore berth and run the piping along the trestle.

The proposed ship berthing plan is shown on Figure 3.1.

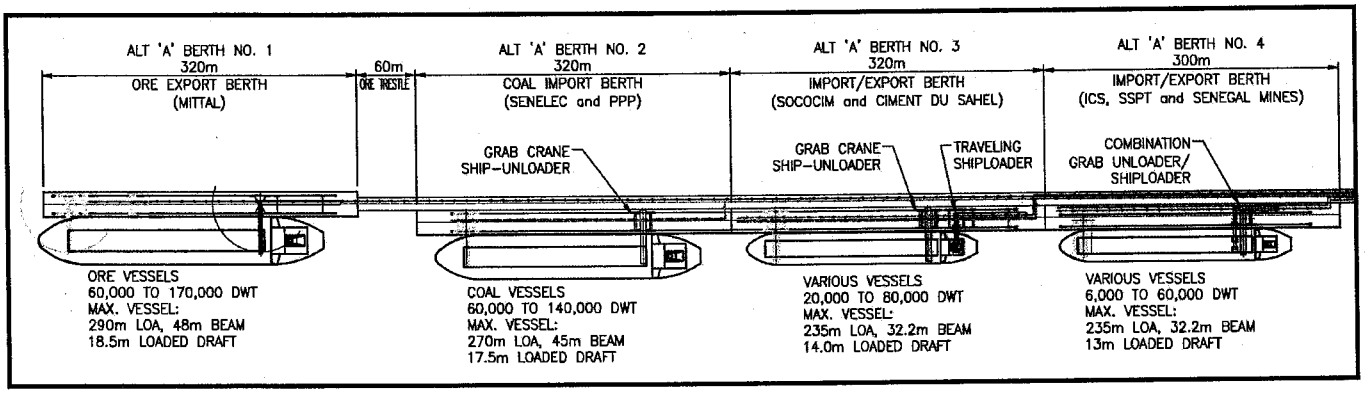


FIGURE 3.1 – Berthing plan for principal stakeholders (from drawing SP-2A)

The development of the Phosphates de MATAM project and the CAMEC alumina project will require two additional berths. Since there was no timeline for the start of these projects, two separate berths to be constructed in the future were proposed as follows:

- Berth No.5 – Reserved for Phosphates de MATAM for annual exports of 1.5 million tonnes of phosphate
- Berth No.6 – Reserved for CAMEC for annual exports of 3.0 million t of alumina

Berth Occupancy

To keep vessel waiting time and potential demurrage costs at a reasonable level, berth occupancies must be kept equal to or below 75%. The Berth Loading/Unloading Rate is defined as the tonnages that are loaded/unloaded into/from a vessel during the overall time period that it occupies the berth. To calculate berth occupancy, various non-productive time elements are included in the period of time that a berth is said to be "occupied" by a vessel. These time elements include:

- Time to transfer from anchorage to the berth,
- Time to attach mooring lines,
- Time for draft checking,
- Time for customs clearance,
- Time to open hatches,
- Time for shiploader moves from hatch to hatch,
- Stoppages due to adverse weather,

- Malfunctions of the conveying system,
- Time to remove mooring lines
- Time to clear berth and approach channel

The vessel fleet size has a significant impact on the berth loading/unloading rate. A higher number of smaller vessels require relatively more time at the berth because the larger number of vessels result in more non-productive time elements.

The annual berth occupancy (in days) is calculated from the number of vessels and their annually accumulated berth occupancy, in days per year. To account for shift changes, one day is calculated as 22.5 hours. The occupancy, in percent, is calculated by dividing the number of days the berth is occupied by the number of available days (assumed to be 330 days per year).

The following assumptions were made for the calculation of berth occupancies at the Port of Bargny-Sendou:

- Vessels arrive on a semi-scheduled pattern, usually not being delayed more than two to three days from the scheduled arrival date
- The berths are assumed to be available 330 days per year. The remaining days are to account for days lost due to holidays, adverse weather, breakdowns, and scheduled maintenance.

Vessel Unloading at Senelec Berth No. 2

The Master Plan was based on importing 1.2 million tonnes of coal for Senelec at a dedicated berth. In all likelihood, the vessels supplying coal to Senelec will be in the PANAMAX size range. However, the location of berth No. 2 will allow for the berthing of small Cape Size vessels. For this reason, the berth occupancy analysis was made on the basis of a range of vessels between 60,000 DWT (maxi-fleet) and 140,000 DWT (mini-fleet). The average cargo size is assumed to be 68,570 tonnes for the maxi-fleet and 109,090 tonnes for the mini-fleet. The overall average cargo size is assumed to be 84,210 tonnes.

The design parameters for each of the vessel sizes are shown in Table 3.2.

Table 3.2

	Senelec Master Plan Vessel Dimensions (meters)				
Vessel Size	**Length Overall**	**Beam**	**Loaded Draft**	**Molded Depth**	**Air Draft**
140,000 DWT	270.0	45.0	17.5	24.0	53.0
60,000 DWT	220.0	32.2	13.0	8.5	48.0

A traveling grab bucket ship unloader operating at a free digging rate between 1,000 tph to 1,200 tph is proposed for unloading Senelec coal. Handling requirements for the coal at Berth No. 2 are approximately 12,256 tons per day, with an average berth occupancy ranging between 27% and 31%. The berth occupancy calculation is shown in Table A2 at the end of this chapter.

The Senelec coal unloading berth has a very low occupancy and could eventually handle more than twice the projected tonnage. Given that Senelec will now begin operations with only 400,000 tonnes of coal per year, it does not make sense to build a dedicated berth for this purpose. The investment cost is prohibitive for such a small volume. This volume could easily be handled at the Cement Companies berth. This will be discussed further in the Cement Companies berth description below.

Vessel Loading and Unloading at Cement Companies Berth No. 3

Berth 3 is designated for the product handling activities of the two cement companies, and will be designed to accept vessels ranging from 20,000 DWT to 80,000 DWT. The design parameters for these vessels are shown in Table 3.3.

Table 3.3

	Cement Companies Vessel Dimensions (meters)				
Vessel Size	**Length Overall**	**Beam**	**Loaded Draft**	**Molded Depth**	**Airdraft**
80,000 DWT	235.0	32.2	14.5	20.0	50.0
20,000 DWT	165.0	25.0	10.0	12.0	44.0

A traveling conventional shiploader is proposed for loading clinker into vessels ranging from 35,000 DWT to 80,000 DWT. A traveling grab bucket type ship unloader with a free digging rate between 1,100 to 1,200 t/h is proposed for unloading 0.82 million tons of coal, gypsum and slag. The shiploader and ship unloader will be mounted on the same berth. The average cargo size assumed for the mini-fleet and maxi-fleet is shown in Table 3.4

Table 3.4

	Average Cargo Size (tonnes)			
Fleet size	**Coal**	**Gypsum**	**Slag**	**Clinker**
Mini	33,330	25,710	13,330	35,420
Maxi	75,000	60,000	20,000	70,830

The berth occupancy resulting from loading/unloading each commodity and the total berth occupancy for Cement Companies Berth No. 3 is shown in Table 3.5.

Table 3.5

	Berth Occupancy				
Fleet size	**Coal**	**Gypsum**	**Slag**	**Clinker**	**Total**
Mini	16.0%	4.4%	1.0%	28.3%	49.7%
Maxi	16.6%	5.0%	1.2%	34.9%	57.7%

The combined loading/unloading berth occupancy ranges between 49.7% to 57.7%, which results in the following average loading/unloading parameters:

- Average time at berth per vessel: 3.14 days
- Average waiting time (based on 54% berth occupancy): 0.73 days per vessel
- Average vessel time in port: 3.86 days.

The Master Plan assumed that berth No. 3 could also be used to unload an additional 0.5 million tons of coal that may be required by CAMEC, should their project prove fruitful and they decide to use the proposed Port of Bargny-Sendou facilities at some point in the future. In this case, the combined loading/unloading berth occupancy would increase to an average 67%, resulting in the following modifications to the loading/unloading parameters.

- Average time at berth per vessel: 3.29 days
- Average waiting time (based on 67% berth occupancy): 1.36 days per vessel
- Average vessel time in port: 4.65 days.

The berth occupancy calculation is shown in Table A3 at the end of this chapter

Including the 400,000 tonnes of coal that Senelec initially requires at the beginning of the project would increase the berth occupancy from 49.7% to 60.5% for the mini-fleet and from 57.7% to 68.8% for the maxi-fleet. The average berth occupancy would therefore be 64.7%, which is acceptable. Berth No. 3 could potentially be used to unload all of the 1.2 million tonnes of coal that Senelec will need in the future. This will require the addition of another grab bucket ship unloader. The advantage of including Senelec in the operations of this berth is that it will reduce the cost per tonne handled for all stakeholders using this berth. This will be discussed in more detail in Chapter 4. However, should the stakeholders agree to this, the berth will have to be made longer to accommodate the addition of another grab bucket ship unloader in the future.

Vessel Loading and Unloading at ICS Berth No. 4

The Master Plan proposed that Berth No. 4 be dedicated for the product handling activities of ICS, Sénégal Mines, and SSPT. The design parameters for the berth are based on accommodating vessels ranging between 6,000 DWT and 75,000 DWT. The dimensions associated with these two vessel sizes are shown in Table 3.6.

Table 3.6

	Berth No. 4 Vessel Dimensions (meters)				
Vessel Size	**Length Overall**	**Beam**	**Loaded Draft**	**Molded Depth**	**Airdraft**
75,000 DWT	230.0	32.2	14.0	19.5	50.0
6,000 DWT	100.0	16.0	8.0	10.0	38.0

The Master Plan proposed to transfer the existing ICS shiploader/unloader from the Port of Dakar to the Port of Bargny-Sendou. The cost estimate budgeted US$3 million to upgrade the existing machine and transfer it to the new berth. The analysis assumed a shiploading rate of 300 to 350 t/h and an unloading rate of 600 to 800 t/h. The average cargo size assumed for each commodity is shown in Table 3.7.

Table 3.7

	Berth 4 Average Cargo Size (tonnes)			
Fleet Size	**Sulfur**	**U. P. AS**	**Fertil**	**Attap**
Mini	33,330	10,000	12,500	6,500
Maxi	66,668	33,330	41,668	13,000

The berth occupancy resulting from loading/unloading each commodity and the total berth occupancy for Berth No. 4 is shown in Table 3.8

Table 3.8

	Berth 4 Berth Occupancy				
Fleet size	**Sulfur**	**U.P. AS**	**Fertil.**	**Attap.**	**Total**
Mini	23.8%	3.8%	6.6%	15.3%	49.5%
Maxi	27.1%	5.4%	8.2%	18.8%	59.5%

The combined loading/unloading berth occupancy ranges between 50% to 60%, resulting in the following average loading/unloading parameters:

- Average berth time per vessel: 3.18 days
- Average waiting time (based on 55% berth occupancy): 0.76 days per vessel
- Average vessel time in port: 3.94 days.

Provision for loading an additional 0.24 million tons of attapulgite and 0.5 million tons of phosphate in the future was requested. To accommodate this future throughput, it is necessary to increase the shiploading rate from the initial range of 300 to 350 t/h to 700 to 800 t/h. There would not be any changes to the unloading rate. The combined loading/unloading berth occupancy will increase to an average of 64%, resulting in the following modifications to the loading/unloading parameters:

- Average berth time per vessel: 2.21 days
- Average waiting time (based on 64% berth occupancy): 0.79 days per vessel
- Average vessel time in port: 3.0 days.

The berth occupancy calculation is shown in Table A4 at the end of this chapter

Vessel loading for Phosphates de MATAM

Provision for accommodating the potential of receiving, stockpiling, and exporting phosphate from the potential Phosphates de MATAM was requested. For planning purposes, we have assumed that the Phosphates de MATAM project will deliver up to 1.5 million tons per year of phosphate rock by rail. A loop track that would be constructed as an expansion on the ladder

track system is recommended to handle this volume of phosphate. The phosphate will be stored in an enclosed building and loaded into vessels ranging from 35,000 to 80,000 DWT.
The Phosphates de MATAM project is still in the study stage and there is no private stakeholder identified to operate the phosphate mine. Because of this, there is no definite timeline for the realization of this project. We have therefore assumed that a new berth will be constructed in the future for the export of this commodity. Currently the berth designated to Phospates de MATAM is identified as Berth No. 5. Future shiploading facilities could also be installed along the iron ore trestle. However, provision to do this would have to be made prior to constructing the trestle.

As currently planned, Berth No.5 will handle 1.5 million tons of phosphates in the future and will receive vessels ranging between 35,000 DWT and 80,000 DWT. The design parameters for the two vessel sizes are shown in Tale 3.9.

Table 3.9

	Berth No. 5 Vessel Dimensions (meters)				
Vessel Size	**Length Overall**	**Beam**	**Loaded Draft**	**Molded Depth**	**Airdraft**
80,000 DWT	235.0	32.2	14.5	20.0	50.0
35,000 DWT	200.0	29.0	11.0	16.0	46.0

With the assumed range of vessel sizes, the average cargo size will be approximately 46,000 tons and the berth occupancy ranges from 35% to 47%. A shiploader design rate of 800 tons per hour results in the following average loading parameters.

- Average berth time per vessel: 3.64 days
- Average waiting time (based on 36% berth occupancy): 0.41 days per vessel
- Average vessel time in port: 4.05 days.

As planned, the phosphate loading berth has a very low occupancy and could eventually handle additional tonnage. However, the time in port for the maximum cargo size (75,000 tons) is over six days, which may not be economical.

Vessel Loading at Berth No.6

Provision for accommodating the potential of exporting 3.0 million tons of alumina and importing 500,000 tonnes of coal for CAMEC has been made at Berth 6, which would be constructed in the future.

The vessels arriving at Berth No. 6 will range between 35,000 DWT and 120,000 DWT. The design parameters for each vessel size are shown on Table 3.10.

Table 3.10

	Berth No. 6 Vessel Dimensions (meters)				
Vessel Size	**Length Overall**	**Beam**	**Loaded Draft**	**Molded Depth**	**Airdraft**
120,000	260.0	42.0	16.5	23.0	52.0
35,000 DWT	200.0	29.0	11.0	16.0	46.0

With an assumed range of vessels from 35,000 DWT to 120,000 DWT, the average cargo size will be 52,174 tons. A shiploading rate of 1,200 tons per hour has been assumed. At this rate, the shiploader could load approximately 18,394 tons per day. Therefore, the 3.0 million tons per year of alumina can be loaded into 58 vessels in 163 days at an average berth occupancy of 49% of 330 days, resulting in the following average loading parameters for Berth No. 6.

- Average berth time per vessel: 2.84 days
- Average waiting time (based on 49% berth occupancy): 0.55 days per vessel
- Average vessel time in port: 3.39 days.

As planned, Berth No. 6 has a relatively low occupancy and could eventually handle another 30% of the projected tonnage. However, the time in port for the maximum cargo size (111,000 tons) is over six days, which may not be economical. It is therefore more likely that a Maxi fleet with average cargo of 35,000 tons will be loaded in approximately 2.0 days, resulting in somewhat higher berth occupancy of 52%.

Importing the 500,000 tonnes of coal was assumed to occur at the cement companies berth No. 3.

3.2.2 Storage yard plan

Rail System

The railroad network is assumed to be available an average of 90% of the year or for 330 days per year. The 10% of unavailability is to account for time loss due to maintenance of the system. The rail system for the multi-commodity terminal will be developed in phases. Initially, a ladder track system is planned for the ICS commodities arriving and departing in railcars. Should the provision for future phosphate exports by ICS and SSPT materialize, a second ladder track will be required. A full loop system will be required should the Phosphates de MATAM and CAMEC projects be implemented. Figure 3.2 presents a schematic of the phased development of the proposed rail track system.

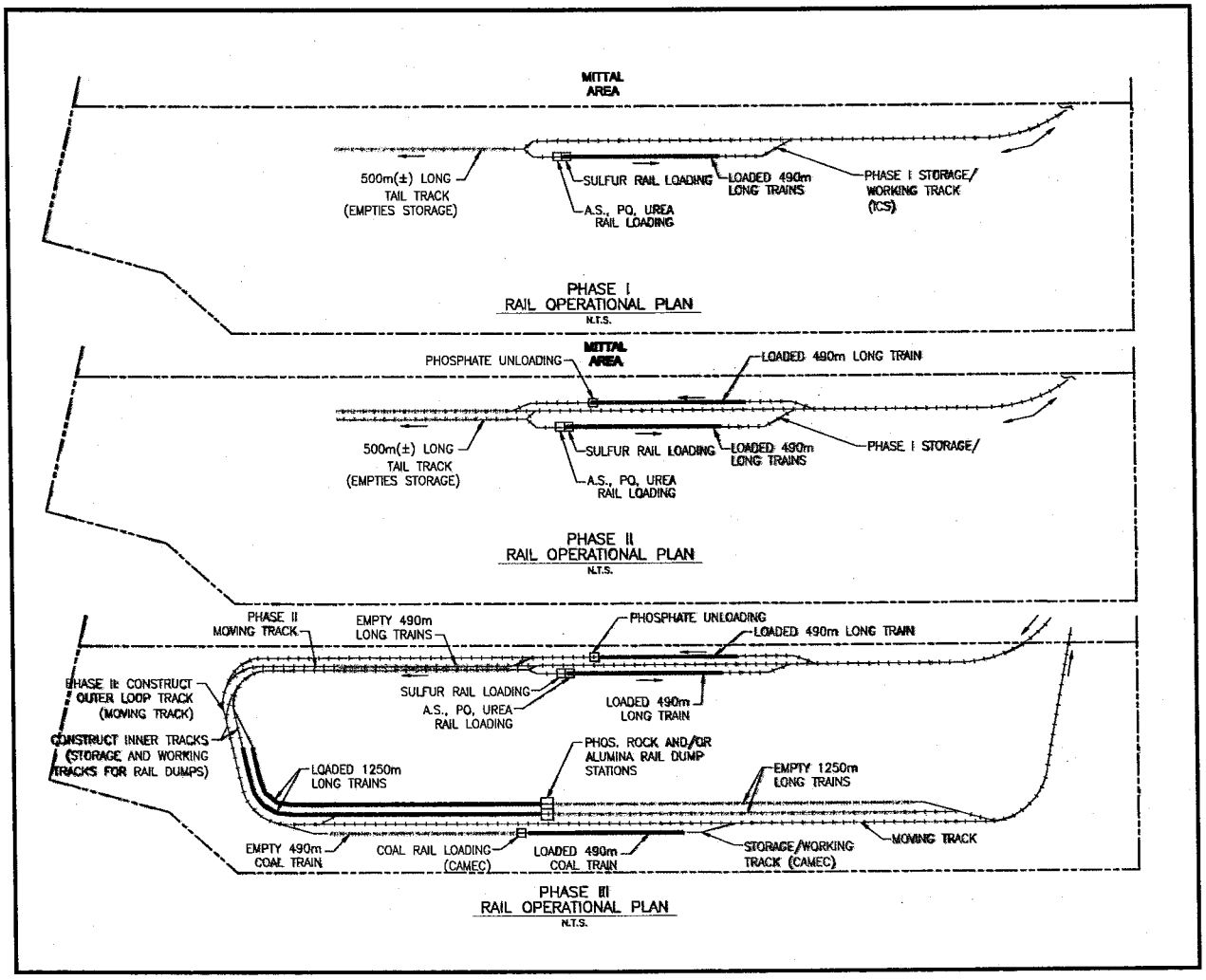


Figure 3.2: Rail operational plan (from drawing SP-8)

Yard layout

The proposed yard layout attempts to segregate the facilities as much as practical. Figure 3.3 presents the portion of the yard dedicated to the facilities required by ICS, SSPT, and Sénégal Mines. Common port roads lead to separate gate entrances for ICS and the attapulgite exporters. Area for future phosphate handling requested by ICS and SSPT is provided within the separate fence lines. Figure 3.4 presents the yard layout proposed for the cement companies. Area to accommodate future CAMEC and Phosphates de Matam facilities are planned for.

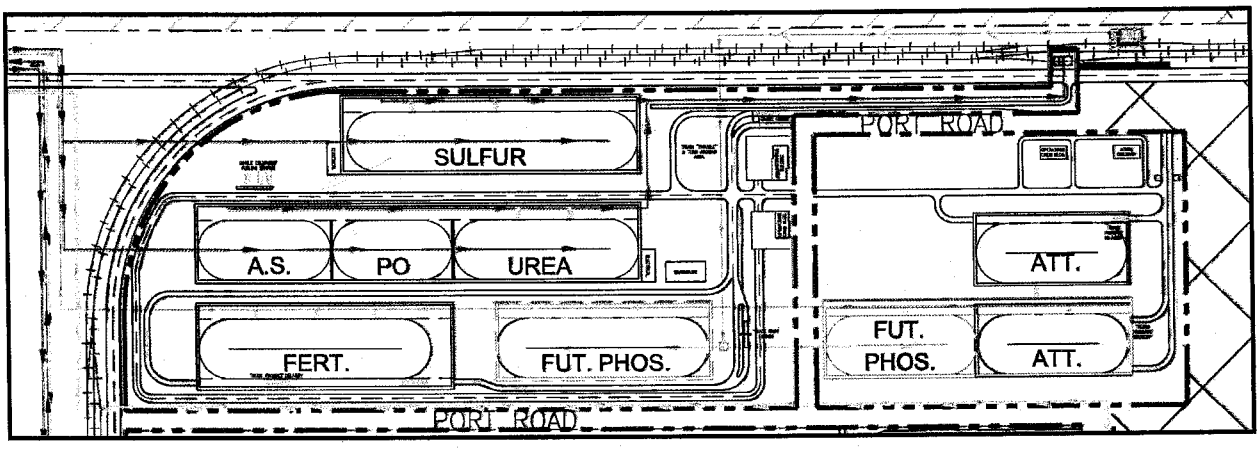


Figure 3.3: Yard layout proposed for ICS, SSPT, and Sénégal Mines (from drawing SP-6)

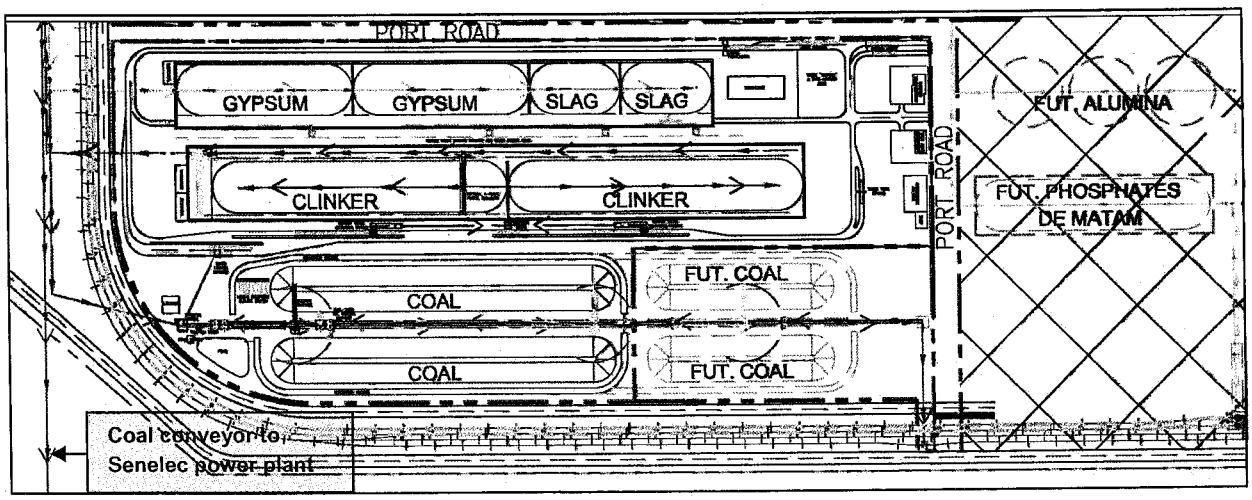


Figure 3.4: Yard layout proposed for cement companies and future CAMEC and Phosphates de Matam commodities (from drawing SP-7)

3.2.3 Description of material handling facilities planned for ICS

Sulfur handling

The facility will receive 600,000 tonnes per year of sulfur from vessels ranging in size from 35,000 DWT to 75,000 DWT at Berth 4. The sulfur will be stored in an enclosed building and loaded into railcars. Each train will have a capacity of approximately 1,000 tonnes.

Storage

The sulfur storage system is designed for a capacity equal to the maximum consignment size of 75,000 tons. This represents about 45 days of the annual throughput of 600,000 tons. To calculate the size of building required to store 75,000 tonnes, we have assumed a pile base width of 45 meters, a height of 14 m, a bulk density of 1,300 kg/m^3, and an angle of repose of 30°. The required pile length will be 190 m for actual storage plus 20 m for the reclaimer maintenance bay. The total length is thus 210 m.

Stacking

A stacking conveyor with overhead tripper and telescopic loading chute to control dust emissions will be arranged in the building above the storage piles. The system will be designed to operate at 800 t/h.

Reclaim

A portal scraper reclaimer will be used to reclaim sulfur from the storage piles. The portal scraper reclaimer will be mounted on rails having a 50-meter rail gauge and will be designed to operate at 800 t/h. Sulfur trains will be loaded at an average rate of 500 t/h.

As an Option, the use of payloaders and mobile reclaim hoppers may be considered. However, since this operation may be hazardous due to the dusty and explosive nature of the product inside an enclosed building, it is recommended that the building not be fully enclosed if this alternative is selected.

Railcar Loading

The average daily throughput of sulfur will be 1,800 tons per day (600,000 tons/yr / 330 days/yr). The maximum train length will consist of 30 railcars plus two locomotives. The railcars will carry an average of 33.3 tonnes. A full train will therefore carry a consignment

of 1,000 tonnes. An average of 1.8 trains per day will arrive at the terminal. Assuming a car length of 12.0 m x 30 cars plus 2 locomotives x 22 m results in an average train length of 405 m. Loading 1,000 tons of sulfur at a rate of 500 t/h will require about 2 hours. Total time, per train, to enter the train loading track, load, and exit will be approximately 3.0 hours, which includes one hour contingency time for interruptions. Thus 1.8 Sulfur trains, representing 0.6 million tons per year will be loaded in 1.8 x 3.0 = 5.4 average hours each day, actually 6.0 hours for two trains.

Urea, Potash and Ammonium Sulfate handling

Approximately 100,000 tonnes of urea, potash, and ammonium sulfate will be received from vessels ranging in size from 10,000 DWT to 35,000 DWT. These products will be stored separately and loaded into railcars.

Storage

Urea, potash and ammonium sulfate will be unloaded by one 600 t/h grab unloader at Berth No.4. The overhead stacking conveyor with tripper and telescopic chute will be designed for 800 t/h. The storage system will be designed for a capacity equal to the average consignment size of 20,000 tons. This represents about 60% of the annual throughput. To calculate the size of building required to store 3 x 20,000 tons of urea, potash, and ammonium sulfate, we have assumed a pile base width of 45 meters, a pile height of 11.0 to 14.5 m, a bulk density of 750 to 1,200 kg/m^3, and a repose angle of 25° to 32°. The required pile lengths will be 115m, 80m, and 85m, respectively, for actual storage. To provide adequate space for access and maintenance, the building requires an inside width of 55 m and a total inside length of approximately 300m.

Railcar Loading

A front-end-loader loader is planned for feeding a mobile hopper at a reclaim rate of 500 t/h to 800 t/h. The products will then be loaded into trains at an average rate of 500 t/h. The average daily throughput of the three products will be 0.1 million tons / 330 days = 300 tons per day. With a train capacity of 700 tons (30 cars x 23.3 tons) there will be 0.43 trains per day (up to 12 trains per month) arriving at the railcar loading track. Assuming a car length of 12.0 m x 30 cars plus 2 locomotives x 22 m results in an average train length of 405 m. Loading 700 tons of the products at a rate of 350 t/h will require about 2 hours. Total time per train to enter the railcar loading track, unload, and exit will be approximately 3.0 hours,

which includes one hour contingency time for interruptions. Thus, 0.43 trains per day, representing 0.1 million tons per year will be loaded in 0.43 x 3.0 = 1.3 average hours each day. For estimation purposes, 3.0 hours for each train is assumed, or 9 hours for 3 trains per week.

Fertilizer

Fertilizer will arrive by truck and will be stored in an enclosed structure. It will then be loaded into vessels ranging in size from 10,000 DWT to 45,000 DWT.

Truck Unloading

To reduce cost, we have assumed that trucks will dump fertilizer directly into the storage shed. If desired, a truck dump hopper and feeder can be provided to feed a separate 400 t/h roof conveyor with tripper. The tripper conveyor with dust controlled telescopic loading chute will be arranged in the building over the top of the pile.

Storage

The fertilizer storage system is planned for a capacity equal to the maximum consignment size; 45,000 tons. This represents about 131 days of the annual throughput of 125,000 tons. To calculate the size of the building required to store 45,000 tons of fertilizer, we have assumed a pile base width of 45 meters, a height of 14 m, a bulk density of 1,000 kg/m^3, and an angle of repose of 30°. The pile length will be 155 meters. To provide adequate space for access and maintenance, the building requires an inside width of 50 m and a total inside length of approximately 165 m.

Reclaim

Fertilizer will be reclaimed at a rate of 800 t/h, with payloaders loading hoppers and feeders supplying a reclaim conveyor, which is arranged alongside the storage building.

Phosphate

ICS and SSPT requested that provision be made for the export of phosphate in the future. Phosphate for ICS (0.4 million tons) and SSPT (0.1 million tons) will arrive by train. An additional length of track will be required. The phosphate will be stored in separate enclosed buildings and loaded into vessels ranging from 35,000 to 80,000 DWT at berths 4 and 5. ICS

will share a storage system with SSPT, while the Phosphate Company, Phosphates de MATAM will operate its storage system separately.

Railcar Unloading

The average daily throughput of phosphate will be 1,515 tons per day (500,000 tons / 330 days). With an average train capacity of 1,011 tons (30 cars x 33.7 tons) there will be 1.5 trains (actually one to two trains) per day arriving at the terminal. Assuming a car length of 12.0 m x 30 cars plus 2 locomotives x 22 m results in an average 405 m train length. With 12.0 m x 37 cars maximum plus 2 locomotives x 22 m, the maximum train length will be 490m.

Railcars will be equipped with bottom gates for dumping into a hopper underneath the rail level. The assumed discharge rate is 10 to 12 dumping cycles per hour. Thus the average unloading rate of a 33.7 t carload ranges from 337 to 404 tons per hour. This results in the following average net unloading time for each 1,011 ton train:

Train 1,011 t / 337 t/h = 3.0 hours upper value
Train 1,011 t / 404 t/h = 2.5 hours lower value

Total time per train to enter the railcar unloading track, unload, and exit will be approximately 3.7 hours, which includes one hour contingency time for train movements and interruptions. Thus, on average, two 1,011-ton trains, may be unloaded in about 7.4 hours each day, or within one 8-hour shift.

Storage

The storage system for ICS phosphate will be designed for a capacity equal to the maximum consignment size, which is 80,000 tons. To calculate the size of building required to store 80,000 tons of phosphate, we have assumed a pile base width of 45 meters, a height of 14 m, a bulk density of 1,500 kg/m^3, and a repose angle of 30°. The required pile length will be 180 meters for actual storage. To provide adequate space for access and maintenance, these piles will be arranged in an enclosed storage shed with an inside length of 190 meters. The ICS storage shed will be arranged in line with the SSPT storage shed. Two 600 t/h stacking conveyors with traveling tripper and a telescopic chute for dust controlled discharge will be arranged above the piles on top of each building. Reclaiming at 800 t/h will be achieved by

payloaders, feeding mobile hoppers to the common reclaim conveyor in the general storage area of the Chemical Companies.

3.2.4 Description of material handling facilities planned for SSPT and Sénégal Mines

Société Sénégalaise de Phosphates de Thies (SSPT) and Sénégal Mines are both exporters of attapulgite. SSPT also requested provision to export phosphate in the future. Below, is a discussion of the truck and rail loading and unloading and storage criteria for each of these commodities.

Attapulgite

The facility planned assumes 260,000 tons per year of attapulgite will be received, with provision to increase to 500,000 tons per year in the future. Attapulgite will arrive to the facility by truck, will be stored in an enclosed building, and loaded into vessels ranging from 6,000 DWT to 12,000 DWT at Berth No.4.

Storage

The attapulgite storage system will be designed for a capacity of 20,000 tons for each exporter. To calculate the size of building required to store the attapulgite, we have assumed a pile base width of 45 meters, a height of 14 m, a bulk density of 900 kg/m^3, and a repose angle of 30°. The required pile length for actual storage will be 90 meters each. These piles will be arranged in separate storage sheds, each with an inside length of approximately 100m and a width of 50m.

Stacking

To reduce cost, we assumed that trucks will dump attapulgite directly into the storage shed. If desired, a truck dump hopper and feeder can be provided to feed a separate 400 t/h roof conveyor with an overhead tripper arranged in the building above the storage pile. The tripper conveyor will be equipped with a telescopic loading chute to control dust emissions.

Reclaiming

The 800 t/h reclaim conveyor for fertilizer will be extended and commonly utilized for reclaiming from the two attapulgite piles by using payloaders and mobile reclaim hoppers.

The future phosphate buildings shall be arranged such that payloaders and mobile hoppers can also reclaim onto this common reclaim conveyor.

3.2.5 Description of material handling facilities planned for SOCOCIM and CDS

The two cement manufacturers, SOCOCIM Industries and Les Ciments du Sahel will import gypsum, slag, and coal and export clinker. Below is a discussion of the railcar and truck loading and unloading requirements and storage criteria for each commodity.

Clinker

Clinker, from both cement manufacturers, will arrive at the facility by truck. The new facility will be designed with a capacity to receive a total of 1.7 million tons per year. The clinker will be unloaded into underground dump hoppers, stored in a closed building, and loaded into vessels ranging from 35,000 to 80,000 DWT at Berth No.3.

Storage

The clinker storage system will be designed for a capacity equal to 1.5 times the maximum consignment size (80,000 tons) resulting in a 120,000 ton capacity for each producer. This represents over 50 days of the annual throughput of 1,700,000 tons. To calculate the size of building required to store 120,000 tons of clinker, we have assumed a pile base width of 45 meters, a height of 18 m, a bulk density of 1,500 kg/m^3, and a repose angle of 40°. The required pile length for actual storage will be 380 meters (2 x 190 m). To provide adequate space for access and maintenance, the building requires an inside width of approximately 55 m and a total inside length of 400 m, which includes a 20 m maintenance bay for the portal reclaimer.

Stacking

A stacking conveyor with overhead tripper and telescopic chute, to control dust emissions, will be arranged in the building above the storage piles. The system is planned to operate at 600 t/h.

Reclaiming

Portal reclaimers designed to operate at 1,000 t/h are planed for the reclaim of clinker. Payloaders and mobile reclaim hoppers can be used to reclaim clinker from the storage piles. However, this type of system is somewhat labor-intensive and creates a dusty environment.

Coal

The coal will be unloaded at Berth No.3 and stored in two separate open storage yards. It will be reclaimed and loaded, separately for each company, into trucks with capacities ranging from 20 to 40 tons.

Storage

The storage system for coal is planned for a capacity equal to the maximum consignment size of 120,000 tons. The storage system will be arranged in two piles with a capacity of 2 x 80,000 tons in each row. This represents about 97 days of the annual throughput of 2 x 300,000 tons. To calculate the size of the footprint of the storage piles, we have assumed a pile base width of 40 m, a pile height of 16 m, a top width of 4.2 m, a repose angle of 38°, and a bulk density of 850 kg/m^3. A pile length of approximately 260 m will be required. Initially, the total coal storage area will be 300 m long (260m + 40m for stacking tripper). In the future, an additional 500,000 tons per year may be received at Berth No. 3, which will require a 10m separation and a 260m extension. Thus, the final coal storage area requires approximately a width of 100 m and a total length of 570m.

Stacking

A traveling stacker is planned to operate between the piles, receiving coal from a 1,000 t/h coal unloading machine at the berth. The peak design rate for the conveyors and the stacker will be 1,200 t/h.

Reclaiming

The two Cement Companies will share a single wheel loader, with a reclaiming rate of 400 t/h. They will also share one reclaim conveyor that will feed two separate truck loading stations, one for each cement company.

Truck Loading

With 0.3 million tons of coal per year to be loaded for each cement company and 330 operating days, the initial daily loading rate is 909 tons. This will require approximately 30

trucks of 30 ton net capacity to be loaded each day for each cement company. The truck loading stations will be designed for 10 to 12 trucks per hour (300 to 360 t/h) and the conveyor feeding design rate shall be 400 t/h. Each truck loading station will be occupied for less than three hours. This allows truck loading for one customer to be scheduled in the morning and the truck loading for the other customer to be scheduled in the afternoon. This provides ample time for cleaning between products.

Gypsum

The facility will receive 180,000 tons per year of gypsum from 30,000 DWT to 60,000 DWT vessels at Berth 3. The gypsum will be stored in an enclosed building, and loaded into trucks ranging in capacity from 20 to 40 tons.

Storage

The gypsum storage system will be designed for a capacity equal to the maximum consignment size of 2 x 60,000 tons. This represents about 240 days of the annual throughput of 180,000 tons. To calculate the size of building required to store the gypsum, we have assumed a pile base width of 45 meters, a height of 17 m, a bulk density of 1,200 kg/m^3, and a repose angle of 38°. The required pile length, for actual storage, will be 2 x 135 m. To provide adequate space for access and maintenance, the total inside building dimensions require an inside width of 55 m and a total inside length of approximately 280 m.

Stacking

An overhead stacking conveyor with tripper and telescopic chute for control of dust emissions is planned to operate at 1,200 t/h.

Reclaiming

To reclaim the gypsum, a wheel loader will feed a mobile hopper. The reclaim rate is planned to be 400 t/h.

Slag

The facility will receive 40,000 tons per year of slag from 20,000 DWT to 30,000 DWT vessels at Berth 3. Slag will be stored in an enclosed building, and will be loaded into trucks ranging in capacity from 20 to 40 tons.

Storage

The slag storage system will be designed for a capacity equal to the maximum consignment size of 30,000 tons carried in a 30,000 DWT vessel. This represents about 273 days of the annual throughput of 40,000 tons. To calculate the size of building required to store the gypsum, we have assumed a pile base width of 45 meters, a height of 14.5 m, a bulk density of 1,700 kg/m^3, and a repose angle of 32°. For actual storage, the required pile length will be 2 x 70 m. The storage building for slag will be an extension of the gypsum storage building. Since slag will be unloaded by the same 1,000 t/h grab unloader at Berth No.3, the overhead stacking conveyor for gypsum will be extended to the slag storage area.

Truck Loading

Initially, payloaders will load both gypsum and slag into trucks at the storage sheds. If desired, a common reclaim conveyor can be installed to feed a truck loading station. In this case, wheel loaders feeding mobile hoppers will perform reclaiming. The common reclaim conveyor will feed two truck loading stations for gypsum and two truck loading stations for slag at a rate of 400 t/h. Gypsum will require 18 trucks per day and slag will require 4 trucks per day.

3.2.6 Description of material handling facilities planned for Phosphates de MATAM

Provision to receive 1,500,000 tons of phosphate per year by rail has been made to accommodate the potential development of the Phosphates de MATAM project. The phosphate will be handled in a loop track that will be constructed as an expansion of the ladder track system. The phosphate will be stored in an enclosed building and loaded into vessels ranging from 35,000 to 80,000 DWT at a berth to be constructed in the future.

Railcar Unloading

The facility shall be designed to receive an average daily throughput of phosphate for Phosphates de MATAM of 4,545 tons per day (1.5 million tons / 330 days). With an average

train capacity of 3,030 tons (90 cars x 33.7 tons) there will be 1.5 trains per day arriving at the terminal. Assuming 90 cars, each with a length of 12.0 m and 2 locomotives at 22 m each, the average train length will be 1,124 m. The maximum train length would be 1,244 m, assuming 100 cars.

Railcars will be equipped with bottom gates for dumping into a hopper underneath the rail level. The assumed discharge rate is 14 to 16 dumping cycles per hour. Thus, the average unloading rate of a 33.7 t carload ranges from 472 to 539 tons per hour. This results in the following average net unloading time for each 3,030 ton train:

Maximum Unloading Time:	Train 3,030 t / 472 t/h = 6.4 hours
Minimum Unloading Time:	Train 3,030 t / 539 t/h = 5.6 hours

The total time required per train to enter the loop, unload and exit the loop will be approximately 7.0 hours, which includes one hour for contingencies for train movements and interruptions. Thus, on average, two 3,030-ton trains may be unloaded in about 14 hours a day, or within two 8-hour shifts.

Storage

The phosphate storage area is planned for an 80,000 ton consignment, which requires an enclosed storage shed with an inside width of 50 m and a total inside length of 190m, to provide adequate space for access and maintenance.

Reclaiming

A tunnel reclaim conveyor is planned under the phosphate pile centerline. There will be multiple floor openings, multiple hoppers, and feeders that feed the tunnel reclaim conveyor.

3.2.7 Description of material handling facilities planned for CAMEC commodities

The storage yard plans include space reserved for CAMEC, which plans to import coal and export alumina in the future. Below is a discussion of the railcar loading and unloading requirements and storage criteria for each commodity.

Alumina

The facility is planned to receive 3 million tons per year of alumina by railroad. Alumina will be stored in silos, and loaded into vessels, ranging from 35,000 to 120,000 DWT. The average daily throughput of alumina will be approximately 9,090 tons per day (3.0 million / 330 days).

Railcar Unloading

With an average train capacity of 3,030 tons (90 cars x 33.7 tons) there will be three trains per day arriving at the terminal. Assuming 90 cars at a length of 12.0 m each and 2 locomotives at 22 m, the average train length is 1,124 m. The maximum train length will be 1,244 m, assuming a maximum of 100 cars.

Railcars will be equipped with bottom gates for dumping into a hopper underneath the rail level. The assumed discharge rate is 14 to 16 dumping cycles per hour. Thus, the average unloading rate of a 33.7 t carload ranges from 472 to 539 tons per hour. This results in the following average net unloading time for each 3,030 ton train:

Maximum: Train 3,030 t / 472 t/h = 6.4 hours
Minimum: Train 3,030 t / 539 t/h = 5.6 hours

The total time per train to enter the loop, unload, and exit the loop will be approximately 7.0 hours, which includes an hour of contingencies for train movements and interruptions. Thus, on average, three 3,030 ton trains, representing 3.0 million tons per year, will be unloaded in about 19.5 hours each day.

Coal

In addition to the 1,200,000 tons of coal for the Power Companies, there will be another 500,000 tons of coal unloaded for CAMEC, in the future. See coal handling description above for the cement companies.

3.3 PRODUCT SAMPLING AND INVENTORY

Quality control measures are required for all products handled at the terminal. Quality control will primarily be performed at sampling stations located at one of the outgoing and incoming conveyor transfer stations, before conveying product to the shiploading berth, or after unloading the product from ships. In addition to product sampling requirements, there will be various product weighing systems throughout the terminal. Since the product weight for invoicing will be based on vessel draught, there is no need for elaborate weighing systems when loading or unloading products to and from the ships. The primary purpose of the weighing systems will be for inventory purposes.

3.3.1 Sampling Station

Initially, four sampling stations are required, two for export products (clinker and fertilizer/attapulgite) and two for import products (coal/gypsum/slag and sulfur/urea/ammonium sulfate). In the future, two additional sampling stations for export products (phosphate and alumina) will be required. All sampling systems will be designed to the latest ISO Standards.

It is recommended that the primary sample cutter cut through the material flow at a conveyor transfer. Typically, these cutters produce about 1 to 10 tons per hour of material. This flow is subdivided into one flow of material for chemical sampling and one for physical sampling. Physical samples are produced to determine the lump size distribution of each material. This is achieved by feeding the product flow over laboratory screens and into weigh hoppers for periodic weighing of the separated sizes. The weighed material will be emptied and the rejects will be returned to the main product conveyors for shiploading.

Chemical samples are crushed or grinded and subdivided in several stages, until manageable sizes of sample are achieved. These samples are then analyzed in a laboratory for all required chemical properties.

3.3.2 Product Weighing

The two types of product weighing systems recommended for this terminal are belt scales for the conveyors and platform scales for truck loading. Idler belt scales are recommended for each product at the incoming and outgoing conveyors. These scales will indicate the flow rate and determine the total material received and shipped, for inventory purposes. Belt scales can usually achieve accuracies of ±0.25% within 40% to 100% of the product flow, in tons per hour.

It is recommended that truck weighing be performed for all incoming and outgoing trucks at the entrance and exit of the truck loading area. This is typically performed with platform scales, which provide accuracies of ±0.1% within 40% to 100% of the scale range.

3.3.3 SHIPLOADERS:

Conventional traveling shiploaders have been proposed as a base and are shown on the attached drawings.

The traveling shiploader at Berth No.1 for 9,000 t/h Iron Ore and 250,000 DWT vessel sizes will have approximately 18 m rail gauge and 38 m reach over the seaside rail. The enclosed longitudinal berth conveyor will be arranged at appropriate height above the berth level. A tripper car traveling along the berth conveyor will feed the shiploader boom conveyor. The shiploader will be able to travel longitudinally along the berth. It is equipped with a shuttling boom that can be raised and lowered.

Traveling shiploaders shall be provided at Berth No.3 for 1,000 t/h Clinker, at Berth No. 4 for 800 t/h fertilizer and attapulgite, at Berth No. 5 for 800 t/h Phosphates and at Berth no. 6 for 1,200 t/h Alumina. Export commodities shall be loaded into vessels up to 80,000 DWT vessels at Berths No. 3, 4 and 5 and into 120,000 DWT vessels at berth No.6. Shiploaders will have 15 m to 18 m rail gauge and 25 m to 30 m reach over the seaside rail. The type of enclosed berth conveyor, tripper car and shiploader features will be similar to those described above for Iron Ore, except that they shall be equipped with telescopic chutes (Cascade Type) to eliminate any formation of dust during ship loading. The shiploader for Alumina shall be equipped with a special boom, consisting of an "airslide" conveyor type

a) Other Types of Shiploaders

Conventional ship loaders have been proposed, which are most common and will also invite sufficient competitors. Other types of shiploaders with the potential of saving investment costs may be more special and may be subject to patent fees.

b) Slewing Type Shiploaders

Slewing type shiploaders have been built for vessels up to 80,000 DWT. They are consisting of a bridge traveling on circular rails and an upper shuttle with raising boom. For larger vessel sizes, this will require two slewing machines at each berth, with the approach conveyor splitting the flow to either of the two shiploaders at full design capacity. The

requirement of two individual loaders will be desirable for operations, since one shiploader can be loading into one ship's hold, while the other loader is placed over the hold next to be loaded. Thus, without stopping the conveyor, the flow of product is directed to this other shiploader. However, the system of two shiploaders will lead to a higher budget cost for the loaders without the benefit of savings in the marine support structures.

c) Dual Linear Shiploaders

Dual linear shiploaders consist of a bridge that moves longitudinally on linear tracks along the berth, while another set of linear tracks arranged perpendicularly for travel at the other end of the bridge compensates for such linear berth travel. The shiploader is equipped with an upper shuttle and luffing boom. The approach conveyor for this shiploader has to be equipped with a shuttling head end, compensating for the linear movement of the bridge tail. This type of shiploader requires 10 to 15 minutes relocation time between ships' hold. While this type of shiploader is somewhat more expensive compared to the conventional traveling loader, there are substantial savings in marine structures, requiring a much shorter berth compared to the conventional arrangement. A typical shiploader for 10,000 t/h iron ore serving 230,000 DWT vessels operates in SEPETIBA Bay in Brazil, having a service weight of 1,250 tons, including the shuttling head end of the approach conveyor.

d) Twin Orbiting Shiploaders

Twin orbiting shiploaders_consist of two slewing shiploaders traveling on circular tracks. Same as described above for the slewing shiploaders, the product flow is directed to either shiploader, with the operational advantage to minimize the shifting time from one ship's hold to another. Here, due to the perpendicular arrangement of the circular tracks substantial savings in marine structure are possible.

e) Conclusion

To determine, which shiploading system will be the most suitable from an operational point of view at reasonably low budget cost shall be performed in a separate investigation, subject to a future more detailed study.

SHIP UNLOADERS:

Since several different commodities have to be unloaded (Coal, Gypsum, Slag, Sulfur, Urea, Potash and Ammonium sulfate) it is recommended to install gantry type grab unloaders. That

type of unloader will be more flexible to accommodate different types of material, utilizing various types and sizes of grab buckets suitable for each product. Grab Unloaders are required at Berth No.2 for Coal, at Berth No. 3 for Coal, Gypsum and Slag and at Berth No. 4 for Sulfur, Urea, Potash and Ammonium Sulfate.

The unloader at Berth No. 3 shall travel on the same rail gauge as proposed for the ship loader. At Berth No.4 the Chemical Company ICS has proposed to install their existing combined shiploader/unloader. The feasibility of that proposal has to be further analyzed with regard to design capacity, rail gauge and boom reach versus vessel sizes.

The reach of the grab unloader bucket over the front rail at berth No.2 shall be approximately 35m to accommodate Coal vessels up to 140,000 DWT at a free digging rate of 1,000 to 1,200 t/h. The reach of the unloaders at Berth No.3 and No.4 shall be approximately 30 m for vessels up to 80,000 DWT and they shall be designed for a free digging rate of 1,000 to 1,200 t/h at Berth No.3 and 600 to 700 t/h at berth No.4.

The crane lifting capacity of the machines will range from 30 tons to 36 tons at Berth No. 2 and Berth No.3. Berth No.4 will require a crane capacity range of 15 to 20 tons. Depending on vessel sizes and operator skill, these machines can achieve 50 to 70 digging and unloading cycles per hour to achieve the above free digging rates. The grab unloaders will unload the product to individual berth conveyors.

Cleaning between products is necessary at Berth No.3 between Coal, Gypsum and Slag and at Berth No.4 between Sulfur, Urea, Potash and Ammonium Sulfate. This will not be a problem since the occupancy of these conveyors is moderate, leaving sufficient time for cleaning between vessel arrivals.

3.4 SUMMARY TABLES

The commodity unloading, loading, and storage activities are summarized in the tables on the following pages, as listed below:

Ship Loading and Unloading Operations

Table 3.4.1 Berth Operations for Export & Import Commodities – PHASE 1

Table 3.4.2 Berth Operations for Export & Import Commodities – PHASE 2

Belt Conveyor Sizing

Table 3.4.3 Conveyor Belt Sizes for Export Commodities – PHASE 1 and PHASE 2

Table 3.4.4 Conveyor Belt Sizes for Import Commodities – PHASE 1 and PHASE 2

Railroad Operations

Table 3.4.5 Railroad Operations – Export/Import Commodities – PHASE 1

Table 3.4.6 Railroad Operations – Export/Import Commodities – PHASE 2

Storage System Parameters

Table 3.4.7 Storage of Export Commodities – PHASE 1

Table 3.4.8 Storage of Export Commodities – PHASE 2

Table 3.4.9 Storage of Import Commodities – PHASE 1

Table 3.4.10 Storage of Import Commodities – PHASE 2

Budget Estimates

Table 3.4.11 Bulk Handling Equipment Budget Estimate

Table 3.4.1
Berth Operations for Export & Import Commodities – Phase 1

	Berth No.2	Berth No.3	Berth No.4
Operation	Import	Export + Import	Export + Import
Product	Coal	EX: Clinker	EX: Fertilizer & Attapulgites
		IM: Coal, Gypsum, Slag	IM: Sulfur, U., P., and AS *
Max. Vessel size	140,000 DWT	80,000 DWT	75,000 DWT
Annual throughput	1.2 M tons	2.52 M tons	1.085 M tons
Type of shiploader and unloader	Traveling gantry Crane with Grab	Traveling SL w/ luffing boom	Traveling SL w/ luffing boom
		Traveling Gantry Crane with Grab	Traveling Gantry Crane +
Nominal ship loading/unloading rate	1,000-1,200 t/h	1,000-1,200 t/h 1,000-1,200 t/h	350 t/h 600-700 t/h
Number of vessels	11- 17	37 - 76	35 – 78
Average cargo	68,000 to 109,000 tons	33,000 to 68,000 tons	14,000 to 31,000 tons
Berth transfer rate	11,500 to 13,200 tons/day	11,000 to 14,000 tons/day	5,000 to 8,000 tons/day
Berth occupancy	91 to 105 days/yr	154 to 190 days/yr	164 to 196 days/yr
Port availability	330 days/yr	330 days/yr	330 days/yr
Berth occupancy %	27 to 31%	50 to 58%	50 to 60%
Average berth occupancy per vessel	6.87 days	3.14 days	3.18 days
Average anchorage waiting per vessel	0.56 days	0.73 days	0.76 days
Total port time per vessel	7.43 days	3.87 days	3.95 days

* Urea, Potash, Ammonium Sulfate

\+ Combined Unloader/Loader to be investigated

Table 3.4.2

Berth Operations for Export & Import Commodities – Phase 2

	Berth No.3	Berth No.4	Berth No.5	Berth No.6
Operation	Export + Import	Export + Import	Export	Export
Product	EX: Clinker IM: Coal, Gypsum, Slag	EX: Fertilizer, Phos. & Attap. IM: Sulfur, U, P and AS *	Phosphates	Alumina
Max. Vessel size	80,000 DWT	80,000 DWT	80,000 DWT	120,000 DWT
Annual throughput	3.02 M tons	1.825 M tons	1.5 M tons	3.0 M tons
Type of shiploader and unloader	Traveling SL w/ luffing boom Traveling Gantry Crane with Grab	Traveling SL w/ luffing boom Traveling Gantry Crane +	Traveling SL w/ shuttling slewing luffing boom	Traveling SL w/ airslide slewing luffing boom
Nominal ship loading/ unloading rate	1,000-1,200 t/h 1,000-1,200 t/h	800 t/h 600-700 t/h	800 t/h	1,200 t/h
Number of vessels	44 - 91	61 - 130	22 – 43	27- 90
Average cargo	33,000 to 68,000 tons	14,000 to 30,000 tons	35,000 to 70,000 tons	35,000 to 100,000 tons
Berth transfer rate	11,000 to 14,000 t/d	6,000 to 12,000 t/d	12,000 to 13,000 t/d	17,000 to 19,000 t/d
Berth occupancy	208 to 236 d/yr	191 to 231 d/yr	116 to 122 d/yr	154 to 172 d/yr
Port availability	330 d/yr	330 d/yr	330 d/yr	330 d/yr
Berth occupancy %	63 to 72%	58 to 70%	35 to 37%	47 to 52%
Average berth occupancy per vessel	3.29 days	2.21 days	3.64 days	2.84 days
Average anchorage waiting per vessel	1.36 days	0.79 days	0.41 days	0.55 days
Total port time per vessel	4.65 days	3.0 days	4.05 days	3.39 days

* Urea, Potash, Ammonium Sulfate

\+ Combined Unloader/Loader to be investigated

Table 3.4.3

Conveyor Belt Sizes for Export Commodities – Phase 1 and Phase 2

	Berth 3. Clinker	**Berth 4.** Fert. & Attap.	**Berth 4 & 5** Phosphate	**Berth 6.** Alumina
Annual throughput	1.7 M tons	0.125+0.5 M tons	0.50+0.10 +1.5 M tons	3.0 M tons
Stacking rate to Storage	600 t/h from trucks	400 t/h from trucks	800 t/h from railroad	1,000 t/h from railroad
Belt Size	800 mm	800 mm	1,000 mm	1,200 mm
Belt Speed	<2.5 m/s	<2.5 m/s	<2.5 m/s	<2.5 m/s
Bulk density	1.2 t/m^3	1.0 t/m^3	1.3 t/m^3	0.9 t/m^3
Surcharge/trough angle	15°/ 40°	10°/ 40°	10°/ 40°	5°/ 45°
Reclaim and Ship Loading Rate	1,200 t/h Portal Reclaimer from storage	800 t/h Tunnel Reclaimer from storage	Reclaimer 800 t/h from storage	Silo Feeders 1,200 t/h from storage
Required Belt width	1,200 mm	1,000 mm	1,000 mm	1,400 mm
Trestle Belt Conveyor No. & Width	No.3: 1,200 mm	No.4: 1,000 mm	No.7: 1,000 mm	No.8: 1,400 mm
Belt Speed	<2.5 m/s	<2.5 m/s	<2.5 m/s	<2.5 m/s

*Future 0.4 plus 0.1 million tons of Phosphate for two Chemical Companies to be stored separately and be loaded at Berth No.4.

1.5 million tons of Phosphate for Alumina Company to be unloaded and stored separately and be loaded at Berth No.5

Table 3.4.4

Conveyor Belt Sizes for Import Commodities – Phase 1 and Phase 2

	Berth 2. Coal	**Berth 3.** Coal	**Berth 3.** Gyp. & Slag	**Berth 4.** Sulfur	**Berth 4.** U, P, AS *
Annual throughput	1.2 M tons	0.6+0.5 M tons	0.18+0.04 M tons	0.60 M tons	Up to 3x0.05 M tons
Transfer rate from ships to storage	1,000 t/h from unloader	1,000 t/h from unloader	1,000 t/h from unloader	600-700 t/h from unloader	600-700 t/h from unloader
Conveyor Design Capacity	1,200 t/h	1,200 t/h	1,200 t/h	800 t/h	800 t/h
Required Belt Width	1,200 mm	1,200 mm	1,200 mm	1,000 mm	1,000 mm
Trestle Belt Conveyor No. & Width	No.2: 1,200 mm	No.5: 1,200 mm		No.6: 1,000 mm	
Belt Speed	<3.0 m/s	<3.0 m/s	<3.0 m/s	<3.0 m/s	3.0 m/s
Bulk density	0.8 t/m^3	0.8 t/m^3	1.1+1.0 t/m^3	1.1 t/m^3	0.7-1.3 t/m^3
Surcharge /Trough Angle	20°/ 40°	20°/ 40°	15°/ 40°	10°/ 40°	5°-10°/ 40°
Reclaim and Loading Rate	1,200 t/h via conveyor	400 t/h to trucks and to future railroad	400 t/h to trucks	800 t/h to railroad	500-800 t/h to railroad
Belt Size	1,200 mm	800 mm	800 mm	1,000 mm	1,000 mm
Belt Speed	<3.0 m/s	<3.0 m/s	<2.5 m/s	<2.5 m/s	<2.5 m/s

* Urea, Potash, Ammonium Sulfate

Table 3.4.5

Railroad Operations – Export/Import Commodities – Phase 1

	IMPORTS	
	Sulfur	**Urea, Potash, Ammon. Sulfate**
Annual throughput	0.6 million tons	0.1 million tons
Type of train unloading system	Separate Railroad loop with train loading station	Separate Railroad loop with train loading station
Design rate	800 tons per hour	500 to 800 tons per hour
Railroad availability	330 days/year	330 days/year
Train tonnage per day	1,800 tons	300 tons
Average train size	1,000 tons	700 tons
Average train length	405 m	405 m
Max. Train length	490 m	490 m
Avg. number of trains per day	1.8	0.43
Avg. number of cars per train	30	30
Max. number of cars per train	37	37
Average car load	33.3 tons	23.3 tons
Train net unloading or loading time	2.0 hours	2.0 hours
Avg. train residence time in loop	~2.0+1.0 = 3.0 hours	~2.0+1.0 = 3.0 hours
Avg. train residence time per day	1.8 x 3.0 = 5.4 hrs	0.43 x 3.0 = 1.3 hrs
Avg. unloading or loading rate	500 t/h	350 t/h
Nominal design rate for conveying system	Reclaiming: 800 t/h	Reclaiming: 500 to 800 t/h

Table 3.4.6
Railroad Operations – Export/Import Commodities – Phase 2

	EXPORTS			IMPORTS
	Phosphates	**Phosphates**	**Alumina**	**Coal**
Annual throughput	0.5 M tons*	1.5 M tons*	3.0 M tons	0.5 M tons
Type of train unloading system	Separate Railroad with bottom dump hopper	Separate Railroad loop with bottom dump hopper		Separate Railroad loop w/ train loading station
Design rate	10-12 railcar dumps per hour	14 - 16 railcar dumps per hour	14 - 16 railcar dumps per hour	800 tons per hour
Railroad availability	330 d/yr	330 d/yr	330 d/yr	330 days/yr
Train tonnage per day	1,515 tons	6,060 tons	9,090 tons	1,500 tons
Average train size	1,011 tons	3,030 tons	3,030 tons	1,000 tons
Average train length	405 m	1,125 m	1,125 m	405 m
Max. Train length	490 m	1,245 m	1,245 m	490 m
Avg. No. of trains per day	1.5	1.5	3.0	1.5
Avg. No. of cars per train	30	90	90	30
Max. No. of cars per train	37	100	100	37
Avg. car load	33.7 tons	33.7 tons	33.7 tons	33.3 tons
Train net unloading or loading time	2.5 to 3.0 hours	5.6 to 6.4 hours	5.6 to 6.4 hours	2.0 hours
Average Train residence time in loop	~2.7+1.0=3.7 hours	~6.0+1.0 = 7.0 hours	~6.0+1.0 = 7.0 hours	~2.0+1.0 = 3.0 hours
Average Train residence time per day	1.5 x 3.7 = 5.6 hours	1.5 x 7.0 = 10.5 hrs	3 x 7.0 = 21.0 hrs	1.5 x 3.0 = 4.5 hrs
Average unloading or loading rate	370 t/h	505 t/h	505 t/h	500 t/h
Nominal design rate for conveying system	Stacking: 600 t/h	Stacking: 800 t/h	Stacking: 800 t/h	Reclaiming: 800 t/h

* Future 0.4 plus 0.1 million tons of Phosphate for two Chemical Companies to be unloaded and stored separately and be loaded at Berth No.4.

Table 3.4.7

Storage of Export Commodities – Phase 1

	Clinker	Fertilizer	Attapulgite
Bulk density	1.2-1.5 t/m^3	1.0 t/m^3	0.9-1.2 t/m^3
Annual throughput	1.7 M tons.	0.125 M tons	0.26 M tons
Total Open storage	-	-	-
Total Covered storage	0.24 M tons	0.045 M tons	0.040 M tons
No of piles	2	1	2
Pile capacity ea.	120,000 tons	45,000 tons	20,000 tons
Pile dimensions B x H x L	45 x 18 x 190 m	45 x 14 x 155 m	45 x 14 x 90 m
Stacking capacity	600 t/h from trucks	400 t/h from trucks	400 t/h from trucks
Reclaim capacity	1,200 t/h to shiploader	800 t/h to shiploader	

Table 3.4.8

Storage of Export Commodities – Phase 2

	Phosphates	Alumina	Clinker	Fertilizer	Attapulgite
Bulk density	1.3-1.55 t/m^3	0.8-1.04 t/m^3	1.2-1.5 t/m^3	1.0 t/m^3	0.9-1.2 t/m^3
Annual throughput	2.0 M tons *	3.0 M tons	1.7 M tons	0.125 M tons	0.5 M tons
Total Open storage	-	-	-	-	-
Total Covered storage	0.20 mill. T	0.12 mill. T	0.24 mill. t	0.045 mill. t	0.040 mill. t
No of piles	3	3 silos	2	1	2
Pile capacity ea.	2 x 80,000 t + 40,000 t	40,000 t	120,000 t	45,000 t	20,000 t
Pile dimensions B x H x L	45 x 14 x 170 m	45m dia. x 40m high	45 x 18 x 190 m	45 x 14 x 155 m	45 x 14 x 90 m
Stacking capacity	800 t/h from railroad	1,000 t/h from railroad	600 t/h from trucks	400 t/h from trucks	400 t/h from trucks
Reclaim capacity	800 t/h to shiploader	1,200 t/h to shiploader	1,200 t/h to shiploader	800 t/h to shiploader	

* Future 0.4 plus 0.1 million tons of Phosphate for two Chemical Companies to be unloaded and stored separately and be loaded at Berth No.4.

Table 3.4.9
Storage of Import Commodities – Phase 1

	Coal	Sulfur	Gypsum	Slag	U, P, AS *
Bulk density	0.8-0.95 t/m^3	1.1-1.35 t/m^3	1.1-1.3 t/m^3	1.6-1.7 t/m^3	0.7-1.3 t/m^3
Annual throughput	0.6 M tons	0.6 M tons	0.18 M tons	0.04 M tons	3 x 0.033 M tons
Total Open storage	0.16 M tons	-	-	-	-
Total Covered storage	-	0.075 M tons	0.12 M tons	0.06 M tons	0.06 M tons
No of piles	2	1	2	2	3
Pile capacity	80,000 tons	75,000 tons	60,000 tons	30,000 tons	20,000 tons
Pile dimensions B x H x L	40 x 16 x 260 m	45 x 14 x 195 m	45 x 17 x 135 m	45 x 14 x 70 m	45 x 14 x 280 m (total)
Stacking capacity	1,200 t/h from ships	800 t/h from ships	1,200 t/h		800 t/h
Reclaim capacity	400 t/h to trucks	800 t/h to railroad	400 t/h to trucks	400 t/h to trucks	500-800 t/h to railroad

* Urea, Potash, Ammonium Sulfate

Table 3.4.10
Storage of Import Commodities – Phase 2

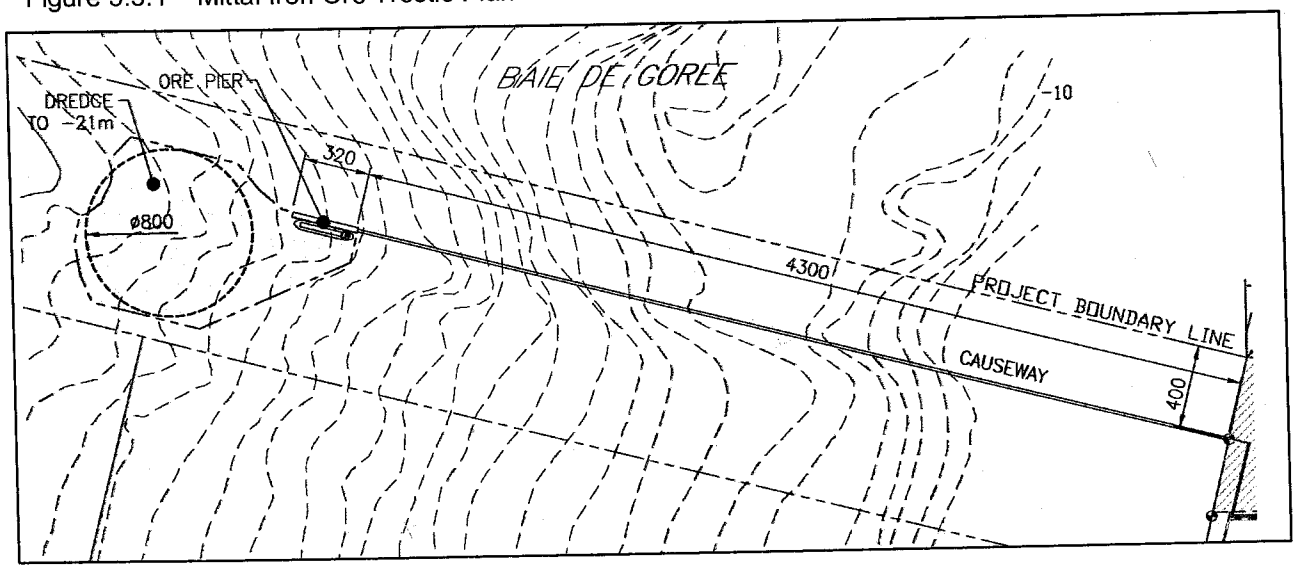
	Coal	Sulfur	Gypsum	Slag	U, P, AS *
Bulk density	0.8-0.95 t/m^3	1.1-1.35 t/m^3	1.1-1.3 t/m^3	1.6-1.7 t/m^3	0.7-1.3 t/m^3
Annual throughput	1.1 M tons	0.6 M tons	0.18 M tons	0.04 M tons	3 x 0.05 M tons
Total open storage	0.24 M tons	-	-	-	-
Total covered storage	-	0.15 M tons	0.12 M tons	0.06 M tons	0.06 M tons
No of piles	3	2	2	2	3
Pile capacity	80,000 tons	75,000 tons	60,000 tons	30,000 tons	20,000 tons
Pile dimensions B x H x L	40 x 16 x 260 m	45 x 14 x 195 m	45 x 17 x 135 m	45 x 14 x 70 m	45 x 14 x 280 m total
Stacking capacity	1,200 t/h from ships	800 t/h from ships	1,200 t/h		800 t/h
Reclaim capacity	400 t/h to trucks + railroad	800 t/h to railroad	400 t/h to trucks	400 t/h to trucks	500-800 t/h to railroad

3.5 TRESTLE

There will be varying sizes of vessels utilized at each of the berths described in Section 3.2, for handling the multiple bulk commodities at the Port of Bargny. Each berth must be accessible by the largest anticipated vessels at their full load. To provide access to these berths, the two options are to dredge a channel towards the terminal or to extend a pier out to the necessary depth, which is dictated by the loaded draft of the largest expected vessel. Due to the initial capital costs associated with dredging an adequate access channel towards the terminal and the subsequent maintenance dredging requirements, it was determined that constructing a pier is the preferred option for this project.

Mittal has plans to construct a trestle for their iron ore export activities. The trestle will extend approximately 4300 meters from the shoreline, where the water depth is approximately 18 meters. Mittal will also dredge an additional 3 meters for a total access channel depth of 21 meters. The Mittal trestle plan is shown in Figure 3.5.1.

Figure 3.5.1 – Mittal Iron Ore Trestle Plan



To accommodate the access road and a 60-inch iron ore conveyor, the minimum Mittal trestle width is 9 meters. Every 490 meters there will also be a 40 meter long, 3.5 meter wide bypass lane. Typical sections of the trestle with and without the bypass road are shown in Figures 3.5.2 and 3.5.3.

Figure 3.5.2 Typical Section - Iron Ore Trestle With Bypass Lane

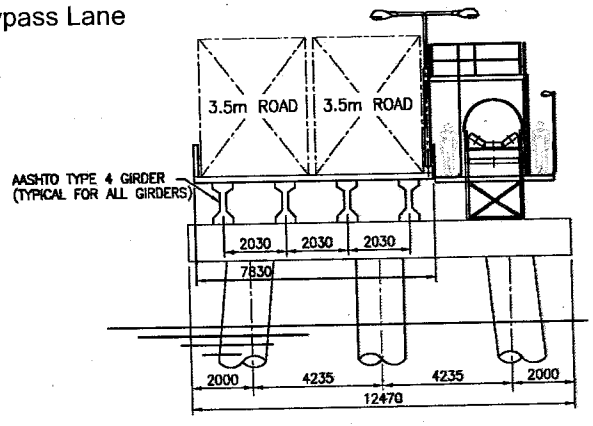
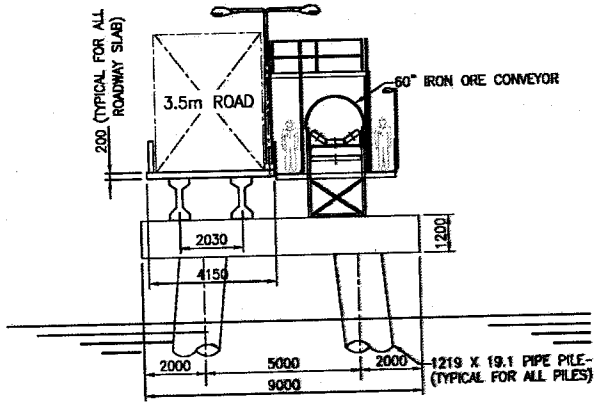
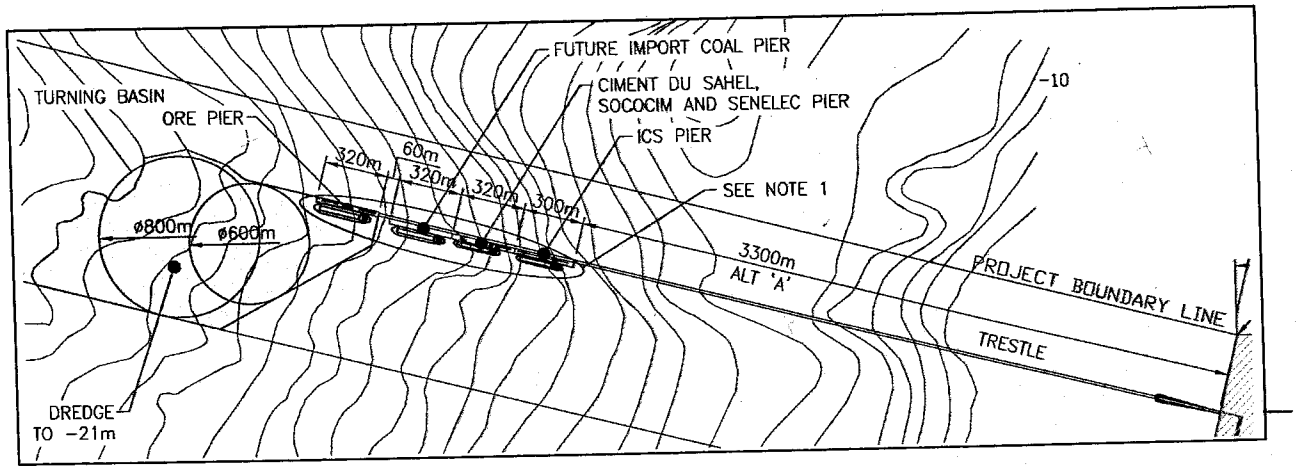


Figure 3.5.3 Typical Section - Iron Ore Trestle



The additional multi-commodity bulk handling activities will initially require three additional berths and conveyors. The multi-commodity berths will not be required to support vessels as large as Mittal's berth and therefore do not need to extend as far off the shoreline and do not require any additional dredging. To meet the depth requirements for the other commodities, the first of the three additional berths needs to extend approximately 3300 meters from the shoreline. The cost of constructing a second trestle, 3300 meters in length would be very expensive and therefore the stakeholders discussed the option of increasing the width of the proposed Mittal trestle to handle the additional conveyors. The shared trestle plan is shown in Figure 3.5.4

Figure 3.5.4 – Multi-Commodity Trestle Plan



To accommodate the additional conveyors, the minimum trestle width increases to 17 meters, with the periodic bypass sections, increasing to 20.5 meters. Typical sections of the wider trestle with and without the bypass road are shown in Figures 3.5.5 and 3.5.6.

Figure 3.5.5 Typical Section – Multi-Commodity Trestle With Bypass

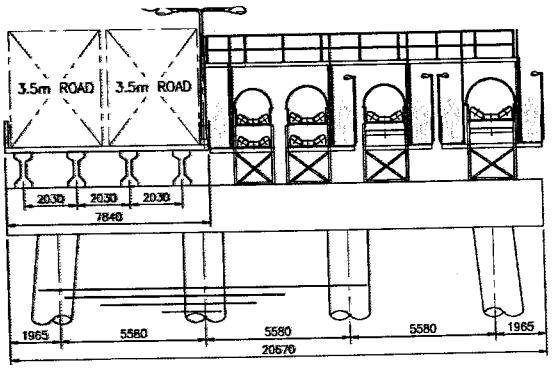
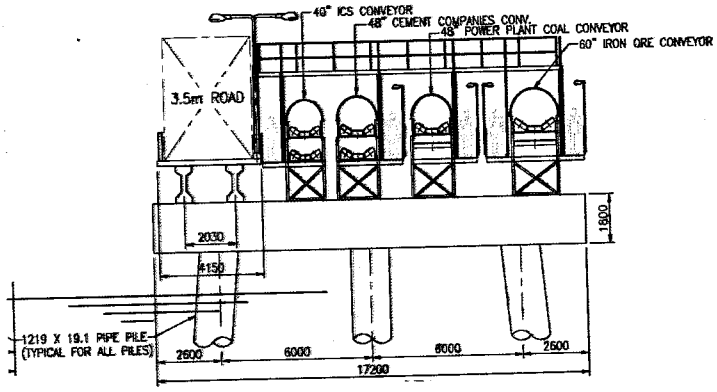


Figure 3.5.6 Typical Section – Multi-Commodity Trestle



Increasing the width of the Mittal trestle to support the additional conveyors for the other bulk commodities will require larger bents and subsequently an additional pile at each bent. Table 3.5.1 summarizes the costs of the components that vary with the size of the trestle. The table is only intended to provide the costs of increasing the width of the trestle and therefore costs for the components that are required regardless of the width of the trestle, such as mobilization/demobilization and the causeway, are not included in the estimate. For a detailed estimate of all costs, refer to Section 4. As seen in Table 3.5.1, the additional cost for increasing the width of the trestle is approximately $11.5M, which is much more cost-efficient than constructing a separate trestle.

Table 3.5.1

Description	Iron Ore Only Trestle (9 m)	Multi-Commodity Trestle (17 m)
Pilings	$11,900,000	$16,000,000
Concrete Pile Caps	$2,700,000	$6,000,000
AASHTO Type IV Girders	$3,100,000	$3,100,000
Deck Slab	$4,100,000	$5,100,000
Office, Facilities, Tools & Running Costs	$11,000,000	$12,300,000
Insurance/Bonds & Engineering Services	$2,800,000	$3,600,000
Contingency	$3,600,000	$4,600,000
TOTAL	**$39,200,000**	**$50,700,000**
	Cost Difference	**+ $11,500,000**

The current plan for the terminal is to construct the shared trestle for all commodities, as shown in Figures 3.5.4, 3.5.5 and 3.5.6. However, some additional consideration should be given to sharing the trestle with the Energy Allied Project. Currently, Energy Allied has plans to construct a new pier, approximately 700 meters from the multi-commodity trestle and approximately 3300 meters long. The pier would support approximately 6 pipelines for the conveyance of petroleum products. To support these pipelines on the shared pier, the trestle would increase in width by approximately 3 meters and the petroleum products berths would be constructed at the end of the multi commodity pier, as shown in Figure 3.5.7. The 3-meter trestle expansion would be as shown in Figures 3.5.8 and 3.5.9.

Figure 3.5.7 Typical Section – Shared Trestle Plan (Multi-Commodity and Energy Allied)

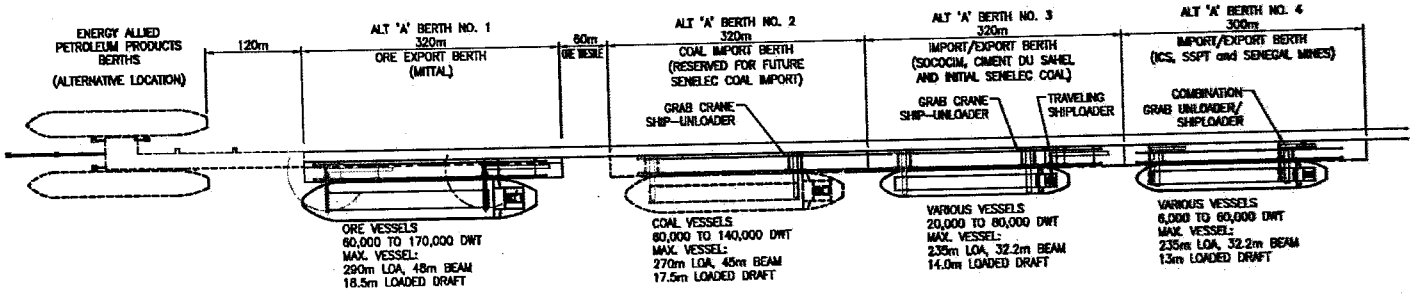


Figure 3.5.8 Typical Section – Shared Trestle (Multi-Commodity and Energy Allied) With Bypass Lane

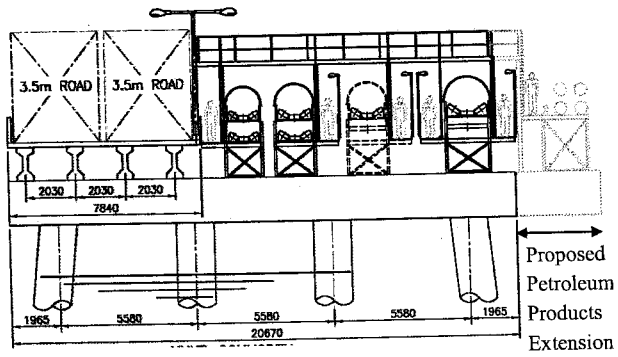
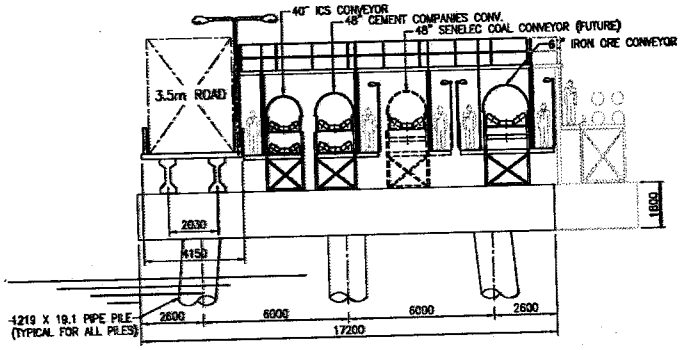


Figure 3.5.9 Typical Section – Shared Trestle (Multi-Commodity and Energy Allied)



No cost estimates have been prepared, nor have the advantages and disadvantages for the shared pier alternative been evaluated. The capital costs associated with the expansion of the single pier will likely be less than the construction of a second stand-alone pier. By sharing the expansion of the Mittal pier costs among more stakeholders, the investment required by each stakeholder will decrease. However, there may be a number of logistical or other non-economic factors that may make this shared option less feasible. This option needs to be discussed among the stakeholders, before further consideration is given to its feasibility.

Chapter 4
Economic and Financial Analysis

4.0 Introduction

An economic and financial analysis was developed to demonstrate the feasibility of constructing and operating the proposed multi-commodity bulk port at Bargny-Sendou. A financial model was built to present the estimated revenues, costs, and financial returns for each of the three stakeholder groups. Projections were made until 2034. Operating data and estimates of investment costs are used to derive income statements, balance sheets and cash flows in order to evaluate the financial viability of this project.

4.1 Approach

The overall financial viability analysis is dependent on:

- the overall investment costs necessary to establish the required facilities,
- the operating costs to run and maintain the facility, and
- the throughput forecasted by each stakeholder group.

The planning criterion for the multi-commodity port, as described in Chapter 3, separates the facilities between three groups of stakeholders, namely:

1. Senelec
2. SOCOCIM and CDS
3. ICS, SSPT, and Senegal Mines

The analysis assumes that each stakeholder group will create a Special Purpose Company (SPC) to finance, build, and operate its facilities. A terminal handling charge (THC) per ton of throughput has been calculated for each group based on the investment required for the throughput forecasted and the cost to operate the facility at that throughput. The THC represents the fee that the SPC created to construct and operate the facility would have to charge the stakeholder to break even on its investment. This break-even fee is calculated by setting the present value of net cash flows generated by the project equal to zero (NPV = 0). The project therefore adds no monetary value to the stakeholders. The decision to build the project is based on other criteria, such as return on sales of commodities, which are not explicitly included in the calculation.

Income statements, balance sheets and cash flow statements are presented for years 2009 (launch of construction) to 2034. The timing is as follows:

2009- Begin construction, secure financing (20 year financing with a 3 year grace period for principal reimbursement). Infrastructure investments depreciated over a 20 year life

2010- Construction continues

2011- Construction ends in 2nd Quarter; operations begin in 3rd Quarter

2028- First long term loan (investment financing) reimbursed

2028-2030- First infrastructure investments depreciated

2031- 20 year anniversary of launch of operations (end of evaluation period).

4.2 Investments

The investment consists of the cost to build and operate the proposed facilities. The details of the investment required are presented below in a summary format for each stakeholder group. The investment period is assumed to occur over a period of 30 months.

Table 4.1 presents a summary of the investment costs to build the facilities required for Senelec to import 1.2 million tonnes per year of coal.

Table 4.2 presents a summary of the investment costs to build the facilities required for SOCOCIM and Ciment du Sahel to import 180,000 tonnes per year of gypsum, 40,000 tonnes per year of slag, 600,000 tonnes per year of coal and to export 1.7 million tonnes per year of clinker.

Table 4.3 presents a summary of the investment costs to build the facilities required for ICS to import 700,000 tonnes per year of Sulfur, Urea, Potash, Ammonium Sulfate, and for ICS, SSPT, and Senegal Mines to export 125,000 tonnes per year of fertilizer and 260,000 tonnes per year of attapulgite.

TABLE 4.1
Capital Investments for Senelec Facilities

MIFERSO Multi-Commodity Bulk Port PRELIMINARY PROGRAM BUDGET ESTIMATE - Senelec Imports: 1.2 Mtpy Coal	UNITS	QTY	$/UNIT	Total	2009 Capital Investment	2010 Capital Investment	2011 Capital Investment
PILE SUPPORTED PIER							
Pile supported pier with concrete deck	lin.m.	320	$45,540	$14,572,800	$14,572,800		
Cathodic Protection	lin.m.	320	$1,280	$409,600	$ 204,800	$ 204,800	
Fenders	lin.m.	320	$1,500	$480,000	$ 240,000	$ 240,000	
Bollards and Marine Fittings	lin.m.	320	$330	$105,600	$ 52,800	$ 52,800	
Machine Runway	lin.m.	320	$780	$249,600	$ 124,800	$ 124,800	
Sub-total				**$15,817,600**	**$ 15,195,200**	**$ 622,400**	
BACKLAND SITE PREPARATION							
Clearing and Stripping	hectare	3.57	$12,000	$42,840	$ 21,420	$ 21,420	
BACKLAND UTILITIES							
Grading & Stormwater Drainage	hectare	3.57	$30,000	$107,100	$107,100		
Potable Water & Sanitary Sewer	LS	1	$400,000	$400,000		$ 200,000	$ 200,000
Fire Protection	LS	1	$400,000	$400,000		$ 200,000	$ 200,000
Sub-total				**$907,100**	**$ 107,100**	**$ 400,000**	**$ 400,000**
TRANSPORTATION							
Heavy duty pavement including base	m2	35,700	$66	$2,356,200		$ 1,178,100	$ 1,178,100
Railway tracks	lm	0	$410	$0			
Sub-total				**$2,356,200**		**$ 1,178,100**	**$ 1,178,100**
BULK HANDLING EQUIPMENT							
Conveyors, Loaders, Sampling Stations, Transfer Stations, etc.	LS	1	$30,430,000	$30,430,000		$ 22,822,500	$ 7,607,500
Wheel Loaders	LS	1	$1,000,000	$1,000,000			$1,000,000
Warehouses	LS	0	$0	$0			
Foundations/Civil	LS	1	$1,100,000	$1,100,000	$ 550,000	$ 550,000	
Spare Parts	LS	1	$1,466,203	$1,466,203		$ 733,102	$ 733,102
Sub-total				**$33,996,203**	**$ 550,000**	**$ 24,105,602**	**$ 9,340,602**
ELECTRICAL EQUIPMENT							
Electric equipment, MCC's, power distribution, controls, lighting & grounding	LS	1	$5,225,066	$5,225,066		$ 3,918,800	$ 1,306,267
Sub-total				**$5,225,066**		**$ 3,918,800**	**$ 1,306,267**
SUB-TOTAL				**$58,345,009**	**$ 15,873,720**	**$ 30,246,321**	**$ 12,224,968**
PORTION OF SHARED EXPENSES							
Project Site Expenses							
Dredging and Mob/Demob	m3	0	$841,400	$0			
Causeway - Quarry Run and Armor Layer	LS	1	$1,380,443	$1,380,443	$1,380,443		
Clearing/Stripping	LS	1	$28,960	$28,960	$28,960		
Pile Supported Trestle	LS	1	$3,833,333	$3,833,333	$ 3,833,333		
Pavement	LS	1	$2,060,300	$2,060,300	$ -	$ 1,030,150	$ 1,030,150
Electrical	LS	1	$2,291,000	$2,291,000		$ 1,145,500	$ 1,145,500
Administration Building (assumed to be at Power Plant)	EA	0	$0	$0			
Maintenance and Storage Building (assumed to be at Power Plant)	EA	0	$0	$0			
Sub-total				**$9,594,036**	**$ 5,242,736**	**$ 2,175,650**	**$ 2,175,650**
Additional Project Expenses							
Bonding and Insurance (2%)	LS	1	$1,358,781	$1,358,781	$ 1,358,781		
Mobilize/Demobilize	LS	1	$2,000,000	$2,000,000	$ 1,500,000		$ 500,000
Engineering and Construction Management (6%)	LS	1	$4,076,343	$4,076,343	$ 1,358,781	$ 1,358,781	$ 1,358,781
Contingency (10%)	LS	1	$7,537,417	$7,537,417		$ 3,768,708	$ 3,768,708
Tugs, pilot boats & Nav. Equipment	LS	1	$3,333,333	$3,333,333			$ 3,333,333
Sub-total				**$18,305,874**	**$ 4,217,562**	**$ 5,127,489**	**$ 8,960,823**
Senelec Sub-Total				**$86,244,919**	**$ 25,334,018**	**$ 37,549,460**	**$ 23,361,441**

TABLE 4.2
Capital Investments for SOCOCIM & Ciment du Sahel

MIFERSO Multi-Commodity Bulk Port **PRELIMINARY PROGRAM BUDGET ESTIMATE - SOCOCIM & Ciment du Sahel** **Export 1.7 Mtpy Clinker** Import **180,000 tpy Gypsum, 40,000 tpy Slag, and 600,000 tpy Coal**					**2009 Capital Investment**	**2010 Capital Investment**	**2011 Capital Investment**
	UNITS	**QTY**	**$/UNIT**	**Total**			30 MONTHS TOTAL
PILE SUPPORTED PIER (SOCOCIM & Ciment du Sahel)							
Pile supported wharf with concrete deck	lin.m.	320	$45,540	$14,572,800	$ 14,572,800		
Cathodic Protection	lin.m.	320	$1,280	$409,600	$ 204,800	$ 204,800	
Fenders	lin.m.	320	$1,500	$480,000	$ 240,000	$ 240,000	
Bollards and Marine Fittings	lin.m.	320	$330	$105,600	$ 52,800	$ 52,800	
Machine Runway	lin.m.	320	$780	$249,600	$ 124,800	$ 124,800	
Sub-total				**$15,817,600**	**$ 15,195,200**	**$ 622,400**	$ -
BACKLAND SITE PREPARATION							
Clearing and Stripping	hectare	17.75	$12,000	**$213,000**	**$ 213,000**	$ -	$ -
BACKLAND UTILITIES							
Grading & Stormwater Drainage	hectare	17.75	$30,000	$532,500	$ 266,250	$ 266,250	
Potable Water & Sanitary Sewer	LS	1	$400,000	$400,000		$ 200,000	$ 200,000
Fire Protection	LS	1	$400,000	$400,000		$ 200,000	$ 200,000
Sub-total				**$1,332,500**	**$ 266,250**	**$ 666,250**	**$ 400,000**
CIRCULATION							
Heavy duty pavement including base	m2	41,300	$66	$2,725,800		$ 1,362,900	$ 1,362,900
Railway tracks	lm	0	$410	$0		$ -	$ -
Sub-total				**$2,725,800**		**$ 1,362,900**	**$ 1,362,900**
BULK HANDLING EQUIPMENT							
Conveyors, Loaders, Sampling Stations, Transfer Stations, etc.	LS	1	$68,703,698	$68,703,698		$ 34,351,849	$ 34,351,849
Wheel Loaders	LS	1	$3,000,000	$3,000,000		$ 1,500,000	$ 1,500,000
Warehouses	LS	1	$10,300,000	$10,300,000		$ 5,150,000	$ 5,150,000
Foundations/Civil	LS	1	$7,380,000	$7,380,000	$ 3,690,000	$ 3,690,000	
Spare Parts	LS	1	$3,773,771	$3,773,771		$ 1,886,886	$ 1,886,886
Sub-total				**$93,157,469**	**$ 3,690,000**	**$ 46,678,735**	**$ 42,888,735**
ELECTRICAL EQUIPMENT							
Electric equipment, MCC's, power distribution, controls, lighting & grounding	LS	1	$12,340,580	$12,340,580		$ 6,170,290	$ 6,170,290
Sub-total				**$12,340,580**		**$ 6,170,290**	**$ 6,170,290**
SUB-TOTAL				**$125,586,949**	**$ 19,364,450**	**$ 55,400,575**	**$ 50,821,925**
PORTION OF SHARED EXPENSES							
Project Site Expenses							
Dredging	m3	0	$0	$0	$ -		
Causeway - Quarry Run and Armor Layer	LS	1	$1,380,443	$1,380,443	$ 1,380,443		
Clearing/Stripping	LS	1	$28,960	$28,960	$ 28,960		
Pile Supported Trestle	LS	1	$3,833,333	$3,833,333	$ 3,833,333		
Pavement	LS	1	$2,060,300	$2,060,300		$ 1,030,150	$ 1,030,150
Electrical	LS	1	$2,291,000	$2,291,000		$ 1,145,500	$ 1,145,500
Administration Building	EA	1	$1,075,000	$1,075,000		$ 537,500	$ 537,500
Maintenance and Storage Building	EA	1	$1,250,000	$1,250,000		$ 625,000	$ 625,000
Sub-total				**$11,919,036**	**$ 5,242,736**	**$ 3,338,150**	**$ 3,338,150**
Additional Project Expenses							
Bonding and Insurance (2%)	LS	1	$2,750,120	$2,750,120	$ 2,750,120		
Mobilize/Demobilize	LS	1	$2,000,000	$2,000,000	$ 1,500,000		$ 500,000
Engineering and Construction Management (6%)	LS	1	$8,250,359	$8,250,359	$ 2,750,120	$ 2,750,120	$ 2,750,120
Contingency (10%)	LS	1	$15,050,646	$15,050,646		$ 7,525,323	$ 7,525,323
Tugs, pilot boats & Nav. Equipment	LS	1	$3,333,333	$3,333,333			$ 3,333,333
Sub-total				**$31,384,459**	**$ 7,000,239**	**$ 10,275,443**	**$ 14,108,776**
SOCOCIM & Ciment du Sahel Project Sub-Total				**$168,890,444**	**$ 31,607,425**	**$ 69,014,167**	**$ 68,268,851**

TABLE 4.3
Capital Investments for ICS, SSPT, Senegal Mines

MIFERSO Multi-Commodity Bulk Port PRELIMINARY PROGRAM BUDGET ESTIMATE - ICS, SSPT & Senegal Mines Export: 125,000 tpy Fertilizer and 260,000 tpy Attapulgite Import: 700,000 tpy Sulfur, Urea, PA, AS	UNITS	QTY	$/UNIT	Total	2009 Capital Investment	2010 Capital Investment	2011 Capital Investment 30 MONTHS
PILE SUPPORTED PIER							
Pile supported wharf with concrete deck	lin.m.	300	$45,540	$13,662,000	$ 13,662,000	$ -	
Cathodic Protection	lin.m.	300	$1,280	$384,000	$ 192,000	$ 192,000	
Fenders	lin.m.	300	$1,500	$450,000	$ 225,000	$ 225,000	
Bollards and Marine Fittings	lin.m.	300	$330	$99,000	$ 49,500	$ 49,500	
Machine Runway	lin.m.	300	$780	$234,000	$ 117,000	$ 117,000	
Sub-total				**$14,829,000**	**$ 14,245,500**	**$ 583,500**	$ -
BACKLAND SITE PREPARATION							
Clearing and Stripping	hectare	16.6	$12,000	$199,200	$ 199,200	$ -	
BACKLAND UTILITIES							
Grading & Stormwater Drainage	hectare	16.6	$30,000	$498,000	$ 249,000	$ 249,000	
Potable Water & Sanitary Sewer	LS	1	$400,000	$400,000		$ 200,000	$ 200,000
Fire Protection	LS	1	$400,000	$400,000		$ 200,000	$ 200,000
Sub-total				**$1,298,000**	**$ 249,000**	**$ 649,000**	**$ 400,000**
CIRCULATION							
Heavy duty pavement including base	m2	43,000	$66	$2,838,000		$ 1,419,000	$ 1,419,000
Railway tracks	lm	3,574	$410	$1,465,340		$ 732,670	$ 732,670
Sub-total				**$4,303,340**		**$ 2,151,670**	**$ 2,151,670**
BULK HANDLING EQUIPMENT							
Conveyors, Loaders, Sampling Stations, Transfer Stations, etc.	LS	1	$42,684,898	$42,684,898		$ 21,342,449	$ 21,342,449
Wheel Loaders	LS	1	$3,000,000	$3,000,000		$ 1,500,000	$ 1,500,000
Warehouses	LS	1	$12,100,000	$12,100,000		$ 6,050,000	$ 6,050,000
Foundations/Civil	LS	1	$6,980,000	$6,980,000	$ 3,490,000	$ 3,490,000	
Spare Parts	LS	1	$2,640,000	$2,640,000		$ 1,320,000	$ 1,320,000
Sub-total				**$67,404,898**	**$ 3,490,000**	**$ 33,702,449**	**$ 30,212,449**
ELECTRICAL EQUIPMENT							
Electric equipment, MCC's, power distribution, controls, lighting & grounding	LS	1	$8,290,000	$8,290,000		$ 4,145,000	$ 4,145,000
Sub-total				**$8,290,000**		**$ 4,145,000**	**$ 4,145,000**
SUB-TOTAL				**$96,324,438**	**$ 18,183,700**	**$ 41,231,619**	**$ 36,909,119**
PORTION OF SHARED EXPENSES							
Project Site Expenses							
Dredging & Mob Demob	m3	1	$0	$0	$ -		
Causeway - Quarry Run and Armor Layer	LS	1	$1,380,443	$1,380,443	$ 1,380,443	$ -	
Clearing/Stripping	LS	1	$28,960	$28,960	$ 28,960	$ -	
Pile Supported Trestle	LS	1	$3,833,333	$3,833,333	$ 3,833,333		
Pavement	LS	1	$2,060,300	$2,060,300	$ -	$ 1,030,150	$ 1,030,150
Electrical	LS	1	$2,291,000	$2,291,000		$ 1,145,500	$ 1,145,500
Administration Building	EA	1	$1,075,000	$1,075,000		$ 537,500	$ 537,500
Maintenance and Storage Building	EA	1	$1,250,000	$1,250,000		$ 625,000	$ 625,000
Sub-total				**$11,919,036**	**$ 5,242,736**	**$ 3,338,150**	**$ 3,338,150**
Additional Project Expenses							
Bonding and Insurance (2%)	LS	1	$2,164,869	$2,164,869	$ 2,164,869		
Mobilize/Demobilize	LS	1	$2,000,000	$2,000,000	$ 1,500,000	$ -	$ 500,000
Engineering and Construction Management (6%)	LS	1	$6,494,608	$6,494,608	$ 2,164,869	$ 2,164,869	$ 2,164,869
Contingency (10%)	LS	1	$11,890,295	$11,890,295		$ 5,945,148	$ 5,945,148
Tugs, pilot boats & Nav. Equipment	LS	1	$3,333,333	$3,333,333			$ 3,333,333
Sub-total				**$25,883,106**	**$ 5,829,739**	**$ 8,110,017**	**$ 11,943,350**
ICS, SSPT, & Senegal Mines Sub-Total				**$134,126,580**	**$ 29,256,175**	**$ 52,679,786**	**$ 52,190,619**

The investment costs have been categorized into three (3) broad categories according to their estimated life span and depreciation rates:

- Long term infrastructure, 20 year life span, 5%, depreciation rate
- Equipment with a 10 year life span (including tug boats); 10% depreciation rate
- Rolling equipment (wheel loaders, etc.) 7 years life span 14% depreciation rate.

4.3 Financing

The analysis assumes that the investments presented above will be financed with 40% equity and 60% long term debt financing. The long term debt financing is set as a 20 year loan, with yearly disbursements and a 3 year grace period on principal reimbursements. A loan reimbursement schedule is established and calculates yearly interest payments and principal repayments. The interest rate is set at **6%**.

4.4 Operating Costs

Operating costs evaluated in this analysis include labor and costs related to the consumption of fuel, electricity and water, which vary according to throughput. Tables 4.4, 4.5, and 4.6 present a summary of operating costs for each stakeholder group.

TABLE 4.4
Operating Costs for Senelec Facilities

Senelec	
Annual Cost of Personnel	**USD**
Administration and Management	$102,000
Maintenance and Engineering	$104,000
Operations	$180,000
TOTAL	**$386,000**
Power	$1,214,000
Water	$43,000
Diesel Fuel	$267,000
TOTAL	**$1,524,000**

TABLE 4.5
Operating Costs for SOCOCIM and Ciment du Sahel Facilities

SOCOCIM and Ciment du Sahel	
Annual Cost of Personnel	**USD**
Administration and Management	$260,000
Maintenance and Engineering	$280,000
Operations	$410,000
TOTAL	**$956,000**
Power	$2,260,000
Water	$220,000
Diesel Fuel	$640,000
TOTAL	**$3,120,000**

TABLE 4.6
Operating Costs for ICS, SSPT, Senegal Mines Facilities

ICS, SSPT, Senegal Mines	
Annual Cost of Personnel	**USD**
Administration and Management	$200,000
Maintenance and Engineering	$200,000
Operations	$350,000
TOTAL	**$750,000**
Power	$1,510,000
Water	$20,000
Diesel Fuel	$320,000
TOTAL	**$1,850,000**

4.5 Financial Feasibility

4.5.1 Introduction

The financial feasibility analysis compares project costs and revenues over a 23-year operating period, which includes a three-year initial construction period and 20-years of subsequent operation. The standard resulting pro forma statements are presented below. These financial statements draw upon the project costs and project revenues developed in previous sections and are used to evaluate project "feasibility".

4.5.2 Revenue Forecasts

The approach taken to estimate "revenues" is to assume that each SPC created to finance, construct, and operate the facilities for each stakeholder group will collect fees (revenue) from the stakeholder group based on throughput. These fees represent the terminal handling charges (THC) imposed on the stakeholder group for use of the facility. Total throughput compared to total investments and operating costs determine the required fee or revenue.

Revenue estimates are calculated on the basis of minimum break-even revenue. This revenue is calculated as follows:

> *For years 2009 to 2031, sum of all annual known net flows (inflows – outflows) divided by the throughput for that same period.*

4.5.3 Projected Financial Statements

The projected income statement, balance sheet and cash flow statements demonstrate the projects: net income potential; composition of assets, liabilities and owners' equity, and the sources and uses of cash over the 23-year project period. In developing the projections we assume that 40% of the capital costs are covered through equity contributions with the remaining 60% covered through debt. Given the size of the project and the benefits that will accrue to the Government of Senegal, the analysis assumes that the income tax rate will be limited to 20%. Initial spare parts have been included in the capital cost estimate, however, annual replenishment of spare parts have not been included in the operating costs. Royalties paid to Mittal and the Government of Senegal are also not included in the analysis.

Tables 4.7, 4.8, and 4.9 present the pro forma income statement, cash flow statement, balance sheet, liabilities and owner's equity for each stakeholder group.

4.5.3.1 Senelec

Income Statement

The THC or "revenue" required by Senelec's SPC to break even on its investments (NPV= 0) is **$10.14** per tonne. On this basis, revenues begin in the 3rd Quarter of 2011 at $6.1 million and reach $12.2 million in 2012. Net income becomes positive in 2012 and retained earnings in 2019. Net cash flows are positive beginning in 2012. A dividend policy of 50% of net cash flow is applied once cash flow is positive (2012).

A 10 year tax holiday starting at the beginning of the construction phase of the project is assumed. A 20% income tax rate is calculated on the 11th year of the project's existence.

Cash Flow

Three types of cash flow are considered: operating, capital expenditures (Capex) and financing. The $86.2 million in total capital costs are summarized by year and type under the Capex Cash Flow. Capital costs are assumed to be financed through 60% debt with and the remaining 40% through equity. This flow of debt and equity issuance as well as debt principal payback is shown under the Financing Cash Flow.

Lastly, annual net income before tax, depreciation, change in working capital and taxes are shown under the Operating Cash Flow. The Net Operating Cash Flow (NOCF) is sufficient to cover capital expenditure cash flow and other financing cash flows, resulting in a net cash flow of $5 million in 2012. These annual NOCFs remain positive and grow substantially over the project analysis period.

Balance Sheet

Total assets will rise at a slow steady pace from $24 million in the first year of existence, year 2009, to $105 million by year 2031.. In 2011, long-term debt is $51.7 million (reflecting 60% of the total investment) and will fall gradually and will be extinct in 2031 when it is fully amortized. Owner's equity would rise steadily from $24.1 million in year 2009 to $105.1 million by year 2031.

4.5.3.2 SOCOCIM and Ciment du Sahel

Income Statement

The THC or "revenue" required by the cement companies' SPC to break even on its investments (NPV= 0) is **$9.08** per tonne. Revenues begin in the 3rd Quarter of 2011 at $11.4 million and reach $22.8 million in 2012. Net cash flows and Net income become positive in 2012 and retained earnings in 2021. A dividend policy of 50% of net cash flow is applied once cash flow is positive (2012).

A 10 year tax holiday starting at the beginning of the construction phase of the project is assumed. A 20% income tax rate is calculated on the 11th year of the project's existence.

Cash Flow

Three types of cash flow are considered: operating, capital expenditures (Capex) and financing. The $168.9 million in total capital costs are summarized by year and type under the Capex Cash Flow. Capital costs are assumed to be financed through 60% debt with and the remaining 40% through equity. This flow of debt and equity issuance as well as debt principal payback is shown under the Financing Cash Flow.

Lastly, annual net income before tax, depreciation, change in working capital and taxes are shown under the Operating Cash Flow. The Net Operating Cash Flow (NOCF) is sufficient to cover capital expenditure cash flow and other financing cash flows, resulting in a net cash flow of $8.2 million in 2012. These annual NOCFs remain positive and grow substantially over the project analysis period

Balance Sheet

Total assets rise at a slow steady pace from $30 million in the first year of existence, year 2009, to $183.7 million by year 2031. In 2011, long-term debt is $101.3 million (reflecting 60% of the total investment) and falls gradually and becomes extinct in 2031 when it is fully amortized. Owner's equity rises steadily from $30 million in year 2009 to $183.7 million by year 2031.

4.5.3.3 ICS, SSPT, and Senegal Mines

Income Statement

The THC or "revenue" required by the Special Purpose Company to break even on its investments (NPV= 0) is **$16.10** per tonne. Revenues begin in the 3rd Quarter of 2011 at $8.7 million and reach $17.5 million in 2012. Net cash flows and Net income become positive in 2012 and retained earnings in 2020. A dividend policy of 50% of net cash flow is applied once cash flow is positive (2012).

A 10 year tax holiday starting at the beginning of the construction phase of the project is assumed. A 20% income tax rate is calculated on the 11th year of the project's existence.

Cash Flow

Three types of cash flow are considered: operating, capital expenditures (Capex) and financing. The $134.1 million in total capital costs are summarized by year and type under the Capex Cash Flow. Capital costs are assumed to be financed through 60% debt with and the remaining 40% through equity. This flow of debt and equity issuance as well as debt principal payback is shown under the Financing Cash Flow.

Lastly, annual net income before tax, depreciation, change in working capital and taxes are shown under the Operating Cash Flow. The Net Operating Cash Flow (NOCF) is sufficient to cover capital expenditure cash flow and other financing cash flows, resulting in a net cash flow of $6.2 million in 2012. These annual NOCFs remain positive and grow substantially over the project analysis period

Balance Sheet

Total assets rise at a slow steady pace from $27.8 million in the first year of existence, year 2009, to $145.5 million by year 2031. In 2011, long-term debt is $80.5 million (reflecting 60% of the total investment) and falls gradually and becomes extinct in 2031 when it is fully amortized. Owner's equity rises steadily from $27.8 million in year 2009 to $145.5 million by year 2031.

4.5.4 Financial Feasibility

The pro forma statements and other supporting cost and revenue data presented above are based on collecting terminal handling charges (THC) required to break even on investments. The terminal handling charges are summarized for each stakeholder group on Table 4.10 below. It is apparent, from the table below, that increasing throughput will reduce the THC.

TABLE 4.10

Summary of CAPEX and THC by Stakeholder (Base Case)

Stakeholder Group	CAPEX	Annual Throughput	THC per tonne
	million USD	million tpy	USD
Senelec	$ 86.2	1.200	$ 12.98
SOCOCIM and Ciment du Sahel	$ 168.9	2.520	$ 9.08
ICS, SSPT, Senegal Mines	$ 134.1	1.085	$ 16.10
Total	$ 389.2	4.805	
Average terminal handling charge per tonne			$ 11.64

The terminal handling charge will add to the cost of the commodities imported and exported and, if these are too high, will jeopardize the competitiveness of each stakeholder group. At first glance, the above charges appear to be quite high. However, there are other financial benefits to building the project that should be taken into account by each stakeholder group. These include, among others:

- Savings in land transportation costs resulting from using the new Port of Bargny-Sendou instead of the Port of Dakar
- Savings in the cost to transport the commodities by ship. These savings will be derived by using larger vessels at the Port of Bargny-Sendou, which cannot be accommodated at the Port of Dakar
- Savings in the cost of the ship at berth. These savings will be derived by loading/unloading each vessel in a shorter amount of time than possible at the Port of Dakar
- Savings in demurrage costs. The new port of Bargny-Sendou will be purpose built for the volumes anticipated. The equipment will be selected to minimize potential demurrage costs.

There are also economic benefits that accrue to the Government of Senegal that should also be considered when evaluating this project. These include, among others:

- Savings in fuel subsidies

- Reduction in air pollution
- Reduction in traffic congestion

4.5.5 Alternatives

The above terminal handling charges could be reduced if the different stakeholder groups decided to pool resources. Several alternatives are presented below to demonstrate the impact that pooling resources and commodities could have on the terminal handling charge.

Alternative 1

As noted earlier, Senelec will begin operations with only 400,000 tonnes of coal. This coal could easily be accommodated at Berth 3, along with the SOCOCIM and Ciment du Sahel commodities. In this case, Senelec will share the berth, the grab bucket unloader, the berth conveyor, berth-to-trestle cross-conveyor, and trestle conveyor with SOCOCIM and CDS. Once on shore, Senelec's coal will be handled by its own equipment. This will slightly increase the berth occupancy, but the overall occupancy will remain within acceptable limits. Adding 400,000 tonnes of coal and the cost to provide on-shore material handling equipment for Senelec will reduce the terminal handling charge to an average of $8.44 per tonne for this stakeholder group. Table 4.11 presents a summary of CAPEX and THC for this alternative.

TABLE 4.11

Summary of CAPEX and THC for Alternative 1

Stakeholder Group	CAPEX	Annual Throughput	THC per tonne
	million USD	million tpy	USD
SOCOCIM, Ciment du Sahel + 400,000 tpy coal from Senelec	$ 177.2	2.92	$ 8.44
ICS, SSPT, Senegal Mines	$ 134.1	1.09	$ 16.10
Total	$ 311.3	4.01	
Average terminal handling charge per tonne			$ 10.52

Alternative 2

While Senelec will begin operations with only 400,000 tonnes of coal, they will eventually require facilities to handle 1.2 million tonnes. This could also be accommodated at Berth 3 by increasing the capacity of the grab bucket unloader. The unloader capacity needs to be increased to keep the berth occupancy within acceptable limits. This would have to be planned for at the beginning of the project. If we include the cost to increase the unloader capacity and assume that the additional 800,000 tonnes of coal will begin arriving at the berth in 2016, the terminal handling charges will be further reduced to an average of $7.82 per tonne. (Note: The THC would be greater in years 2011 through 2015 and less in subsequent years. The average is presented here for comparison purposes.)

TABLE 4.12
Summary of CAPEX and THC for Alternative 2

Stakeholder Group	CAPEX	Annual Throughput	THC per tonne
	million USD	million tpy	USD
SOCOCIM, Ciment du Sahel + 1.2 M tpy coal from Senelec	$ 182.6	3.72	$ 7.82
ICS, SSPT, Senegal Mines	$ 134.1	1.09	$ 16.10
Total	$ 316.7	4.81	
Average terminal handling charge per tonne			$ 9.70

Note: In this alternative Senelec coal imports begin at 400,000 tpy in 2011 and increase to 1.2 Mtpy in 2016

Alternative 3

The criteria established for the terminal layout required the separation of facilities by stakeholder group. This has resulted in increased capital cost and terminal handling charges. Terminal handling charges could be further reduced for all stakeholders by handling all commodities at one berth. To keep berth occupancies within acceptable limits, a 2nd grab bucket ship unloader would be required and wider conveyor belts would be used to increase the material handling capacity for export and import commodities. The berth would also have to be lengthened to 340m to accommodate the additional machine. All commodities would share the berth, the berth equipment, and trestle conveyor. Once on shore, separate conveyors would be used for each stakeholder group. Table 4.13 presents a summary of the investment costs to build the facilities required for Alternative 3.

TABLE 4.13
Capital Investments for Alternative 3

MIFERSO Multi-commodity Bulk Port PRELIMINARY PROGRAM BUDGET ESTIMATE Single SPC for All Commodities	UNITS	QTY	$/UNIT	Total	2009	2010	2011
PILE SUPPORTED PIER							
Pile supported wharf with concrete deck	lin.m.	340	$45,540	$15,483,600	$15,483,600		
Cathodic Protection	lin.m.	340	$1,280	$435,200	$217,600	$217,600	
Fenders	lin.m.	340	$1,500	$510,000	$255,000	$255,000	
Bollards and Marine Fittings	lin.m.	340	$330	$112,200	$56,100	$56,100	
Machine Runway	lin.m.	340	$780	$265,200	$132,600	$132,600	
Sub-total				**$16,806,200**	**$16,144,900**	**$661,300**	
BACKLAND SITE PREPARATION							
Clearing and Stripping	hectare	45.16	$12,000	$541,920	$541,920		
BACKLAND UTILITIES							
Grading & Stormwater Drainage	hectare	37.92	$30,000	$1,137,600	$568,800	$568,800	
Potable Water & Sanitary Sewer	LS	3.00	$400,000	$1,200,000		$600,000	$600,000
Fire Protection	LS	3.00	$400,000	$1,200,000		$600,000	$600,000
Sub-total				**$3,537,600**	**$568,800**	**$1,768,800**	**$1,200,000**
TRANSPORTATION							
Heavy duty pavement including base	m2	213,650	$66	$14,100,900		$7,050,450	$7,050,450
Railway tracks	lm	3,574	$410	$1,465,340			$1,465,340
Sub-total				**$15,566,240**		**$7,050,450**	**$8,515,790**
BULK HANDLING EQUIPMENT							
Conveyors, Loaders, Sampling Stations, Transfer Stations, etc.	LS	1	$94,399,000	$94,399,000		$70,799,250	$23,599,750
Wheel Loaders	LS	1	$5,000,000	$5,000,000			$5,000,000
Warehouses	LS	1	$22,400,000	$22,400,000		$16,800,000	$5,600,000
Foundations/Civil	LS	1	$16,440,000	$16,440,000	$8,220,000	$8,220,000	
Spare Parts	LS	1	$5,730,000	$5,730,000		$2,865,000	$2,865,000
Sub-total				**$143,969,000**	**$8,220,000**	**$98,684,250**	**$37,064,750**
ELECTRICAL EQUIPMENT							
Electric equipment, MCC's, power distribution, controls, lighting & grounding	LS	1	$21,460,000	$21,460,000		$16,095,000	$5,365,000
Sub-total				**$21,460,000**		**$16,095,000**	**$5,365,000**
SUB-TOTAL				**$201,880,960**	**$25,475,620**	**$124,259,800**	**$52,145,540**
OTHER EXPENSES							
Project Site Expenses							
Dredging (no dredging required)	m3	0	$0	$0			
Causeway - Quarry Run and Armor Layer	LS	1	$4,141,328	$4,141,328	$4,141,328		
Clearing/Stripping (included above)	LS	0	$0	$0			
Pile Supported Trestle (for a single conveyor)	LS	1	$11,500,000	$11,500,000	$11,500,000		
Pavement (included above)	LS	0	$0	$0			
Electrical (Power to Site)	LS	1	$6,873,000	$6,873,000		$3,436,500	$3,436,500
Administration Building	EA	1	$1,075,000	$1,075,000		$537,500	$537,500
Maintenance and Storage Building	EA	1	$1,250,000	$1,250,000		$625,000	$625,000
Sub-total				**$24,839,328**	**$15,641,328**	**$4,599,000**	**$4,599,000**
Additional Project Expenses							
Bonding and Insurance (2%)	LS	1	$4,534,406	$4,534,406	$4,534,406		
Mobilize/Demobilize	LS	1	$6,000,000	$6,000,000	$4,500,000		$1,500,000
Engineering and Construction Management (6%)	LS	1	$13,603,217	$13,603,217	$4,534,406	$4,534,406	$4,534,406
Contingency (10%)	LS	1	$25,085,791	$25,085,791		$12,542,896	$12,542,896
Tugs, pilot boats & Nav. Equipment	LS	1	$10,000,000	$10,000,000			$10,000,000
Sub-total				**$59,223,414**	**$13,568,812**	**$17,077,301**	**$28,577,301**
Single SPC for All Commodities PROJECT SUB-TOTAL (ROUNDED)				**$286,000,000**	**$54,685,760**	**$145,936,101**	**$85,321,841**

Table 4.14 presents a summary of CAPEX and THC for this alternative.

TABLE 4.14
Summary of CAPEX and THC for Alternative 3

Stakeholder Group	CAPEX	Annual Throughput	THC per tonne
	million USD	million tpy	USD
SOCOCIM, Ciment du Sahel, Senelec, ICS, SSPT, & Senegal Mines	$ 286.0	4.805	$ 8.93

Section 4.5.4.1 below presents the financial outcome of this alternative.

4.5.6 Financial Statements for Single SPC Handling all Stakeholder Commodities

Income Statement

The THC or "revenue" required by the Special Purpose Company to break even on its investments (NPV= 0) is **$8.93** per tonne. Revenues begin in the 3rd Quarter of 2011 at $17.9 million and reach $42.9 million in 2012. Net cash flows and Net income become positive in 2012 and retained earnings in 2021. A dividend policy of 50% of net cash flow is applied once cash flow is positive (2012).

A 10 year tax holiday starting at the beginning of the construction phase of the project is assumed. A 20% income tax rate is calculated on the 11th year of the project's existence.

Cash Flow

Three types of cash flow are considered: operating, capital expenditures (Capex) and financing. The $286 million in total capital costs are summarized by year and type under the Capex Cash Flow. Capital costs are assumed to be financed through 60% debt with and the remaining 40% through equity. This flow of debt and equity issuance as well as debt principal payback is shown under the Financing Cash Flow.

Lastly, annual net income before tax, depreciation, change in working capital and taxes are shown under the Operating Cash Flow. The Net Operating Cash Flow (NOCF) is sufficient to cover capital expenditure cash flow and other financing cash flows, resulting in a net cash flow of $8.6 million in 2012. These annual NOCFs remain positive and grow substantially over the project analysis period

Balance Sheet

Total assets rise at a slow steady pace from $52 million in the first year of existence, year 2009, to $339.4 million by year 2031. In 2012, long-term debt is $163.0 million (reflecting 60% of the total investment) and falls gradually and becomes extinct in 2031 when it is fully amortized. Owner's equity rises steadily from $52 million in year 2009 to $339.4 million by year 2031.

Table 4.15 presents the pro forma income statement, cash flow statement, balance sheet, liabilities and owner's equity for the case where the stakeholders form a single SPC to finance, construct and operate the facilities to handle all commodities.

It would be reasonable to apply terminal handling charges on the basis of CAPEX and throughput for each stakeholder group. To calculate this, the CAPEX for each group was segregated and a factor was applied to the cost of shared facilities based on the occupancy requirements of each group. Table 4.15 presents a summary of CAPEX and THC per stakeholder group for this alternative.

TABLE 4.15
Summary of CAPEX and THC by Stakeholder for Alternative 3

Stakeholder Group	CAPEX	Annual Throughput	THC per tonne
	million USD	million tpy	USD
Senelec	$ 54.2	1.20	$ 8.77
SOCOCIM and Ciment du Sahel	$ 124.4	2.52	$ 7.17
ICS, SSPT, Senegal Mines	$ 106.5	1.085	$ 12.47
Total	$ 285.1	4.805	
Average terminal handling charge per tonne			$ 8.77

4.5.7 Economic Feasibility of Project as Profit Center

The pro forma statements and other supporting cost and revenue data presented above is used to generate Capital Budgeting analysis for the financial feasibility evaluation of the proposed Port of Bargny from the perspective of an SPC, formed by the stakeholders, for the sole purpose of financing, constructing, and operating the facilities for the benefit of the stakeholders. Terminal Handling charges are calculated to break even on investments. This break-even fee is calculated by setting the present value of net cash flows generated by the project equal to zero (NPV = 0). The project therefore adds no monetary value to the SPC or stakeholders. The decision to build the project is based on other criteria, such as return on sales of commodities, which are not explicitly included in the calculation.

Another perspective would be to assume that the stakeholders contract with a professional terminal operating company, on either a Build-Operate-Transfer (BOT) or Build-Own-Operate (BOO) structure with a 23-year operation period (2009-2031). In this case, the terminal operating company would finance, construct, and operate the facilities for profit. The following section describes the approach and evaluation principles to determine the economic feasibility of the project as a profit center for a terminal operator looking to make a 20% margin.

Approach and Evaluation Principles

Due to economies of scale, it is assumed that the private sector operator would consist of a single firm that would be given the necessary ability to set and adjust rates to ensure a reasonable return on investment.

Capital Budgeting Approach – A firm's capital budgeting evaluation compares the change in cash inflows and outflows associated with a major project or initiative over a multi-year period. This differs compared to the cash flow statement, which concerns annual working capital cash needs. A firm typically conducts a capital budgeting analysis when a major project includes a significant capital investment.

The capital budgeting analysis that follows is straightforward and concerns only the costs and revenues of port facility.

Evaluation Principles – The maximization of shareholder wealth underpins the capital budgeting analysis. This objective implies that projects should be considered if they generate a positive Net Present Value (defined below). Those projects that generate the greatest NPV should be pursued given a firm's financial resource constraints. With this in mind, the analysis followed the evaluation principles below:

- Indicators of "Financial Feasibility" – To determine whether the proposed facility investment is economically feasible, the costs of building and maintaining the port are compared with the financial revenues attributable to the investment. This revenue and cost comparison yields three indicators of "economic feasibility" for the proposed investment.
- Internal Rate of Return – This calculation determines that discount rate at which the net present value of the discounted benefits is equal to the net present value of the discounted costs. If the rate of return, expressed as a percentage, is equal to or greater than the discount rate, then the investment is deemed to be "economically feasible".
- Net Present Value – All costs and benefits in future years are discounted back to the base year using a discount rate. For this study the base year is 2008, the first year in which construction costs are spent. The future stream of discounted costs is subtracted from the future stream of discounted benefits. When the sum of the discounted benefits is greater than the sum of the discounted costs, the "net present value" is positive and the investment is deemed to be "financially feasible". The discount rate used for this analysis is 12% (see below).
- Discount Rate – Revenues and costs (present and future) are tabulated in constant dollars (excluding inflation). Because of the time value of money and the preference of having returns earlier versus later, all future revenues and costs are "discounted back" to a base year. By doing so, the analysis accounts for the "opportunity cost" of investing in one project versus another. The selected discount rate greatly impacts the project's feasibility and should reflect a project's risk as well as the general cost of capital. A constant dollar discount rate of 12% is used in this study, which excludes future price level changes (i.e., inflation).
- Discounted Payback – A third measure is used to assess the project's liquidity and general risk. Projects that rapidly convert investment into cash are preferred to those that take longer to repay. Since we can anticipate near-term events better than long-term events, projects that rapidly repay investment costs are generally viewed as less-risky. To account for the time value of money, the discount rate is applied to these annual cash flows.

The bottom line from an analysis perspective is to identify projects that have a relatively high NPV, an IRR that is significantly greater than the discount rate, and a short payback period.

4.5.7.1 Capital Budgeting Feasibility

The forecasted cash inflows and outflows under this scenario, implementation of Phase 1 investments only, are presented over the 23-year project life in the previous section. For the purpose of this analysis, the cash inflows and outflows are as follows:

Cash Inflows – The cash inflows consists of the revenue charged by the Terminal Operator for all throughput.

Cash Outflows – Cash outflows include the equity capital, operating and debt loan repayment. The equity capital represents 40% contribution made by investors. Other cash outflows include, the principal repayment on the long term debt contracted, representing 60% of the total investment, the interest paid on this long term debt and the operating expenses (labor and variable operating costs) as well as the income tax when applicable.

Net Cash Flows – Net cash flows are the difference between cash inflows and cash outflows.

Financial Returns – The NPV calculation applies the discount rate (12%) to the annual Net Cash Flow After Tax over the 23-year period. The results indicate that the projected revenues cover capital and operating costs and generate a favorable NPV of $29.3 million in the basic scenario (20% margin over estimated minimum revenue) and of 39.9 millions when the margin over estimated minimum revenue is increased to 25%.

The project's IRR under this initial scenario is 15.72%.

Finally the payback period calculations show that the project will generate the cash to cover the initial investments and operating expenses after 8 years if the cash flow is not discounted and after almost 13 years when the flows are discounted to a present value with a 12% discount rate.

The table below presents the results of the capital budgeting analysis are presented below according the 6 different scenarios that can affect the project.

Financial Feasibility Results

SPC - Phase 1 only with No Dredging	
Internal Rate of Return	15.72%
Net Present Value (12%)	$29,364,445
Payback Period (years)	8
Discounted Payback Period (years)	14

Chapter 5

Port Funding and Operations

5.1 Funding and Operations Summary

This chapter explores the various alternatives for funding the construction of the proposed facility in Bargny. Additionally, it explores several port operating structures that are directly related to the funding.

The alternatives explored in this section all include private sector participation (PSP) or even private sector ownership of the port facility The most viable and bankable funding and operating structures and a "road map" for moving forward on the port project are also presented in this chapter including investor criteria such as project specific and overall financial, market, legal, regulatory and tax issues that are critical to both the success of the port project and to obtaining the required funding.

As described earlier in the report, the projected capital cost of constructing the port facility in Bargny is $511 million for Phase 1 (with an optional $225 million for a Phase 2 that will add "customers" and more than double throughput to the facility.

It is assumed that the Port of Bargny will be financed, constructed and operated by the private sector through a Build-Own-Operate ("BOO") or a very long-term (minimum 30 years) Build-Operate-Transfer ("BOT") structure depending on whether the Government of Senegal ("GoS") has funding capacity at the time of awarding the contract.

Based on our knowledge and analysis of the industry, the overall goals of the GoS and the feasibility of the project, it is anticipated that the port of Bargny will be either financed through a major private sector, port operator, through its own means ("corporate financing") or through a "non or limited-recourse" special purpose company ("SPC"). This latter form of financing is referred to as project financing.

It is important to understand that the bulk, if not all, of the project funding will come from the private sector and therefore the responsibility for obtaining that funding will also rest with the private sector. Virtually all of the risks, aside from those legal, regulatory and tax risks over which the GoS has direct control, will also be borne and managed by the private sector

participant(s) in the project. Therefore, this chapter focuses primarily on the PSP issues directly related to BOT's and BOO's.

5.2 Overview of the Alternative Funding Structures

The port project funding alternatives explored included:

- Government or public sector funding through:
  - The GoS's capital and operating budget,
  - Bilateral and/or multilateral donors,
  - Bilateral and/or multilateral International Financial Institutions ("IFI") and Export Credit Agencies ("ECA"), and/or
  - Private sector financial institutions (e.g., commercial and investment banks).
- Private sector funding directly through a shipping and/or port management company.
- Private sector funding using a SPC:
  - Sponsors (e.g., construction, port management companies) of the port project,
  - Non-sponsor equity investors,
  - IFI's, and/or
  - Private sector financial institutions.

Although the port project may be funded through one funding alternative, most large infrastructure projects are funded through a combination of two or more of the alternatives presented above. A common example of this would be for the GoS to be responsible for funding and providing the basic infrastructure or "footprint" (e.g., basic infrastructure, perimeter fencing and direct access to electricity, water, wastewater and road services) and the private sector being responsible for constructing and equipping the actual port facility. A unique feature of this project is the role played by ArcelorMittal who will build the approach trestle to the berths that will be shared by the stakeholders. Payment for the additional cost of the approach trestle will be negotiated between the GoS, the stakeholders, and ArcelorMittal.

It should be noted that although, some of the funding (e.g., debt or equity) of the port project and its components may be standalone; guarantees are often required by both private and public sector investors. Although use of these guarantees have a cost to the project, whether paid or subsidized, they are often less costly than not having the guarantees and may be essential in obtaining the

funding required for the port project. These guarantees may be provided by governments (including the GoS), IFI's and/or ECA's.

Another critical funding related factor that should be fully understood and formally allocated to the individual parties is the various risks. Such risks include design, construction, cash flow, operation, market, tax and force majeure (e.g., weather).

5.3 Private Sector Participation (PSP)

5.3.1 Port PSP Contracting Options

This section focuses on the potential for private sector funding and operations of the port project. The level of private sector participation can vary tremendously. The following table presents examples of possible PSP relationships between the government and private sector. The list is presented from the simplest form of PSP - generally shorter-term and does not include financing - to more complicated and longer-term structures that usually require a substantial investment on the part of the private sector.

Port Private Sector Participation Contracting Options

Type PSP	Advantages	Disadvantages
Service Contract - Operate certain specific tasks within port - Port management remains with GoS - Fixed and variable fee based on performance - Government responsible for setting rates and collection - Term 6 months to 7 years	- Good technical capacity from private sector - Competitively bid	- Minimal funding included - Level of private sector commitment is limited - Requires strong government oversight and management - Virtually all risk borne by government
Management Contract - Private sector management of port - Fixed and variable fee based on performance - Government responsible for setting rates and collection - Term 3 to 5 years	- Obtain private sector managerial capacity and efficiency - Specific targets and incentives set in contract - Competitively bid	- Minimal funding included - Level of private sector commitment is limited - Requires government oversight - Most risk borne by government

Lease Contract - Private sector management of port - Term 10 to 15 years	- Commercial risk borne by private sector - Secure source of revenue for government - Competitively bid	- Administratively demanding - Government retention of some risk - Minimal investment in infrastructure - Requires regulation on pricing of imports to and exports from Senegal
Build-Operate-Transfer (BOT) - Private sector responsible for all aspects of design, construction and operation of port - Term 15 to 30 years	- Substantial capital investment by private sector - Promotes efficiency - Transfer of most risks to private sector - Secure source of revenue for government - Competitively bid	- Contract oversight required - Assure preservation of asset value until end of contract - Requires regulation on pricing of imports to and exports from Senegal
Build-Own-Operate (BOO) - Private sector responsible for all aspects of design, construction and operation of port - Perpetuity	- All capital investment by private sector - Secure source of revenue for government - Transfer of all risk other than those for which government has direct control (legislation, taxes) to private sector - Competitively bid	- Permanent commitment and reduced level of control on part of government - Requires regulation on pricing of imports to and exports from Senegal

Both the BOT and BOO can be awarded to either a single company or a consortium of companies and can be financed through corporate or project financing. A private operator could also enter into one or more of these types contracts (particularly service contracts) with other domestic and/or international private sector companies.

5.3.2 Project Risks

Most of the project risks outlined below will exist regardless of the port funding option or operating structure selected and should therefore be considered in determining the preferred structure. The principal risk is to not enter into a concession agreement that optimizes the overall benefits to the domestic economy. The lenders or debt investors on the other hand are primarily concerned about the likelihood of being paid the interest and repaid the principal on their investment. The equity investors (both sponsors and non-sponsors) are concerned about the availability and volatility of the project's residual cash flow for the payment of dividends and the ability to exit the project by selling their shares at a desired value. As mentioned elsewhere in this

study, the sponsors are also interested in earning an acceptable return on the services they provide the project.

The three principles that should be understood through the risk analysis and allocation process are:

- The private sector's objective is to minimize its exposure to risk by diverting it to other parties,
- A risk should be managed by the party that can best manage the risk (e.g., construction risk should be borne by the construction company through a fixed price or "turn key" contract), and
- The higher the risk assumed by a party, the higher the required rate of return on their investment.

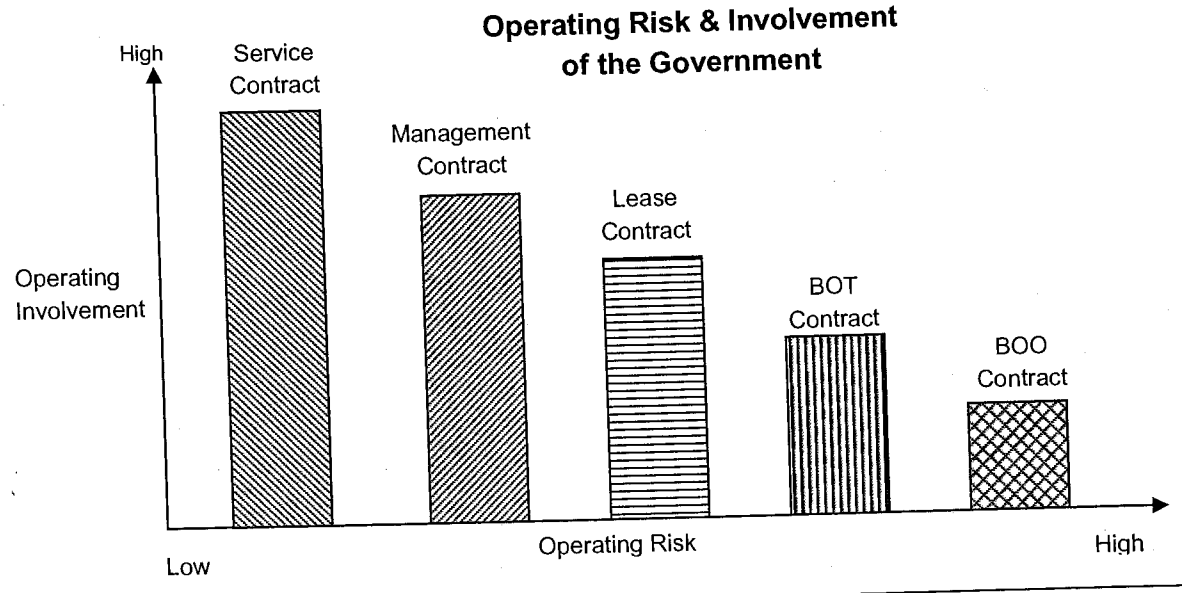
Although the GoS is not in a position to assume most of the risks listed below in, it is important that the individual risks be understood and considered in reviewing proposals, negotiating and awarding contracts. The table below lists the risks associated with ports projects.

Port Project Risks

Type of risk	Party best suited to manage the risk	Examples of methods of managing the risk
Pre-Construction – Feasibility study – Development of necessary investment environment	GoS	– Undertake project feasibility study – Determine and implement laws (investment, tax, etc.) that create a conducive environment for investing private sector funds in the port project
Construction (Technical) – Engineering – Cost overrun – Completion	Engineering & Construction Companies (Concessionaire)	– Enter into a "turn key" or fixed price contract with very limited ability to increase price (e.g., adverse weather conditions)
Operations & Maintenance (Technical) – Operations – Maintenance – Quality of service	Port Operator (Concessionaire)	– Provide incentive based contract (e.g., service or management contracts) – Market driven project (BOT or BOO)
Market, Revenue & Competition	Port Operator (Concessionaire) & GoS	– Enter into minimum usage contracts with prospective customers – Determine the proper market based fee structure – Consider marketing capacity in awarding the contract – Regulate domestic import and export fees
Currency/Exchange Rate	Port Operator (Concessionaire)	It is important to match the revenue and expense currencies

Inflation	Port Operator (Concessionaire)	Match the effect of inflation on revenues and expenses – Obtain fixed and/or variable interest rate – Determine the pricing structure and sensitivity to inflation of potential competitors
Country (Political)	GoS, Port Operator (Concessionaire)	– Obtain ECA and IFI insurance
Regulatory	GoS	– Allow pricing, specifically the transshipment pricing, to be market driven and determined by the port operator – Include terms and conditions that protect the port operator from any changes in regulation (e.g., reduction in concession fees) in the concession agreement
Legislative	GoS	– Include terms and conditions that protect the port operator from any changes in the law (e.g., grandfather clause) in the concession agreement
Environmental/Labor	Port Operator (Concessionaire)	– Must meet all GoS and/or global environmental laws and regulations – Must meet all GoS labor laws
Termination/Credit	GoS, Port Operator (Concessionaire)	– Assure strong financial position – Manage/monitor concession contract and concessionaire financial strength
Force Majeure – Natural – Other	GoS, Port Operator (Concessionaire)	– Obtain insurance or demonstrate ability to self insure – Provide temporary concession fee suspension in the contract

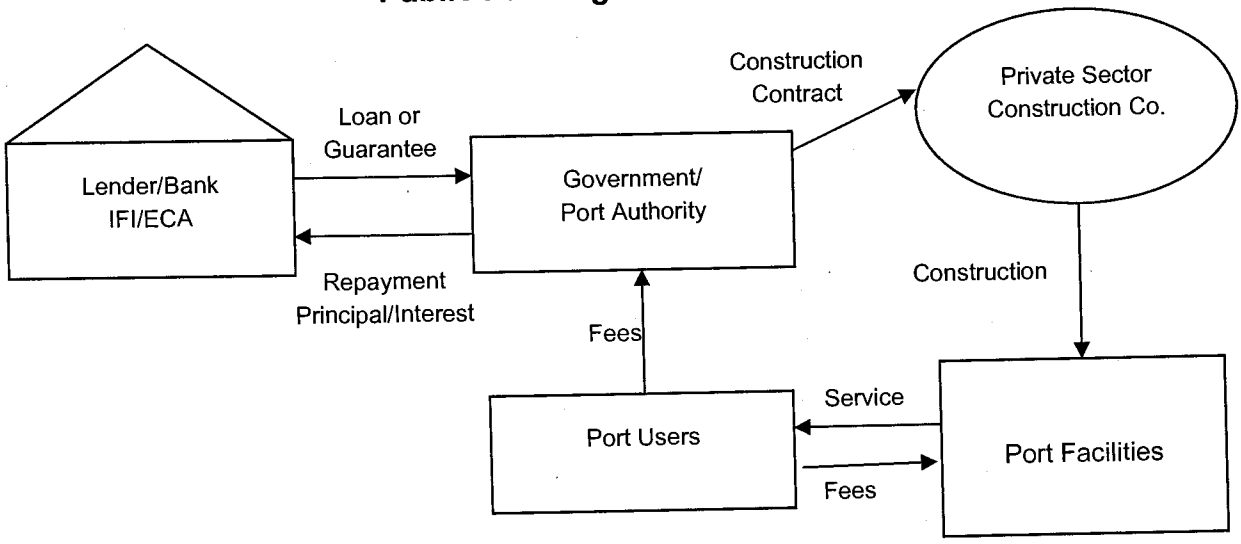
The following graph sets forth the level of risk by PSP contracting option.



5.4 Public Sector (Government) Funding

Public sector funding generally comes from the Government's capital budget, investments from IFI's, commercial banks and/or a special port funds. The following chart presents the public funding structure.

Public Funding Structure



5.4.1 IFI Funding Through the Public Sector

This section focuses on the GoS's potential sources of port project financing should it undertake to construct and contract or lease the port to the private sector. The GoS borrows the funds to finance the port project and gives a sovereign guarantee to the lender(s) to repay the loan and all the interest due. The lender(s) on the other hand analyze the Government's ability to raise the funds through taxation and revenues from public enterprises, such as the new port. The sovereign guarantees or loans are considered a government liability and can affect its ability to borrow funds in the future for other projects.

IFIs, a critical source of infrastructure funding in the developing world, vary substantially in their mandates and methods for investing in or making grants to projects. This section focuses specifically on IFI's that are in a position to provide funding to the GoS (not private sector companies) for this port project. Although this list includes the primary potential IFI investors in the port project, there are many others (especially on a bilateral basis) that are not included in this section.

The following exhibit contains a list of the primary multilateral IFI's that invest or grant funds to projects such as the Bargny port Project.

Some Multi and Bi-Lateral International Financial Institutions

World Bank Group (IBRD & IFC)
African Development Bank (ADB)
Kfw Banking Group – DEG (Germany)
IPAD (Portugal)
European Investment Bank
European Investment Fund
Agence Française de Développement (AFD)
Millennium Challenge Corporation (USA)
Japanese Bank of International Cooperation
FMO (Holland)
AFD – Propaco (France)
SIDA (Sweden)
OPIC (USA)

Generally, the maximum term of the loans (depending on currency) to regional member countries or public entities (e.g., a Port Authority) is 20 years. The ADB, which prefers to lend in USD, ZAR, JPY or Euros, does allow for grace periods on principal and is willing to structure the repayment schedule based on projected cash flows. The loans can be on a variable or fixed interest rate basis. ADB infrastructure funding would also be available to private sector companies and/or SPC's involved in constructing and operating the port.

The European Investment Bank ("EIB") has invested in African infrastructure projects based on the commercial viability of the project. The EIB also invests in private sector companies and projects and may be available to participate with European private sector companies or SPC's in funding the construction of the port.

In addition to the multilateral IFI's described above, the GoS has access to several bilateral donor and investment institutions. These institutions are generally committed to providing funding (commercial and subsidized/soft loans and/or grants) to promote development and the alleviation of poverty. The United States Agency for International Development ("USAID") and the United States Millennium Challenge Corporation ("MCC") are US based bilateral institutions that might be of interest.

Most bilateral institutions encourage private sector participation, including funding, in projects such as the port project.

5.5 Private Sector Funding

The private sector has two options in approaching projects such as this port project. The first option ("corporate financing") is to participate in the funding, operation and management on its own behalf (e.g., Maersk-SeaLand) and therefore carrying the capital costs and the resulting risks on its own balance sheet. The second option ("project financing") is through an SPC. Project

financing is usually used when the project requires significant funding and the sponsors want to distribute some of the risk. The SPC equity investors generally include sponsors (e.g., construction and port management companies) and other non-sponsor higher risk investors. The debt holders generally include IFI's, and international and domestic private sector financial institutions (e.g., commercial and investment banks).

The difference in investment objectives and profiles of the various equity and debt investors has led to the development of many types of equity and debt instruments. The nature, terms and conditions of these hybrid-financing vehicles depend not only on the investors' requirements but also on the needs of the project. The following is a general list of some of the hybrid vehicles, listed from most risky to least risky:

- Equity,
- Preferred equity (with a guaranteed dividend),
- Convertible debt (convertible at a pre-established value),
- Subordinate debt, and
- Secured debt.

The financing vehicles that fall between equity and secured debt are also often referred to as mezzanine financing. Some of the reasons for obtaining such hybrid financing are that:

- The equity investor can attract investors that might otherwise not be able or interested investing in the project,
- The secured debt investors will consider the mezzanine financing as form of equity in analyzing the risk of their investment in the project, and
- The hybrid financing investors will earn a higher return than the debt investors and can, in fact, benefit as equity investors in the case of convertible debt.

For our purposes we will focus on the standard debt and equity investments.

5.5.1 Corporate Financing

Corporate financing occurs when a company invests in a project in the ordinary course of business (e.g., a shipping or port management company).

A company may choose this option when the size and nature of the project would not limit its ability to continue seeking new core business opportunities. These companies are not investment

companies and will generally only invest in projects in which, through operations, they see an opportunity to improve profits by increasing market share (revenues) and/or reducing expenses.

Corporate financing of a project may come from either the company's cash flow and/or in the case of larger projects such as the transshipment port may require the issuance of corporate (not project specific) debt and/or equity. The investors look to the corporation's overall income and asset base as its source of payment and security. The investment (whether debt or equity) is included on the corporation's balance sheet. As a result of the security for the newly issued debt being based on the overall operations and balance sheet of the company, often the terms, conditions and costs (e.g., interest rate) are more favorable.

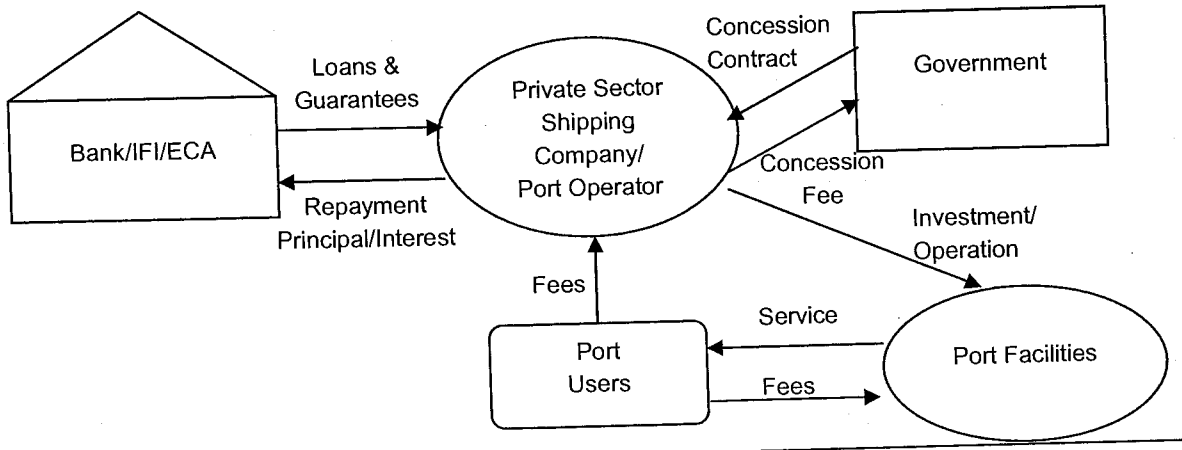
As with an SPC, the company may also seek funding, guarantees and insurance (e.g., political risk) from ECA's, such as the Export-Import Bank of the United States ("EXIM Bank"), and multi and bilateral IFI's such as the International Finance Corporation ("IFC") and the Overseas Private Investment Corporation ("OPIC") in the United States.

Although the selection of this option by a company will require a greater commitment of capital and the assumption of more risk, it may be a viable option for the port project considering the global carriers are seeking to establish their competitive position by entering into long-term dedicated port contracts and may be interested in constructing a small to moderate sized dedicated transshipment container terminal.

A clear advantage to this or the SPC option in which a larger shipping company participates as a sole or major investor is that it will virtually guarantee an immediate market, thereby, reducing the market risk and cost of capital.

The following chart presents the structure of a corporate financed port project.

Corporate Financing



5.5.2 Project Financing

The project financing structure is used as a funding tool for companies who do not have the ability to or interest in committing their own capital resources and/or guarantees to a project. By committing large amounts of their own capital to one or a few projects, a company often limits its ability to enter into other potentially lucrative projects.

Project financing is accomplished through the creation and equity financing of a "non or limited-recourse" SPC. The "non or limited-recourse" legal designation limits the exposure of all equity investors in the project to the amount actually invested in equity. The equity investors (sponsors) generally consist of a team or consortium of private companies.

The contract vehicles applicable to an SPC are BOT's and BOO's. In order to be able to generate investor interest in the SPC, they must be satisfied that revenues generated by the SPC will be sufficient to cover all expenses, including interest, and other cash flow obligations (e.g., repayment of principal) and provide the equity investors with an acceptable return (e.g., IRR of 30%). The GoS would not be required to provide any guarantees on the debt issued by the SPC.

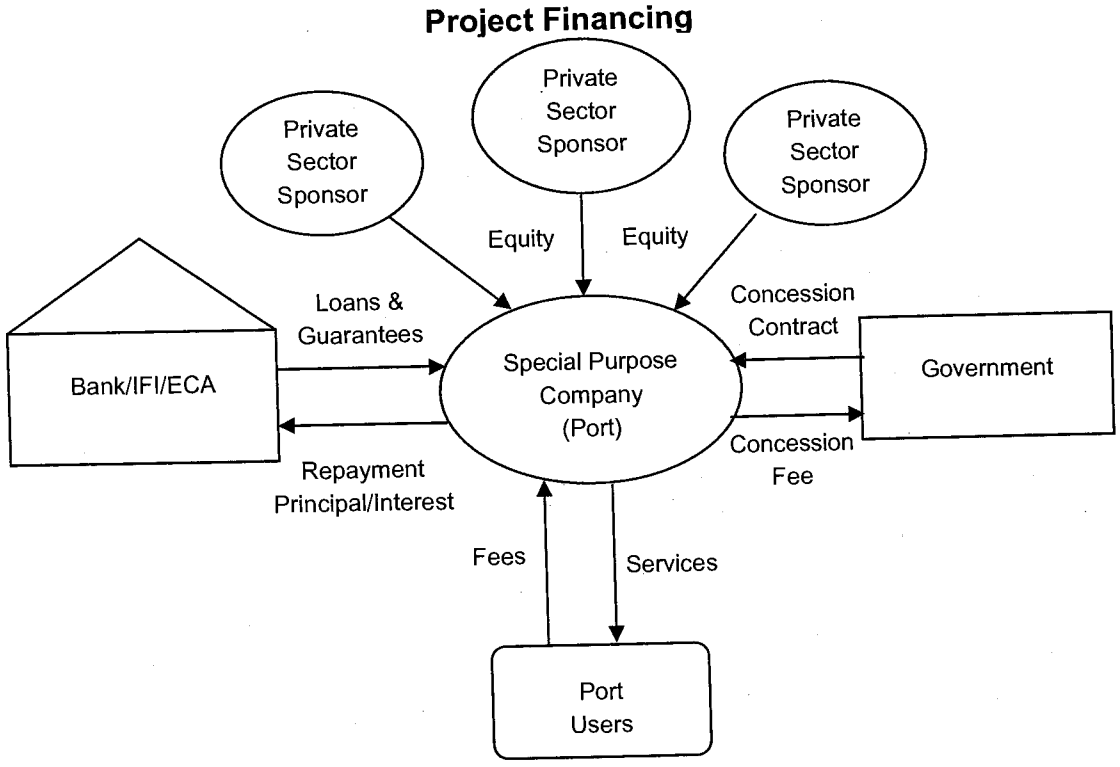
Under this funding option, the equity investors in the project include both sponsors (active investors) and non-sponsors (passive investors). The SPC's sole purpose is to raise funds, collect revenues, pay expenses and distribute profits to the equity investors. The SPC does not have the capacity to construct or operate the port and therefore subcontracts these services to other companies often including the sponsors. As a result of this relationship between the sponsors and the SPC, the non-sponsor equity investors and to a certain extent the debt investors generally require terms and conditions in the contracts that assure an arms length relationship exit between the parties. The non-sponsor equity and debt investors may also require that the sponsors retain their equity position in the SPC for a minimum period of time (e.g., 5 years) and provide pre-established fixed priced services (e.g., "turnkey" construction contract). All of these conditions are put in place to reduce the potential for abuse on the part of the sponsor(s).

In addition to providing the sponsors with "non- or limited-recourse" funding of the project and thereby reducing their risk, an SPC structure also allows other potential sponsor companies with complimentary capacity or expertise to take a stake in the project. The potential private sector sponsors of a port SPC should include companies already involved in port management operations and possibly a construction company.

As with corporate financing, project financing will also seek funding, guarantees and insurance from ECA's and other IFI's.

In summary, the advantages of project financing through an SPC are that it facilitates the funding of large projects and creates a vehicle in which several private sector companies share in the risk and benefits derived from a project. Project financing may also provide a more conducive environment to open competition.

The following chart presents the structure of a project financed SPC port project.



5.5.3 Non-Sponsor (Passive) Equity Investors

Unlike the sponsors who benefit from selling service to an SPC, the non-sponsor equity, investor(s) in a project, are only concerned with the profitability/cash flow after all expenses are paid, and the potential future sale of its equity interest in the project. Also unlike a sponsor, a non-sponsor equity investor will only have the opportunity to participate in an SPC (not a corporate financing) structure.

Typical non-sponsor investors in the port may include certain IFI's (mandated to invest equity and/or mezzanine debt) and regional or global investment funds. Although the number of potential funds that invest in the developing world is limited, due to perceived risk and limited size of many projects, this port project may provide the opportunity for global investment funds to diversify their portfolios.

Two of the larger African infrastructure specific funds are AIG Africa Infrastructure Fund, whose investors include American Insurance Group and the International Finance Corporation ("IFC"), and the New Africa Infrastructure Fund, which is sponsored by OPIC.

In addition to the two large infrastructure funds, other smaller regional funds have been established by bilateral and multilateral IFI's such as Propaco, FMO (Holland), DEG (Germany), European Investment Bank, the African Development Bank and the IFC.

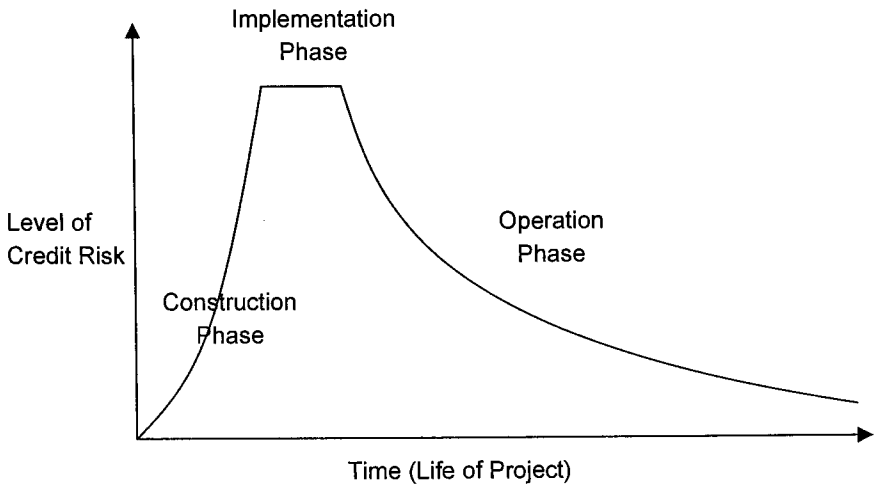
5.5.4 Debt Investors

As there are several different types of debt instruments and lenders, this section will focus on those types and sources of debt financing available for a feasible infrastructure port project.

In the developing world, IFI's and ECA's play an integral role in funding infrastructure projects through the provision of both loans and loan guarantees. Also, other forms of financing, such as equipment leases, are often used to fund a portion of a project. However, the ultimate responsibility for financing the port project will rest with the private sector.

Before beginning it is important to understand the risk profile of the project through the various phases. The following graph shows the general risk profile of a project in the construction, implementation and operations of a port project.

Project Life / Risk Cycle



5.5.4.1 Terms and Conditions of Debt

The types of debt issued by an SPC or company raising funds through its own balance sheet depend on the funding requirements of the project, the interests/objectives of the specific lenders, and the capital structure requirements of the other investors.

The financing of the construction of a project can include short-tem debt and/or drawing down of long-term debt. Short-term funding mechanisms include construction, bridge or line of credit financing. The short-tem lenders are usually commercial banks that rely on the proceeds from longer-term financing to be issued upon completion of the construction. The availability of long-term debt is essential to the short-term lenders considering the high-risk level in the earlier stage of a project.

Long-term financing can consist of several types of secured and unsecured or subordinate debt. Secured debt takes precedence over all other unsecured debt in the case of liquidation and the payment of interest and principal. Debt can be secured by specific assets or by all of the assets of a project. Unsecured debt is generally next in line with respect to the distribution of funds from the liquidation of assets and the distribution of interest. As a result of this subordinate status, unsecured debt investors require a higher interest rate than secured lenders. Unsecured debt investors that are interested in benefiting from the upside of the project may also have an option to convert their debt into equity at a predetermined conversion price. Other methods for providing a debt investor with the opportunity to benefit from appreciation in the common stock are through warranties or stock options that allow for the purchase of equity at a later date.

The following is a list of the standard terms and conditions included in lending agreement.

The terms include:

- Amount of loan (including currency),
- Method and timing for distributing the loan (e.g., bulk or drawdown),
- Pricing (e.g., fixed and/or variable interest rate),
- Repayment method (e.g., grace period, deferral of principal, straight line, balloon), and
- Maturity (e.g., length of loan).

The conditions may include:

- Conditions precedent to closing (e.g., the signing of the concession agreement),
- Representations and warranties,
- Restrictions on related party transactions,
- Financial covenants (described below),
- Guarantees, security and/or collateral,
- Use of proceeds, and
- Events of default.

5.5.5.1 International Financial Institutions (IFI's)

IFI's can often be counted on to co-finance or "parallel" finance private sector banks. In addition to the AfDB, which may provide direct debt funding to the private sector port investors (under certain conditions as described in the "Public Funding" section), the World Bank, through the International Bank of Reconstruction and Development (IBRD) may also be involved in funding along side banks. This parallel financing is often critical to the funding of a project.

The IFC, the private sector arm of the World Bank Group, can participate in the funding of a private sector port project through two principal mechanisms. The first mechanism is direct financing or the provision of a guarantee. Under this mechanism, the IFC funds or guarantees the last installment (usually between 10% and 25%) of a bank loan to a private port project SPC or company. The second mechanism is to guarantee any amount in excess of the borrower's ability to pay interest on the last installment of a variable interest rate loan thereby providing a ceiling on a variable rate loan. In fact, IFI's often add significant value to projects by offering longer-term financing than private sector banks.

In addition to actually funding and/or guaranteeing debt, investors are also reassured by the participation of IFI's in a project.

5.5.5.2 Banks

Commercial/investment banks have traditionally been the largest source of PSP financing and often play a pivotal role in the funding of a project. In BOO and BOT projects, one or more banks can also be members of a bidding PSP consortium.

In addition to lending to a SPC or company, banks also provide construction financing and stand-by credit facilities that are considered critical in case of capital expenditure overruns. Lenders may also act individually or through a syndicate or group of banks. Syndicates, like consortiums, allow the banks to diversify their investments by investing less money in more projects and thereby reduce their risk to any one project. Banks tend to be more flexible in their lending than other lending institutions such as IFI's. Banks, like other the other investors, are interested in minimizing their credit risk and therefore often require guarantees on all or a portion of their loans. Guarantees are often obtained from institutions such as MIGA and even the host government. Other forms of credit enhancement include the creation of reserve accounts (e.g., three months of principal and interest payments) and escrow accounts into which large customers pay their fees. Escrow accounts provide the beneficiary banks with a first right to the funds with any surplus being passed on to the SPC or company to cover operating expenses.

The following is a list of some of the larger international banks with a presence in Sub-Saharan Africa and the capacity to participate in the funding of the project:

ABN AMRO Bank (Netherlands)
ABSA Bank (South Africa)
Barclays Bank (England)
Citibank (USA)
Deutsche Bank (Germany)
HSBC Bank (England)
Investec Bank (South Africa)
JPMorgan Chase Bank (USA)
Nedcor Bank (South Africa)
Société Générale (France)

5.6 Investor Criteria With Respect to the Port Project

This section focuses on the various project-specific and overall Senegal criteria that will be important to prospective investors. These criteria should be considered in conjunction with the aforementioned risk descriptions. This section also addresses the manner in which the transshipment port being considered meets these criteria.

It should be noted that for proposals submitted to the GoS, the consortium members will be required to demonstrate their ability to fund their own equity interest in the project, and to also secure the required debt and non-sponsor equity funding. In short, the company, or consortium of companies (which may include a financial institution), will be responsible for obtaining the required funding for the project.

The level of importance of the specific criterion will also depend on whether the project is financed through a corporate or project financing structure.

5.6.1 Strength and Experience of the Project Sponsors

Ultimately, the strength and experience of the project sponsors are the most important factors considered by potential, non-sponsor equity and debt investors in a project. Therefore, in evaluating the various proposals, emphasis should be placed on the technical capacity and experience of the sponsors. Although the investors evaluate the strength and experience of the consortium team as a whole, significantly more weight needs to be put on the strength and experience of the lead sponsor(s).

Other issues under this criterion are the success of the sponsors in building and operating similar projects in similar environments and the strength of the individuals that will be responsible for the construction and operation of the port.

Therefore it is essential for the viability of this project that a strong and experienced sponsor company or consortium be selected for this project.

5.6.2 Project Fundamentals and Financial Covenants

The financial and economic fundamentals of the project are considered critical to prospective investors. Although all stakeholders and investors are interested in the overall success of the project, the debt and equity investors are ultimately interested in different financial and economic criteria of the project. Should this project be financed through corporate rather than project financing, the financial and economic viability of the project is less important to the investors considering they will be relying on the financing company's entire operations.

5.6.3 Credit of Project Sponsors

The investors will be interested in the credit of the company or the consortium members on the project. This criterion will be especially important in a corporate financing structure considering losses in other company operations will affect the port project even if it is operating profitably.

The sponsors' credit will be examined on both an actual and proforma (after project implementation) basis. In determining the credit worthiness of a company, many of the indicators discussed above in the "Financial and economic viability of the project" section will be examined for the company itself.

This criterion should also be considered closely by the GoS in evaluating the proposals submitted by the bidders on the project.

5.6.4 Contractual Arrangements

The investors will also examine any contractual arrangements that may exist between the various stakeholders (e.g., GoS, sponsors, prospective customers and other investors) prior to committing their funds. As discussed elsewhere in this study, contractual arrangements may include:

- Consortium agreement,
- Proposed concession agreement,
- Exclusivity or minimum usage of port services contracts with shipping companies,
- Guarantees by the GoS, IFI's or ECA's, and
- Project reserve funds.

5.6.5 Non-financial Covenants

In addition to the financial covenants discussed in the "Project fundamentals and financial covenants" section above, debt investors will require the inclusion of other covenants to protect their investment. Some of these other covenants are:

- Drawdown capital structure requirement (e.g., for every dollar of debt drawn down through the construction period, a dollar of equity must also be drawn down),
- Minimum maintenance requirements (e.g., annual maintenance of the port facility must equal 3% of the asset value),
- Participation on the project's board of directors under certain circumstances, and
- Veto right on the issuance of additional debt.

5.6.6 Legislative Environment and Incentives

The viability of the project, as a whole, and the interest of investors in funding the port project depends on the legislative climate and the incentives (e.g., taxes and guarantees) that may be available. The following describes some of the legislative areas of interest to the investors.

Concession Fees, Duties and Corporate and Individual Taxes

To encourage capital investment, the GoS may also want to consider providing a tax holiday in the early years of the project.

Ultimately, the port sponsors and investors will compare the overall investment and operating climate to those of other countries in the region. They will also compare the net savings from the use of a transshipment port to cost of constructing and operating the port.

Other Legislative and Environmental Issues

Investors will be looking at Senegal's PSP track record and the stability of the legal system. The perceived legislative risk will certainly require a premium on the return on investment for both the debt and equity investors.

5.6.7 Strengths and Weakness of the Port Project

The following is a summary of the project specific strengths and weaknesses that will be considered by potential port investors and operators.

Strengths

- The feasibility of the project,
- Existence of the Mittal operation,
- Regional opportunity for economic development

- Relatively stable government,
- Minimal GoS intervention in the construction and operations of the port.

Weaknesses

- Limited PSP track record,
- Heavy upfront investment,
- "Green field" project.

5.7 Recommended Structure

The winning bidder will be responsible for funding and operating the port project. It is recommended that the GoS select either a long-term BOT (greater than 30 years) or BOO structure and enter into a concession agreement with the winning bidder. The principal reasons for recommending one of these structures are:

- The construction and operation of a self funding and sustaining port in Bargny is feasible and would be attractive to sponsors and investors,
- The GoS does not have the financial or operating capacity to undertake all or even a portion of the funding and related risks of the port project,
- The BOO and BOT structures promote the GoS's objective of encouraging PSP in infrastructure projects.

The long-term concession agreement should be flexible and allow for adjustments through the life of the contract. This can be accomplished by including agreed upon periodic review and renegotiation of certain terms and conditions within the concession agreement and/or by including automatic adjustments (e.g., concession fees) based on one or more operating and/or financial performance criteria. The operating criteria could include the number of ships and/or containers serviced in the port, and the financial criteria used may be total revenues and/or net income generated by the port. However, it should be noted that any conditions allowing for the renegotiation of the concession contract may be considered additional risk on the part of the investor and therefore require a higher rate of return on investment.

There are several port project related factors that should be considered by the GoS in undertaking the implementation of this project. These factors should also be considered in developing the investment environment, promoting the project, preparing requests for proposals, evaluating proposals, negotiating with private sector counterparts and selecting and designing the ultimate structure of the PSP.

A fair concession contract and amenable investment environment will also discourage the port operator from diverting revenues and income to other off shore profit centers.

The two funding related options available to the GoS and the private sector participant in the port are whether to enter into a BOT or BOO concession agreement and whether the winning bidder will utilize its own corporate funds or create a SPC to undertake the project. The final structure will be determined over time as the project continues to develop.

5.7.1 Comparing BOO and BOT Options

The following is a comparison of the BOT and BOO structures as they pertain to the port project.

Comparison of BOT and BOO Structures

Issue/Condition	BOT	BOO
Capital Investment	Reluctance to make additional capital investments, especially in the latter stages of the BOT/ concession agreement.	Willingness to invest throughout the life of the port as the benefits from the investment will be realized.
Maintenance	A shorter-term profit motive promotes less maintenance, principally in the later stages of the contract.	Promotes optimum maintenance throughout the project.
Ability to replace operator	The GoS will be able to renegotiate the contract and replace the port operator at the end of the contract.	More difficult to replace operator considering it owns the port.
Amount of GoS infrastructure investment required	Some GoS investment may be required as the private sector investors' ability to recover on long-term capital assets may be limited.	Less, if any, capital investment required on the part of the GoS.
Management and monitoring of contract and port operations	More management and monitoring required as the interests of the private sector operator and investor may be differ from GoS mostly in the latter stages of the contract.	Less management and monitoring required as decisions are purely market based and the interests of the private sector and GoS are similar throughout the life of the port.
Market Value of port and concession	The value of the port and concession will decrease as the port matures and approaches transfer to the GoS.	The value of the port and concession will be based on market value with no discounting for expiration.

Chapter 6

Development Impact Assessment

6.1 Introduction

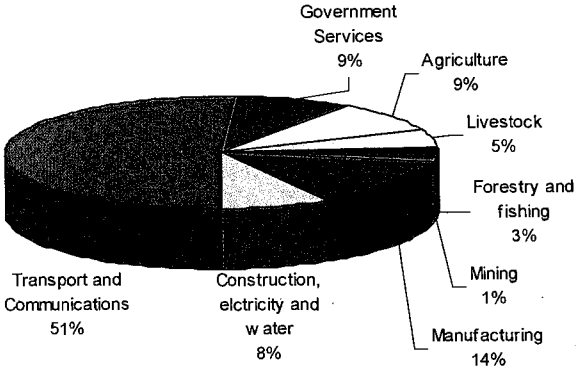
The successful implementation of the proposed multi-commodity bulk port in Bargny requires an effective partnership between several private and government entities. Much of the funding for the new port will come from private companies and therefore the primary purpose for the multi-commodity bulk port in Bargny is the economic and logistical benefits gained by the stakeholders. In addition to the economical and logistical benefits sought by private industry, policy considerations linked to traffic congestion and pollution in the city of Dakar lend themselves to the creation of a special purpose-built bulk port in Bargny.

With a project of this size and nature, there are impacts, both direct and indirect, which extend beyond the stakeholders into the surrounding region. This Development Impact Assessment (DIA) identifies the potential benefits to the region with respect to the following areas:

- Infrastructure
- Human Capacity Building
- Technology Transfer
- Productivity Improvement/Market-Oriented Reform

In order to accurately assess the impacts of the proposed development, it is necessary to first take a look at the current socioeconomic status of the region. Currently, the population of Senegal is approximately 12,000,000 with an annual growth rate of approximately 2.9 percent. Senegal's gross domestic product (GDP) is made up of the sectors shown in Figure 6-1.

Figure 6-1 GDP of Senegal



The unemployment rate is approximately 48%, of which 40% affects the urban youth (2001). Bargny has a population of approximately 28,000. Bargny is bordered by two small villages; Minam and Sendou, with populations of 200 people and 1,000 people, respectively. Fishing and agriculture are the main economic activities within this area.

Senegal does currently have a port (Dakar) and an international airport, but transportation in Senegal is not well developed. The road network consists of 14,358 km, and the one railway consists of 906 km of track. However, the project site is located adjacent to the highway from Dakar to Thies.

Potable water resources are also a concern, with only 56% of rural and 78% of urban households having clean water. Water shortages and poor quality are due to inadequate distribution systems and a lack of wastewater treatment facilities. In Dakar, only 10% of wastewater is treated. The remaining wastewater is either discharged directly to the land surface or the ocean. Outside of Dakar, the percentage of treated wastewater is even less.

6.2 Infrastructure

There are a number of major projects in the vicinity that are currently being planned and/or designed.

1. Special Economic Zone-Dakar:
Jafza International of Dubai is negotiating with the Government of Senegal the terms of a concession agreement on acquiring 10,000 hectares of land to set up an integrated Special Economic Zone adjacent to the new Dakar International Airport. It will comprise a free zone, an industrial zone, an office park, and tourism and residential areas.

2. Dakar International Airport:
Currently, there are plans to construct a new airport approximately 10 km southeast of the proposed Port site. With it's location between Dakar and the new airport, the region should see improved infrastructure as development extends outside of Dakar.

3. Dakar-Thies Toll Road:
Portions of the new toll road between Dakar and Thies are currently under construction. The City of Thies is approximately 25 kilometers northeast of Bargny and is the regional

capital and a regional development center. The toll road passes approximately 1 km north of the proposed port site, which will improve access to the Bargny region.

4. Falamé Railroad Rehabilitation:
In order to transport the iron ore from the mines in Falamé and phosphates from Matam to the new Port of Bargny, the railroad system will need to be improved. This project requires approximately 740 km of new and/or rehabilitated rail lines, which can either be accomplished with the construction of an all new railroad or the construction of approximately 310 km of new railroad and the rehabilitation of 430 km of existing railroad.

The port project contributes only a portion of the cumulative development impacts of all the projects planned for the region. However, the port project, alone, will provide benefits to the region with respect to the roads, water treatment, and power distribution.

The operation of the port will require significant truck traffic to and from the site. Therefore, a new system of roads and renovations to some of the existing roads will be imperative to the successful operation of the port facilities. The successful operation of the port will also require the use of potable water. The port will be designed to ensure there is a potable water supply, as well as providing adequate wastewater treatment. Depending on the development schedule of the adjacent Jafza project, these systems may be combined to meet the needs of both projects. Regardless of the location of the final systems, additional water and wastewater infrastructure will be in place, which will be more accessible to the local inhabitants.

Part of the multi-commodity port project will be used to import coal for two power plants that are planned for construction adjacent to the port. Coal will be unloaded from ships at the port and conveyed to the plants for power generation. The power plants will construct distribution systems that will provide the local inhabitants with access to additional power sources.

When considering the proposed multi-commodity port project as a portion of all the development projects planned for the region, there will be extensive infrastructure upgrades realized in and around Bargny. The addition of adequate transportation, power and water supplies to the region will provide the local inhabitants with the basic necessities to support economic growth.

6.3 Human Capacity Building

The construction and subsequent operation and maintenance of the proposed port will create numerous jobs. The initial construction of the port will take approximately three years and will employ skill levels ranging from engineers and managers to machine operators and general laborers. Port operations and maintenance will employ approximately 180 personnel. A breakdown of the required personnel is summarized in Table 7.1. The number of personnel included in the table are for the multi-commodity bulk port, only. The ArcelorMittal port facilities will require similar numbers of personnel.

Table 7.1 Required Personnel - Port Operations and Maintenance

Management & Administration		**Operations**		**Maintenance and Engineering**	
Title	**#**	**Title**	**#**	**Title**	**#**
Terminal Manager	1	General Super.	4	Mechanical Engineer	1
Secretary	1	Foreman	4	Scheduler/Planner	1
Operations Manager	1	Control Room	4	Mechanical Foreman	2
Maintenance Manager	1	Train Unloader	4	Assistant Foreman	1
Administration Manager	1	Stacker/Reclaimer	8	Mechanics	8
Secretary	2	Shiploader	8	Vehicle Mechanic	1
Receptionist	1	Labourers	12	Heavy Veh. Mechanic	1
Clerk	4	Dozer/Heavy Equip.	4	Marine Mechanic	2
Accountant	1	Marine Super.	1	Labourers	8
Security Supervisor	1	Tug Master	3	Welder	2
Guards*	24	Tug Mate	3	Electrical Engineer	1
Gate Men*	4	Tug Engineer	3	Electrical Foreman	2
Warehouse Supervisor	1				
Buyer	1				
Clerk	1				
Warehouse Helper	4				
Janitorial & Housekeep.	4				
Driver	4				
Sampling Technicians	4				
TOTAL	**61**	**TOTAL**	**74**	**TOTAL**	**46**

There are a wide variety of required skills for the personnel listed in Table 7.1. Many of the positions are typical port-related positions and most of the labor force should be able to be filled with local inhabitants. However, many of the positions will require some training, particularly for computers and the material handling control systems. Some of the positions may require more specific skills and therefore may require more extensive training. As ports become more automated, the staff needs to be able to keep up with the

technology and therefore the overall skill level of the workers should improve through initial training programs and with on-the-job experience.

6.4 Technology Transfer

Automated control systems in the port and bulk material handling industry are becoming more advanced, requiring a more skilled labor force. In order for this project to be successfully implemented, and operate with continued efficiency, the staff will require training on the control systems, which will require general computer knowledge as well as experience with the specific control system software programming and functions. As technological advances become more common in the developed nations, it is important that this technology be introduced and implemented in less developed nations to provide uniformity and promote economic growth where it is needed the most.

In addition to producing a more skilled workforce, the proposed multi-commodity bulk port project will help to create a more safety, health, and environmentally aware workforce. The U.S. is very conscious of worker safety and potential environmental hazards and has therefore created federal organizations such as the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA). Similar organizations with the same goals have been established throughout most of the developed countries. These organizations have strict standards and guidelines for protecting human health and safety in the work place and maintaining and restoring the health of the environment. These standards and guidelines require measures such as fall prevention equipment, proper ventilation, and containment areas at potential spill locations. These guidelines will be utilized in the design and construction of the port and bulk handling facilities, and the personnel will be trained to properly use the equipment as part of their standard operating procedures. By equipping the facilities with proper safety measures, human health and safety, and environmental impact awareness will be heightened and will hopefully influence how safety and environmental impact procedures are practiced throughout the region.

6.5 Productivity Improvement/Market Oriented Reform

The proposed multi-commodity port will improve the productivity of the private stakeholders' commercial operations by reducing the time it takes to transport import and

export commodities to and from the port, and by reducing the time it takes to load and unload ships. The proposed facility will also allow them to charter larger bulk vessels, which in turn will reduce shipping costs.

Two of the stakeholders of the proposed Port of Bargny project are cement manufacturers that are presently expanding their process plants. Once completed (2010) they will both move from clinker importers to clinker exporters, making this essential building material more accessible to the sub-region and therefore more affordable.

6.6 Summary

The primary goals of moving the bulk commodity port activities from Dakar to Bargny are to remove some of the congestion in Dakar and to allow the Dakar port to expand its container terminal activities. There are also some economic benefits for the stakeholders associated with relocating their import and export activities from Dakar to Bargny. Whereas this report focuses on the logistics and economics of the port activities, this chapter takes a broader look at the impacts of the proposed development on the socioeconomics of the region, more specifically the infrastructure, human capacity building, technology transfer, and productivity improvement/market-oriented reform.

The implementation of the Port of Bargny project, alone, will have a significant socioeconomic impact on the surrounding area, but when considered with the other proposed projects, the socioeconomic impacts will be extensive and widespread. These developments will create numerous jobs, both direct and indirect. The new infrastructure will provide the necessary network of utilities and transportation to provide a better standard of living and create an environment more conducive to economic growth in and around Bargny.

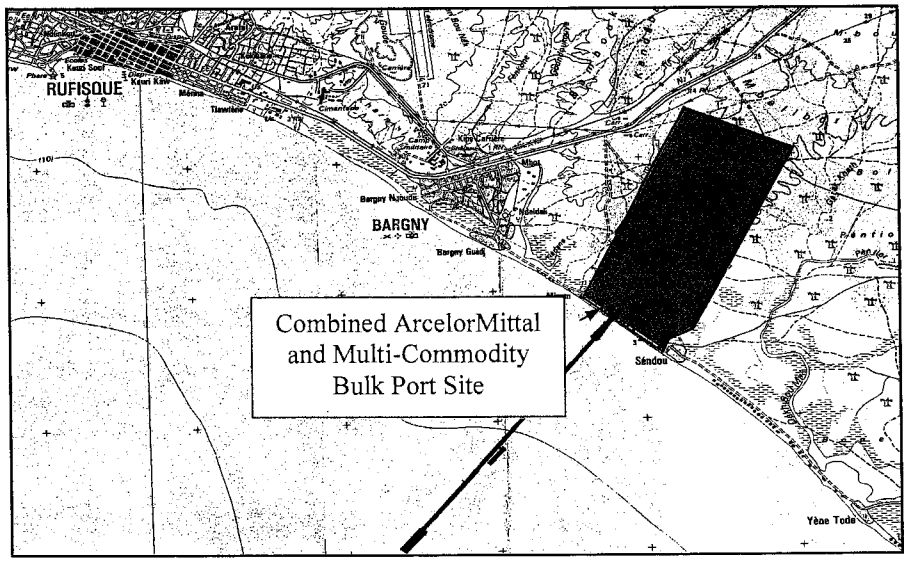
Chapter 7

Environmental Assessment

7.1 Introduction

The proposed site for the proposed multi-commodity port in Bargny encompasses approximately 232 ha of undeveloped property, with approximately 285 m of coastal access. As discussed in previous chapters, the new multi-commodity port is a portion of the larger combined site, which includes the ArcelorMittal iron ore port and material handling facility. The combined property includes approximately 485 ha, with 1,320 m of coastal access.

The purpose of this Chapter is to identify significant potential adverse impacts associated with the proposed new multi-commodity port. This assessment identifies the existing site conditions, the possible environmental and socioeconomic impacts that could result from the construction and operation of the proposed new port, and suggested mitigation measures to reduce the major adverse impacts identified. This initial assessment is a general assessment of potential impacts as identified from available records and information. A more detailed environmental assessment will be required prior to proceeding into the construction phase of the project.



7.1.1 Data Collection

This initial environmental assessment included a review of available records, site plans, a site visit, and various meetings and interviews.

Meetings and interviews were conducted with MIFERSO and other stakeholders, which included representatives of the companies interested in relocating their bulk commodity import and export activities from Dakar to Bargny. TEC issued a questionnaire to MIFERSO, requesting operating considerations, future development, and fleet composition.

7.2 Existing Conditions

7.2.1 Flora and Fauna

Senegal is predominantly a low-lying country, with foothills in the southeastern portion of the country. The Senegal River separates Senegal from Mauritania to the North. Senegal is bordered by Mali to the east and Guinea and Guinea-Bissau to the South. Savannah covers most of Senegal. It consists of large stretches of grass with occasional acacias, baobabs and palm trees. The Casamance River runs through southern Senegal, which is the only region of Senegal characterized as tropical forest. The Senegalese are very ecologically aware and have established six national parks and five reserves. Senegal is protected under such environmentally focused international agreements, as Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Life Conservation, Ozone Layer Protection, Ship Pollution, Wetlands, and Whaling.

Senegal is located on one of the principal migration paths of wild birds and therefore is a large sanctuary for birds. There are three primary migratory routes; coastal, Senegal River and Casamance River. There are about 630 species of birds that can be identified in Senegal, approximately one-third of which are European migratory species.

Fish are also abundant along the coast of Senegal. Fifty-one species of fish have been recognized in Senegal. The best period for big game fish is June to October. Common species fished for include swordfish, sailfish, blue marlin, albacore tuna , barracuda, coryphenes, grouper, wahoos, bluefishes, stingfish, sole, African hind, breams, serioles, badeches, red carp, ombrine, carrangues, and moray (eel).

There are 188 mammal species in Senegal (including marine mammals), of which 1 is critically endangered, 3 are endangered, 11 are vulnerable, and 3 are near-threatened, as shown in Table 7.1.

Table 7.1 Endangered and Threatened Mammals of Senegal

Critically Endangered	Endangered	Vulnerable	Near-Threatened
Dama Gazelle	Red Colobus (monkey)	African Bush Elephant	Schreber's Yellow Bat
	Common Chimpanzee	African Manatee	Daubenton's Free-tailed Bat
	African Wild Dog	Barbastelle (bat)	Aba Roundleaf Bat
		Guinean Horseshoe Bat	
		Harbour Porpoise	
		Cheetah	
		African Golden Cat	
		Lion	
		Hippopotamus	
		Dorcas Gazelle	
		Red-fronted Gazelle	

7.2.2 Setting

The proposed site for the new port is located at Bargny between Minam and Séndou. The proposed site is a greenfield site, located at a relatively flat area adjacent to the ocean. The proposed project site shows limited vegetation and wildlife. There are a few Baobab trees on the property. These trees are sometimes used for pharmaceutical, nutritional and cosmetic purposes. The site visit provided evidence of rabbits and other small mammals, but there was no evidence of additional wildlife.

Along the shoreline of the proposed combined site for the multi-commodity bulk port and ArcelorMittal port, there are approximately ten vacation houses. Interviews with MIFERSO indicate that these homes did not have the proper authority to build and are therefore characterized as "illegal".

The north foreshore of the site is rocky, and the south foreshore is sandy, both with beaches approximately 20m wide. The littoral zone is composed of rock and sand. The geology of the site consists of calcareous rocks, silt and schist in the upper layer. Lower layers include the following geology:

- -10m: silt combined with gravel and calcareous rocks
- -15m: - substratum of calcareous rocks covered by a small layer of fine sand and gravel.
- -20m: 3m layer of alternating layers of fine sand and clay, 4.25m of compacted clay, and some calcareous rocks.

Although Senegal has a diverse population of wildlife, much of the wildlife identified, live in habitats located closer to the two rivers (Senegal and Casamance) and in the national parks and reserves. The project site is not located near these habitats and is not suitable for a large portion of the wildlife listed in section 7.2.1, with the exception of the aquatic species.

7.2.3 Environment

Terrestrial

Senegal has a tropical climate characterized by rainy season with abundant precipitation from July to October, and dry season from November to June. Temperatures range between 40°C in dry season and 15°C in rainy season. In the littoral zones, the winds provide lower than average temperatures. The winds are prevailing in the north except during the rainy season, when the winds are also strong in the west and south-west.

Bargny average wind velocities are between 4.4 and 6.2 m/s, and are directed toward the north-east. Currently, there is little activity at the site and therefore there are no existing

sources of noise emissions and the only impacts to the air quality are from the treatment of fish (smoking) and the burning of waste.

Aquatic

The ocean tide is semi-diurnal, with a high tide of 1.80m, and a low tide of 0.20m. The extreme water level is set at 2.50m. Our review of available records indicates that currents are parallel to the shore, prevailing north to south, with velocities rarely going over 0.20m/s. The shoreline and coastal area next to the proposed site is characterized by a beach width of 20m. The depth of -15m is located at 4 to 5 km from the coast.

In addition to the current practice of discharging wastewater to the ocean, solid waste is also dumped directly into the sea. These activities have adversely impacted the water quality by elevating the concentration of nutrients, bacteria, heavy metal and other contaminants.

7.2.4 Socioeconomics

The socioeconomics of Senegal are described throughout this report, most specifically in the Development Impact Assessment in Chapter 6. Although Senegal remains among the "least developed" countries, recent elections and a new Accelerated Growth Strategy (AGS) are encouraging organizations such as The World Bank and International Monetary Fund (IMF) to focus some of their efforts on the economic growth of Senegal.

Due to its location at the tip of West Africa, Dakar has a favorable geographic position. It has the potential to play an important role in the transport of goods throughout the region. However, the current congestion issues in the city are hampering the potential of the city to grow into an important hub for products to and from West Africa.

7.3 Environmental Impact and Mitigation Efforts

There are a number of potential impacts to the environment during both construction of the new port and its normal operation. Therefore, it is extremely important to identify potential hazards and pollutants and develop adequate control measures, prior to the construction and operation of the facility.

This section identifies the potential impacts associated with the proposed new port, and provides possible preventative and/or control measures. At this phase of the study, these measures are just identified as potential mechanisms for addressing the identified problems. Specific control measures will be decided upon and included in the design phase of this project.

7.3.1 Setting

Any potential "setting" impacts are limited to the site itself and the adjacent villages of Minam and Séndou. Minam and Séndou are small fishing and agricultural villages. The fishing communities are limited to artesan fishermen. There are no commercial establishments and therefore the construction of the port should not create any adverse impacts to their fishing efforts. The detailed Environmental Assessment Report, performed during the design phase should confirm this assessment.

The vacation homes constructed along the coast, within the site boundary, will obviously be impacted. As stated previously, the homes were illegally constructed and therefore should not prevent the progression of this project. However, the Guidelines from the World Bank Resettlement Advisory Committee (RAC) will be adhered to when working with these homeowners to relocate their homes and there may be some compensation offered for their resettlement.

7.3.2 Environment

The environmental issues associated with the construction and operation of this port are typical issues associated with most ports and terminals. To help address these issues, the World Bank Group has established The Environmental, Health, and Safety (EHS) Guidelines for Ports, Harbors, and Terminals. These guidelines represent the standards by which projects that involve members of the World Bank Group must abide by, unless more stringent regulations exist in the host country or other regulatory authority involved in the project. The environmental issues or primary concern in port and terminal construction and operation include the following:

- Dredged materials management
- Air emissions
- Wastewater
- Waste management
- Noise

Dredged Materials Management

The dredging process will create suspended sediment for a period of time, but the sediment will settle after the dredging and disposal are complete. Therefore the issues of concern are associated with the initial impacts to the aquatic habitat and species during the actual dredging process and the subsequent impacts associated with the disposal of the dredge material. Prior to beginning the dredging process, a plan needs to be establish that considers the species present at the location and the type of material to be dredged. There are several methods of dredging and the procedure selected should be based on minimizing suspension of sediments and destruction of habitat. The dredging plan should also consider the timing of the planned dredge to avoid interferences with feeding, breeding, calving, and spawning areas. Once the dredging process starts, there are also several methods for disposal of dredge material; land reclamation, open water discharge, or contained disposal. Again, the plan should evaluate the local species and content of the dredge material to determine the best procedure for managing the material.

Air Emissions

There are air emission concerns associated with the handling of the bulk commodities, themselves, as well as the emissions from the ships and land based vehicles.

During project construction, the air quality will be disturbed by the increased concentration of particulates in the air, caused by construction traffic and activities. There are a number of measures that should be implemented during construction that will help minimize impacts to the environment:

- Construction entrances, work areas, and haul roads should be stabilized (application of stabilizing agents such as water and calcium chloride)
- Stockpiled material should be stabilized.
- Haul trucks should be covered and undergo regular inspection.
- Erosion and sedimentation control measures should be implemented.

During operation, there are a number of other emission management strategies that can be implemented that target combustion sources and dust.

To address combustion sources, ship operators need to develop air quality management procedures such as abiding by international NO_x and SO_x emission regulations, using low-sulfur fuels and navigation of port access areas at partial power. Land based activities should keep transfer equipment in good working condition, reduce engine idling during on- and off-loading activities, and utilize less polluting land vehicle fleets and alternative fuels.

Dry bulk material handling procedures are very important in managing dust emissions. The loading and unloading of a ship can generate dust from several locations as the cargo is moved and transferred to conveying equipment. When a unloader or reclaimer moves material to the conveying system, the material is disturbed and air currents are generated. Fines within the material will be let loose by these currents.

As the cargo is moved and deposited onto the conveying system, wind currents generated by the movement, as well as weather conditions will cause the fines to be lofted from the material. Spillage from the ship loading and unloading operation will add to the amount of dust. As the cargo is transferred to receiving hoppers and deposited, the cargo will push air ahead of itself and cause additional turbulence. Air entrained in the cargo, as the cargo falls into the hopper will be squeezed out as it comes to rest, again generating more air currents.

Dust abatement for the ship unloading operation consists of several components:

- Tight sealing for closing surfaces on grabs
- Telescoping chutes for ship loaders and stackers
- Proper operation to stay within filling levels of conveying components
- Wind screens, covers, and where possible, full enclosure to attenuate the effect of wind on conveyors and transfer stations
- The installation of dust collection equipment and dust suppression sprays where possible
- Keep hatches covered when material handling is not being conducted

- Cover transport vehicles
- Regularly sweep docks and handling areas

The latest unloading cranes are equipped with aprons between the ship's side and the berth face to collect any spillage cause during the unloading operation. This collected material is then transferred to the receiving system. All closing surfaces of unloading grabs must be well maintained so as to contain the carried material.

Dust collection can consist of wet scrubbers or bag houses dependent upon the particle size distribution and the sensitivity to water. The bag houses can return any collected material directly to the conveyor system through a vortex reducer and rotary valve. Scrubbed material would discharge to settling ponds to recapture the water as well as separate the captured material.

Storm and Wastewater Discharge

Wastewater management refers to stormwater and sewage from port operations, as well as ship wastewater. For port operations, it is important that stormwater and sewage be maintained in separate streams to avoid increasing the volume of sanitary wastewater that requires treatment. Whereas filter mechanisms are often recommended for installation on stormwater collection systems, to prevent sediment and particulates from reaching the surface water, sanitary wastewater requires treatment for the removal of contaminants such as BOD, COD, total nitrogen, total phosphorous, TSS and total coliform bacteria.

Ship wastewater must also be treated for removal of the contaminants listed above, as well as oil and grease, as applicable. This may be done with a shipboard treatment system, or transported to the port for treatment at the on-site system.

Unlike a manufacturing plant, where there are byproducts to be disposed, the contaminants in the wastewater and storm water at a dry bulk terminal are spilled cargo or dust that has settled to the ground and been carried into the sewers by water. The first priority in limiting water contamination is to control spillage and fugitive dust.

None of the materials that are proposed to be handled at the new port can be considered as highly toxic.

Contaminants can be grouped into four general classes:

- Oils and hydrocarbons. These range in severity, the worst being the man-made chemicals such as chlorinated aromatic hydrocarbons, such as PCB's and dioxins
- Heavy metals - lead, copper, and cadmium are examples. These are ingested by fish and benthic organisms that live on the seabed. Soluable compounds of heavy metal are absorbed more readily than insoluable compounds and result in higher than normal mortalities of these fish and organisms, depending upon the particular compound and its concentration.
- Biological oxygen demand. Some chemicals and organic materials sauch as agricultural products absorb oxygen from the woter during the process of degrading and decomposition. This leaves the water depleted of oxygen, which affects fish and other organisms. Phosphates act directly the same way by fertilizing the growth of algae, which in turn consumes abnormal amounts of oxygen during decay.
- Inert solids. These are least harmful but they can smother the seabed and cause harm to fish if they are ingested through the gills.

Discharge of treated effluent water to the sea is not an operational plan for this facility. However, because discharge may be necessary on an occasional basis, treatment will be carried out to the regulatory levels.

Waste Management

There are a number of solid waste management practices that are outlined in the EHS Guidelines that should be reviewed prior to establishing the procedures for the port. However, the major environmental concern associated with waste management is the handling of hazardous wastes. The primary concern with hazardous wastes is spillage and therefore the port design needs to include spill prevention as well as spill control measures. All potential leakage sites should be equipped with secondary containment basins. Also, all potentially hazardous material storage and handling facilities should be constructed as far from traffic as possible and be protected from potential vehicular accidents.

Noise

There are sources of noise from vehicular traffic and loading/unloading equipment on the berths, as well as in the loading and unloading areas of each commodity storage location. Vegetation and walls can reduce noise levels, but due to the barren land, there are no natural noise buffers at the site. Therefore, the port must implement noise control measures to ensure noise levels do not exceed ambient noise level regulations. Noise control measures include:

- Selecting equipment with lower sound power levels
- Installing silencers for fans
- Installing acoustic enclosures, as necessary
- Installing acoustic barriers

As stated previously, the control measures identified in this section introduce methods, equipment, and procedures that are commonly used in the port, harbor, and terminal industry to address the various environmental concerns. Decisions on the actual equipment and procedures to be implemented for this project will be finalized during the design phase of this project.

7.3.3 Socioeconomic Impacts

The socioeconomic impacts of this proposed project are huge. There are the direct impacts to the Bargny region discussed in the Development Impact Assessment, associated with infrastructure, human capacity building, technology transfer, and

productivity improvement. There are also direct impacts to Dakar. By relocating the bulk commodity port activities away from the city, traffic congestion will be significantly reduced and the Port of Dakar will have additional capacity, which can be refocused on growing their container terminal facilities. This will allow Dakar the opportunity to pursue its potential as a major West African hub.

7.4 Summary

The existing 232 ha site for the proposed multi-commodity bulk port has little vegetation and little evidence of wildlife. The construction and operation of the Port of Bargny will have some impacts on the environment, but there should be no threat to any endangered or threatened species. The types of environmental concerns that will impact the site are the same types of impacts that would be addressed at most port projects. There are a number of proven control measures that can reduce or eliminate most of the concerns identified. It will be important to incorporate these measures during the final design of the port. If these control measures are implemented and the recommended standard operating procedures are adhered to, the environmental impacts of this project should be minimized.

The major impacts associated with the project will be the benefits focused around the socioeconomic development of the region. The Port of Bargny project is just one of several projects planned for the area, which will provide important infrastructure and create numerous jobs. The relocation of the bulk commodity port activities from Dakar is imperative to growth at the Port of Dakar. The successful relocation of the bulk commodity port and subsequent growth of Dakar's container terminal activities has the potential to stimulate the entire Senegalese economy.

Chapter 8

Implementation Plan

8.1 Regulatory Framework

The State of Senegal and Mittal Steel Holdings AG entered into a Port Agreement that establishes the framework for financing, designing, constructing, maintaining and operating the Mittal port facility. The initial term of the Agreement is twenty-five (25) years. It may be extended for one or more periods, not to exceed twenty-five years each time. The Agreement establishes the formation of an Infrastructure Company to act as a Senegalese company to carry out the transactions as intended in the Port Agreement and in the Railway Agreement.

The Port Agreement outlines a number of guarantees and rights that are to be provided to Mittal and the Infrastructure Company by the State. Below is a summary of the State's primary obligations, all of which include a requirement that the activities of Mittal and the Infrastructure Company be in compliance with applicable standards and guidelines and are subject to approval by the State's representative.

1. The Infrastructure Company has the right to occupy a parcel of the national domain
2. The Infrastructure Company is guaranteed the free choice of Sub-Contractors, Suppliers and partners
3. The Infrastructure Company has the right to charge users a tariff for terminal services
4. Mittal and the Infrastructure Company will have free management of the Port Operations
5. The State will facilitate obtaining necessary authorizations and permits
6. The State will resettle inhabitants whose presence on the Port Zone hinders the conduct of the Port Operations
7. The State guarantees access to existing infrastructure and any infrastructure built in the future that is required for Port Operations

The Agreement also outlines some guidelines for the activities of the Infrastructure Company. Below is a summary of their primary obligations related to Port activities and to the surrounding community.

1. The Infrastructure Company will pay to the State, an annual Domain Fee

2. The Infrastructure Company and its Sub-Contractors and Suppliers will give preference to Senegalese businesses for any purchase of equipment, supply of goods or provision of services, where possible
3. The Infrastructure Company will give preference to the Senegalese staff, when applicable and will use local staff for all jobs that do not require any specific professional skills
4. The Infrastructure Company will implement a program of training, development and promotion for Senegalese staff
5. The Infrastructure Company will create sanitary, school and entertainment infrastructures for workers and the closest members of their families
6. The Infrastructure Company will perform an Environmental Impact Study in accordance with Environmental Law, for the protection of the environment and preservation of the national cultural heritage.

In summary, the Port Agreement creates the Infrastructure Company and establishes the responsibilities of each of the entities. Mittal is primarily responsible for arranging the financing of the port project. The Infrastructure Company is responsible for the implementation of the necessary port activities, including social responsibilities to the surrounding community. The State is responsible for providing the land and facilitating the project implementation, as needed. In case of a breach of contract, the Agreement also includes additional provisions outlining the liability for each party, as well as legal recourse for any necessary dispute settlement.

The development of the multi-commodity terminal will therefore require an agreement between the stakeholders, Mittal, and the Infrastructure Company. The Government of Senegal and Mittal have already expressed their agreement in principle for the development of the multi-commodity terminal within the boundary of land granted to Mittal by the State.

8.2 Steps Required to Implement Project

The proposed multi-commodity bulk terminal is a complex project with as many as 12 potential stakeholders exporting and importing a variety of commodities. The financial analysis presented in Chapter 4 demonstrated the benefits of having the stakeholders pool resources to finance, construct, and operate the facilities.

Certain commitments are required of the stakeholders prior to the detailed feasibility and environmental impact studies. These studies will be required before investors and lenders can make financial commitments. A stakeholder syndicate will be the most efficient and expedient path to finalizing project requirements and responsibilities.

Economic and environmental benefits to Senegal and the Government of Senegal should also be considered when evaluating this project. These include, among others:

- Reduction in traffic congestion
- Savings in fuel subsidies
- Reduction in air pollution

The Government of Senegal should also evaluate the project's beneficial impact on the public and the national treasury and consider developing the project through a Public-Private-Partnership with the stakeholders. Governments typically participate in the development of projects that promote transportation and trade. Government participation in the following areas would be appropriate:

- Detailed feasibility studies
- Environmental Impact Studies
- Construction of basic infrastructure such as utilities, site preparation, and the offshore trestle

Successful implementation of this project with many potential users will require vision, leadership, and a substantial amount of coordination – between stakeholders,the State and Mittal who owns the rights to the property. It would be logical for MIFERSO to take on the role of promoter and coordinator for the project. MIFERSO is best positioned to liaise between all parties and advocate for success of the project.

Once detailed feasibility and environmental impact studies are completed, the stakeholders can form a Special Purpose Company (SPC) to develop the project. The objective of the SPC will be to finance, build, and operate efficient port facilities to maximize benefits for all stakeholders. Alternatively, a private terminal operating company could finance, build, and operate the facilities on a BOT or BOO basis.

Figure 8.1 below provides a simple schematic of the milestones required to implement the project.

Figure 8.1
Implementation Milestones

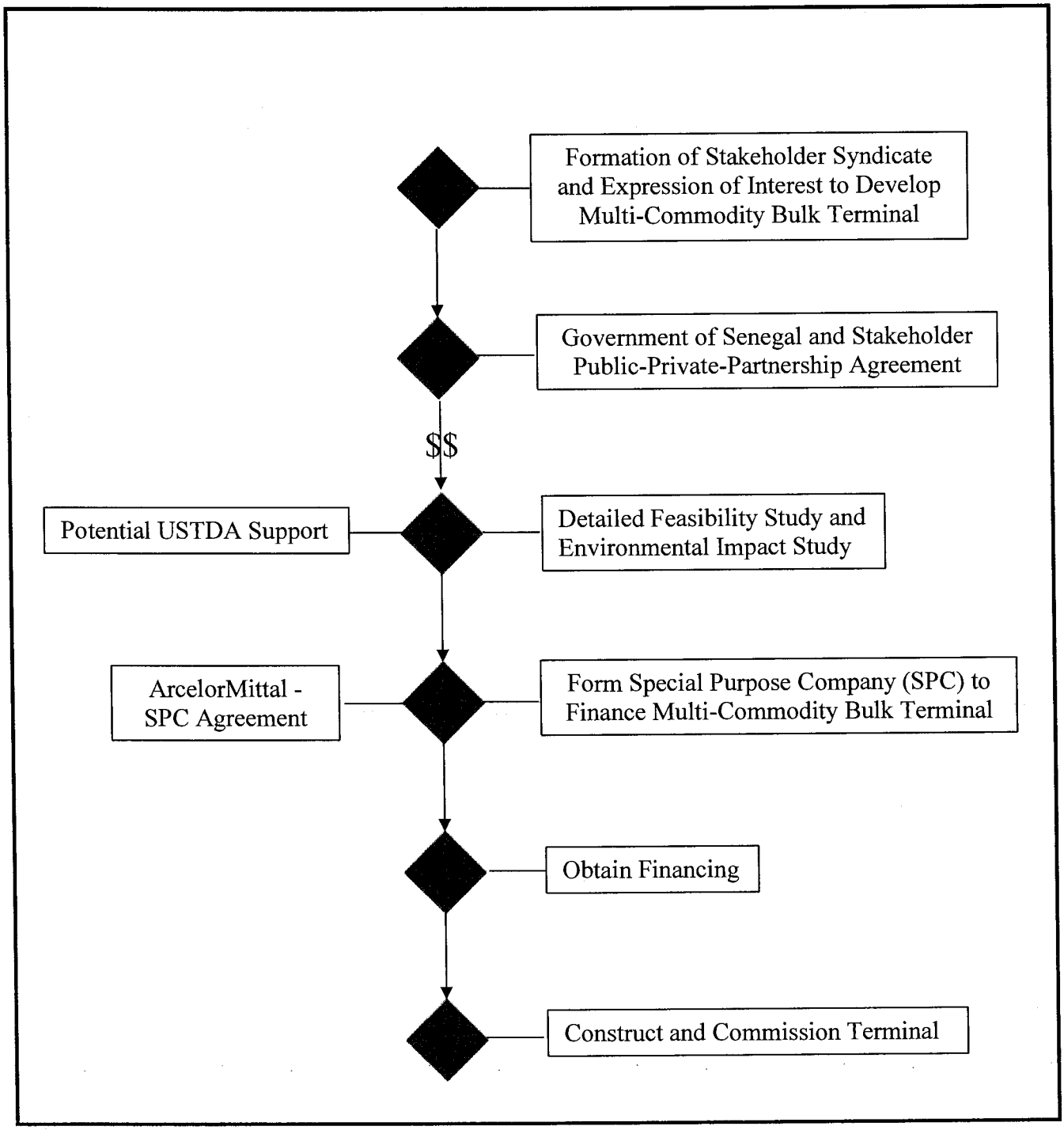
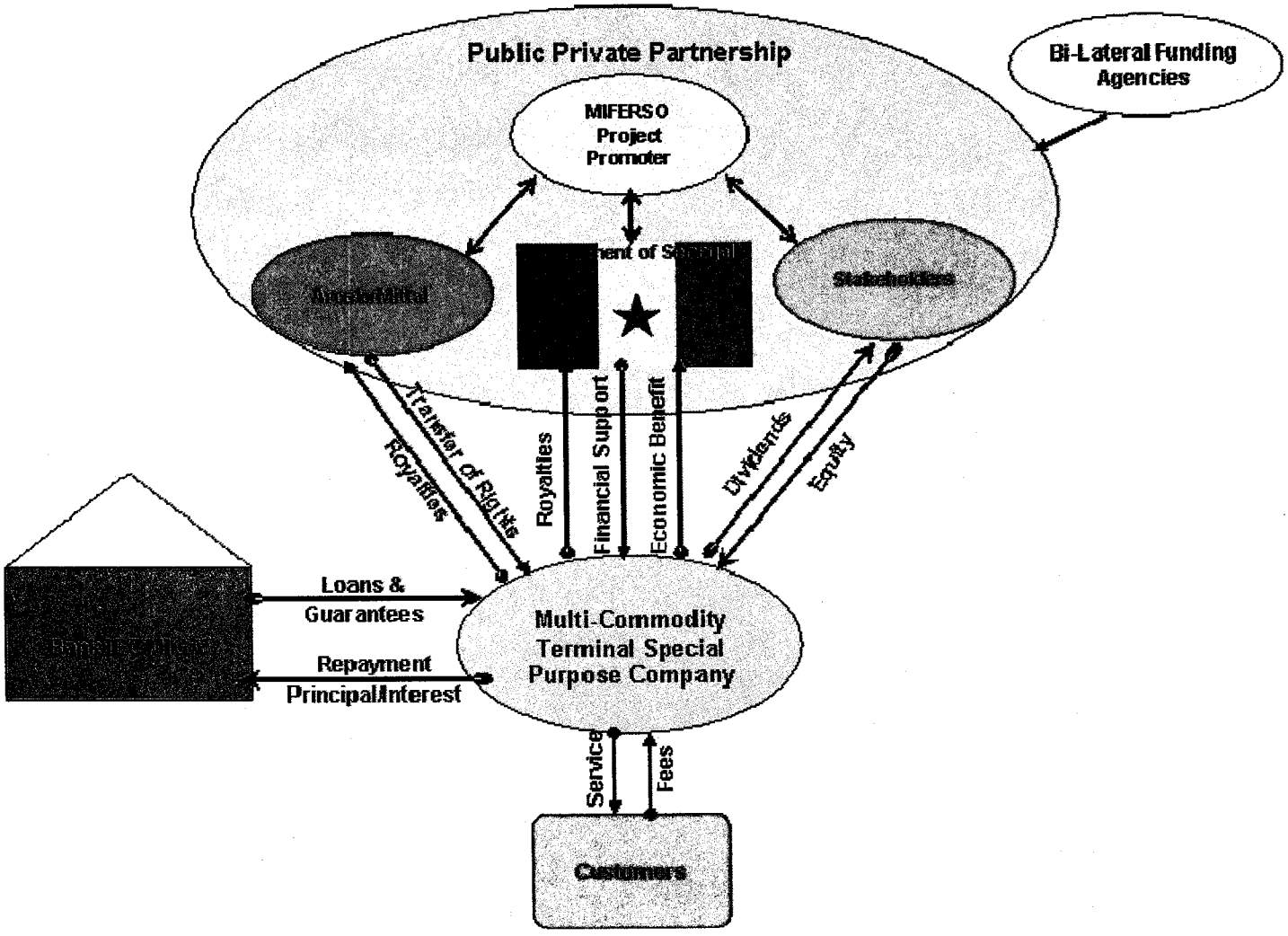


Figure 8.2
Financing Structure



APPENDIX A

Port Vision Document

Bulk Material Handling Facility

New Multi-Commodity Bulk
Port
Bargny,Senegal

May 2007

Marcel Veilleux
TEC Inc.
619 Severn Avenue, Suite 202
Annapolis, MD 21403

EXPORT COMMODITIES

Commodity	Base (tpy)	Future (tpy)	Delivery Mode	Storage Requirement
Iron Ore	15 M	25 M	Railroad	Open
Phosphate	1.6 M	2.05 M	Railroad	Closed
Clinker	1.7 M	2.55 M	Truck	Closed
Fertilizer	125,000	187,500	Truck	Closed
Attapulgites	260,000	600,000	Truck	Closed

TEC inc

IMPORT COMMODITIES

Commodity	Base (tpy)	Future (tpy)	Delivery Mode	Storage Requirement
Coal	1.45 M	2.175 M	Truck*	Open
Sulfur	0.6 M	1.4 M	Railroad	Closed
Ash	40,000	60,000	Truck	Closed
Gypsum	180,000	270,000	Truck	Closed
Urea	33,300	50,000	Railroad	Closed
Potash	33,300	50,000	Railroad	Closed
Ammonium Sulfate	33,300	50,000	Railroad	Closed

* Portion conveyed to Power Plant – Remainder trucked to customers

TEC inc

General Railroad Design

- Assumed Railway Availability (90%) = 330 days per year
- Two principal railroad loops
- Rail length sufficient for 3 iron ore trains

TECinc

IRON ORE

Rail Unloading - BASE

EXPORT

- Throughput: 15 M tons / 330 days = 45,500 tpd
- Avg. Train Capacity: 12,000 tons (125 cars)
- Avg. Train Requirements: 3.8 trains per day
- Unloading Process:
  - Single car dumper
  - Car puller moves train one car length at a time
- Avg. Unload Time: 3.3 hours per train
- Avg. Time to Exit Loop: 4.3 hours per train
- Daily Avg. Unload Time: 3.8 trains x 4.3 hrs = 16.3 h/d

TEC inc

IRON ORE

Rail Unloading - FUTURE

EXPORT

- Throughput: 25 M tons / 330 days = 75,800 tpd
- Avg. Train Requirements: 6.3 trains per day
- ★ **Requires a Twin Car Dumper – See NOTE Below**
- Avg. Unload Time: 1.7 hours per train
- Avg. Time to Exit Loop: 2.7 hours per train
- Daily Avg. Unload Time: 6.3 trains x 2.7 hrs = 17 h/d

NOTE: Dumper capacity (i.e. single or twin car dumper) should be determined prior to initial design. Replacement will require operations to shutdown.

TECinc

Storage Yard Design Criteria

EXPORT

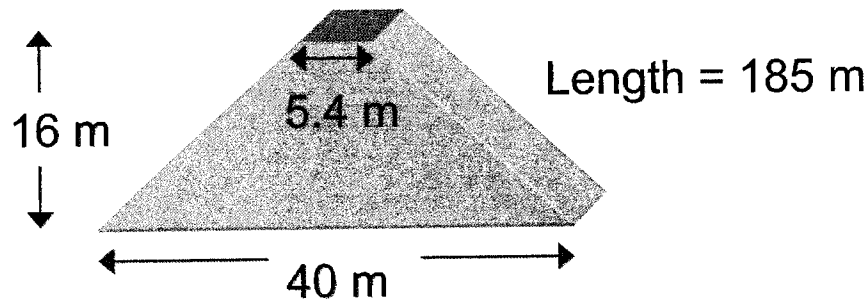
- Exports arrive by train in two grades
  - Fines
  - Lumps
- Storage Requirements:
  Minimum of 30 days of annual throughput
  - Base: 1.25 M tons
  - Future: 2.05 M tons
- Each grade separated into at least 2 piles
  - Stacking Pile
  - Ship Loading Pile

TEC inc

Storage Yard Operations

EXPORT

- Three rows of ore piles
  - Each row divided into 3 individual piles of 180,000 tons each
  - Includes 1 pile of screened fines
- Cross-Section

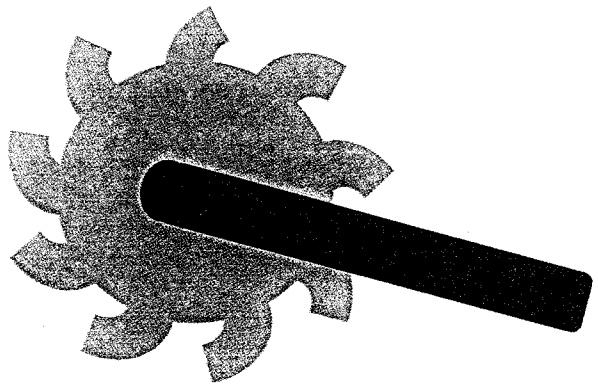


- Storage Area Requirements
  - Footprint: 600 m x 140 m

Storage Yard – Stacking and Reclaiming

EXPORT

- Two combined stacker/bucket wheel reclaimers
  - Maximum stacking rate: 9,000 t/h
  - Maximum reclaiming rate: 9,000 t/h
  - One in stacking mode
    - receiving from trains
  - One in reclaiming mode
    - loading ore into ships



- Include bypass function – enable direct loading

Storage Yard – Screening Iron

EXPORT

- Assume screening of lump iron ore is performed at the mine
- Control screening system at port
  - Rate of 9,000 t/hr prior to shiploading
- Screening system to include six individual screens
  - Screening capacity of each: 1,800 t/h
  - Includes one spare

IRON ORE

Vessel Loading

EXPORT

170,000 DWT Vessel	60,000 DWT Vessel
290 m overall length	200 m overall length
48 m breadth	32 m breadth
18.5 m full load draught	12 m full load draught
25 m molded depth	17.5 m molded depth
56 m air draught	47 m air draught

- Effective berth loading rate of 120,000 tons per day
  - Base: 15 M tpy loaded in 125 days – berth occupancy = 38% of 330 days
  - Future: 25 M tpy loaded in 208 days – berth occupancy = 63% of 330 days
- Type of Shiploader: Traveling with shuttling slewing luffing boom

TECinc

PHOSPHATE

Rail Unloading

EXPORT

- Base Throughput: 1.6 M tons / 330 days = 4,900 tpd
- Future Throughput: 2.05 M tons / 330 days = 6,212 tpd
- Avg. Train Capacity: 1,100 tons
  - 30 cars (12 m) + 2 locomotives (22 m) = 405 m
- Avg. Train Requirements: 4.5 trains per day – BASE
  5.6 trains per day – FUTURE
- Railcars equipped with bottom dump gates
- Avg. Unload Time: 2 hours per train
- Avg. Time To Exit Loop: 3 hours per train
- Daily Avg. Unload Time: 4.5 trains x 3 hrs = 13.5 h/d - B
  5.6 trains x 3 hrs = 16.8 h/d - F

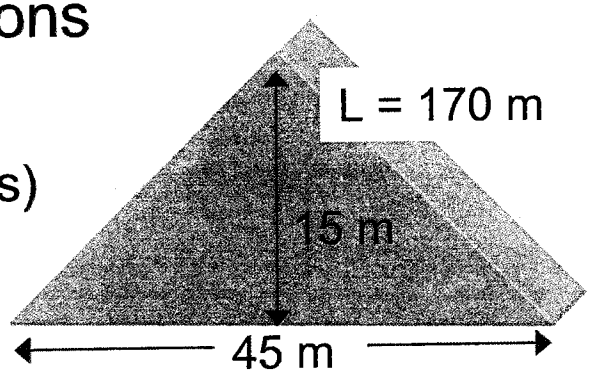
TEC inc

PHOSPHATE

Storage Yard Design Criteria

EXPORT

- Exports arrive by train:
  - Base: 1,600,000 tpy from 2 producers
  - Future: 2,050,000 tpy from 3 producers
- Max. Consignment Size: 75,000 tons
- Storage Requirements
  - Enclosed shed: 360 m x 65 m (2 piles)
    - 700 t/h stacker
    - 2,000 t/h portal scraper reclaimer with 50 m rail gauge
  - Future storage requirements
    - Additional 75,000 ton storage volume
    - 170 m extension (530 m total length)



Cross Section

TEC inc

PHOSPHATE

Vessel Loading

EXPORT

- Fleet Size:
  - Maxi-fleet: 40,000 DWT
  - Mini-fleet: 75,000 DWT
- Effective berth loading rate of 28,000 tons per day
  - Base: 1.6 M tpy loaded in 57 days – berth occupancy = 17% of 330 days
  - Future: 2.05 M tpy loaded in 73 days – berth occupancy = 22% of 330 days
- Type of Shiploader: Traveling with shuttling slewing luffing boom

TEC inc

Truck Unloading

EXPORT

- One Producer
- Base Throughput: 125,000 / 330 days = 380 tpd
- Future Throughput: 187,500 / 330 days = 570 tpd
- Avg. Truck Capacity: 30 tons
- Avg. Truck Requirements:
  - 13 trucks per day – BASE
  - 19 trucks per day - FUTURE

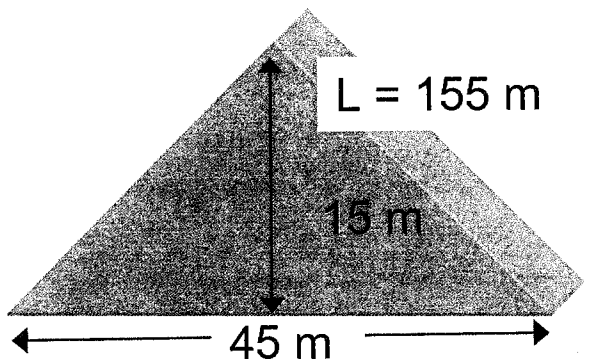
TEC inc

FERTILIZER

Storage Yard Design Criteria

EXPORT

- Exports arrive by trucks in 1 grade
- Max. Consignment Size: 40,000 tons
  - Represents 117 days of annual throughput
- Storage Requirements
  - Enclosed shed: 175 m x 65 m
    - 400 t/h stacker
    - 2,000 t/h portal scraper reclaimer with 50 m rail gauge Future-No additional storage required



Cross Section

TECinc

FERTILIZER

Vessel Loading

EXPORT

- Fleet Size:
  - Maxi-fleet: 10,000 DWT
  - Mini-fleet: 45,000 DWT
- Effective berth loading rate of 20,000 tons per day
  - Base: 0.125 M tpy loaded in 6 days – berth occupancy = 1.8% of 330 days
  - Future: 0.188 M tpy loaded in 9.5 days – berth occupancy = 2.9% of 330 days
- Type of Shiploader: Traveling with shuttling slewing luffing boom

TECinc

ATTAPULGITES

Truck Unloading

EXPORT

- Two Producers
- Base Throughput: 260,000 / 330 days = 790 tpd
- Future Throughput: 600,000 / 330 days = 1,820 tpd
- Avg. Truck Capacity: 30 tons
- Avg. Truck Requirements:
  - 26 trucks per day – BASE
  - 60 trucks per day - FUTURE

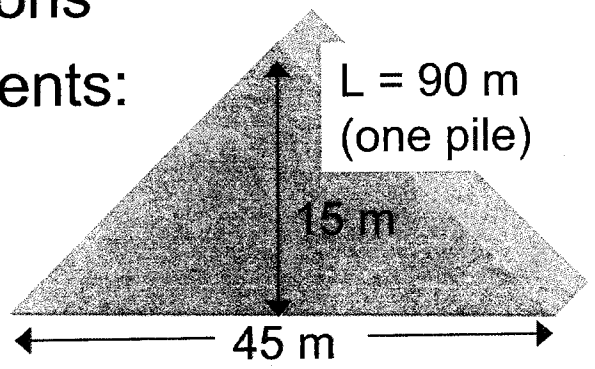
TECinc

ATTAPULGITES

Storage Yard Design Criteria

EXPORT

- Exports arrive by truck from 2 producers
- Max. Consignment Size: 12,000 tons
- 30 day storage capacity requirements:
  - Base – Two 12,000 ton piles
  - Future – Three 20,000 ton piles
- Storage Requirements
  - Enclosed shed to include:
    - 700 t/h stacker
    - 2,000 t/h portal scraper reclaimer with 50 m rail gauge (to be shared between fertilizer, attapulgites, and clinker)



Cross Section

TECinc

ATTAPULGITES

Vessel Loading

EXPORT

- Fleet Size:
  - Maxi-fleet: 6,000 DWT
  - Mini-fleet: 12,000 DWT
- Effective berth loading rate of 9,000 tons per day
  - Base: 0.26 M tpy loaded in 29 days – berth occupancy = 8.8% of 330 days
  - Future: 0.6 M tpy loaded in 66.5 days – berth occupancy = 20% of 330 days
- Type of Shiploader: Traveling with shuttling slewing luffing boom

TEC inc

Truck Unloading

EXPORT

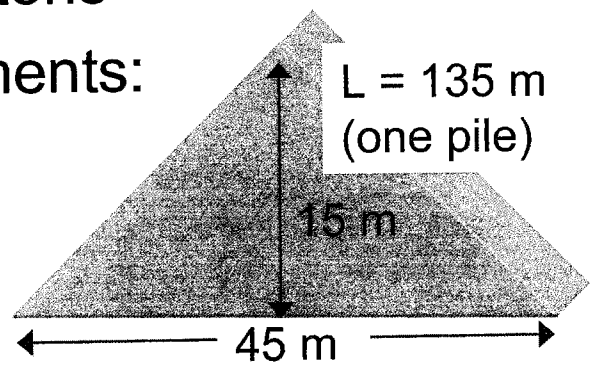
- Two Producers
- Base Throughput: 1,700,000 / 330 days = 5,150 tpd
- Future Throughput: 2,550,000 / 330 days = 7,730 tpd
- Avg. Truck Capacity: 30 tons
- Clinker unloaded into underground dump hoppers
- Avg. Truck Requirements:
  - 172 trucks per day – BASE
  - 258 trucks per day – FUTURE

CLINKER

Storage Yard Design Criteria

EXPORT

- Exports arrive by trucks from 2 producers
- Max. Consignment Size: 75,000 tons
- 30 day storage capacity requirements:
  - Base – Two 135 m piles
  - Future – Three 135 m piles
- Storage Requirements
  - Enclosed shed to include:
    - 600 t/h stacker
    - 2,000 t/h portal scraper reclaimer with 50 m rail gauge



Cross Section

TECinc

CLINKER

Vessel Loading

EXPORT

- Fleet Size:
  - Maxi-fleet: 40,000 DWT
  - Mini-fleet: 80,000 DWT
- Effective berth loading rate of 28,000 tons per day
  - Base: 1.7 M tpy loaded in 61 days – berth occupancy = 18.5% of 330 days
  - Future: 2.55 M tpy loaded in 91 days – berth occupancy = 27.6% of 330 days
- Type of Shiploader: Traveling with shuttling slewing luffing boom

TEC inc.

SULFUR

Vessel Unloading

IMPORT

- Annual Volume:
  - FUTURE – 1,400,000 tons
  - BASE - 600,000 tons
- Type of Ship unloader: Two traveling gantry cranes
- Ship Sizes
  - Maxi-fleet: 35,000 DWT
  - Mini-fleet: 75,000 DWT
- Ship Requirements (Number)
  - BASE: 18 maxi-fleet OR 9 mini-fleet vessels per year
  - FUTURE: 42 maxi-fleet OR 20 mini-fleet vessels per year

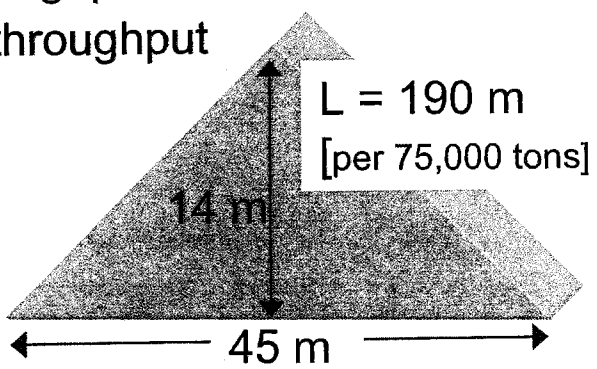
TEC inc

SULFUR

Storage Yard Design Criteria

IMPORT

- Imports arrive by ships
  - 1 grade – Base (one customer) - 0.6 M tons
  - 2 grades – Future (two customers) – 1.4 M tons
- Maximum Consignment Size: 75,000 tons
  - 75,000 tons = 45 days of Base annual throughput
  - 150,000 tons = 39 days of Future annual throughput
- Storage Requirements
  - One 190 m pile – Base
  - Two 190 m piles - Future
  - 20 m reclaimer maintenance bay
  - 3,500 t/h stacker (for two 1,600 t/h grab unloading machines
  - 700 t/h portal scraper reclaimer with 50 m rail gauge



Cross Section

TECinc

SULFUR

Rail Loading

IMPORT

- Base Throughput: 0.6 M tons / 330 days = 1,800 tpd
- Future Throughput: 1.4 M tons / 330 days = 4,200 tpd
- Avg. Train Capacity: 1,000 tons
- Avg. Train Requirements: 1.8 trains per day – BASE
  4.2 trains per day – FUTURE
- Avg. Load Rate: 1000 tons at 500 tons/hr = 2 hrs/train
- Avg. Time To Exit Loop: 3 hours per train
- Daily Avg. Load Time: 1.8 trains x 3 hrs = 5.4 h/d - B
  4.2 trains x 3 hrs = 12.6 h/d - F

TEC inc

ASH

Vessel Unloading

IMPORT

- Annual Volume:
  - BASE - 40,000 tons
  - FUTURE - 60,000 tons
- Type of Ship unloader: Two traveling gantry cranes
- Ship Sizes
  - Maxi-fleet: 20,000 DWT
  - Mini-fleet: 30,000 DWT
- Ship Requirements (Number)
  - BASE: 2 maxi-fleet OR 2 mini-fleet vessels per year
  - FUTURE: 3 maxi-fleet OR 2 mini-fleet vessels per year

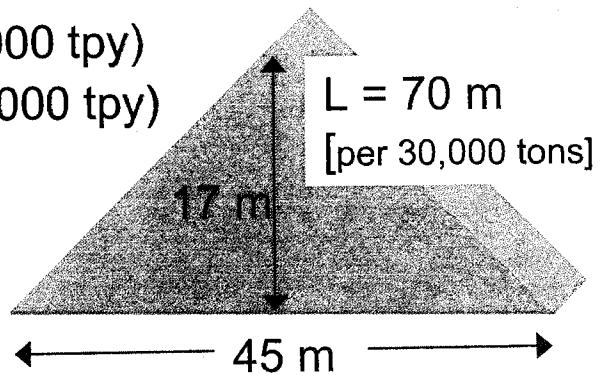
TEC inc

ASH

Storage Yard Design Criteria

IMPORT

- Imports arrive by ships
  - Provided in two grades to two customers
- Maximum Consignment Size: 30,000 tons
  - Base: 273 days of annual throughput (40,000 tpy)
  - Future: 182 days of annual throughput (60,000 tpy)
- Storage Requirements
  - One 70 m pile – Base
  - Two 70 m piles - Future
  - One 1,600 t/h grab unloaders
  - One 3,500 t/h stacker
  - 400 t/h portal scraper reclaimer with 50 m rail gauge with reclaim conveyor (load trucks@ 300 t/h)



Cross Section

TECinc

ASH

Truck Loading

IMPORT

- Two Customers
- Base Throughput: 40,000 t / 330 days = 121 tpd
- Future Throughput: 60,000 t / 330 days = 182 tpd
- Avg. Truck Capacity: 30 tons
- Avg. Truck Requirements:
  - 2 trucks per customer per day – BASE
  - 3 trucks per customer per day – FUTURE

TEC inc.

GYPSUM

Vessel Unloading

IMPORT

- Annual Volume:
  - BASE - 180,000 tons
  - FUTURE - 270,000 tons
- Type of Ship unloader: Two traveling gantry cranes
- Ship Sizes
  - Maxi-fleet: 30,000 DWT
  - Mini-fleet: 60,000 DWT
- Ship Requirements (Number)
  - BASE: 6 maxi-fleet OR 3 mini-fleet vessels per year
  - FUTURE: 9 maxi-fleet OR 5 mini-fleet vessels per year

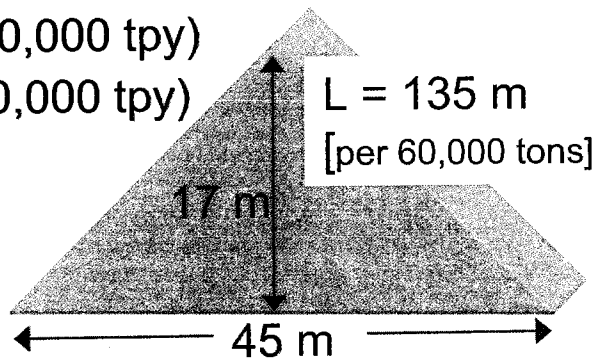
TEC inc

GYPSUM

Storage Yard Design Criteria

IMPORT

- Imports arrive by ships
  - Provided in one grade to two customers
- Maximum Consignment Size: 60,000 tons
  - Base: 120 days of annual throughput (180,000 tpy)
  - Future: 80 days of annual throughput (270,000 tpy)
- Storage Requirements
  - One 135 m pile – Base
  - Two 135 m piles - Future
  - Two 1,600 t/h grab unloaders
  - One 3,500 t/h stacker
  - 400 t/h portal scraper reclaimer with 50 m rail gauge with reclaim conveyor (load trucks@ 300 t/h)



Cross Section

TECinc

GYPSUM

Truck Loading

IMPORT

- Two Customers
- Base Throughput: 180,000 t / 330 days = 545 tpd
- Future Throughput: 270,000 t / 330 days = 818 tpd
- Avg. Truck Capacity: 30 tons
- Avg. Truck Requirements:
  - 9 trucks per customer per day – BASE
  - 14 trucks per customer per day – FUTURE

TEC inc.

COAL

Vessel Unloading

IMPORT

- Annual Volume:
  - BASE – 1,450,000 tons
  - FUTURE – 2,175,000 tons
- Type of Ship unloader: Two traveling gantry cranes
- Ship Sizes
  - Maxi-fleet: 60,000 DWT
  - Mini-fleet: 140,000 DWT
- Ship Requirements (Number)
  - BASE: 26 maxi-fleet OR 12 mini-fleet vessels per year
  - FUTURE: 40 maxi-fleet OR 18 mini-fleet vessels per year

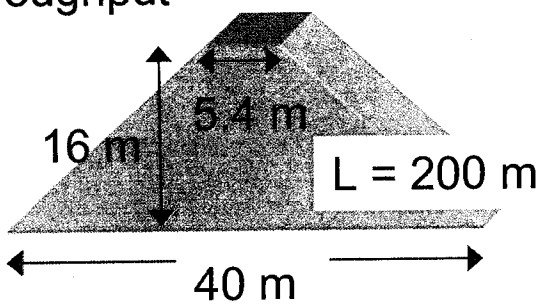
TEC inc

COAL

Storage Yard Design Criteria

IMPORT

- Imports arrive by ships in one grade to three customers:
  - SENELEC Power Plant (conveyor) - Base: 1M tons / Future: 1.5 M tons
  - Ciments Du Sahel – Base: 250,000 tons / Future: 375,000 tons
  - SOCOCIM – Base: 200,000 tons / Future: 300,000 tons
- Maximum Consignment Size: 120,000 tons
  - Base: 30 days storage based on annual throughput
  - Future: 18 days storage based on annual throughput
- Storage Requirements
  - One 200 m pile – Base
  - Two 200 m piles - Future
  - Two 1,300 t/h coal unloading machines
  - One 3,000 t/h stacker
  - Two 400 t/h portal reclaimers (one for conveyor; one for trucks)



Cross Section

TEC inc

COAL

Truck Loading

IMPORT

- Base Throughput: 1.45 M tons / 330 days = 4,400 tpd
- Future Throughput: 2.175 M tons / 330 days = 6,600 tpd
- Loading Capacities:
  - Conveyor (to SENELEC) – Base: 3,000 t/d / Future: 4,500 t/d
  - Truck loading – 300 t/h (Ten 30-ton trucks per hour)
- Avg. Truck Requirements:
  - BASE: 45 trucks per day (two separate loading stations)
    [20 for SOCOCIM and 25 for Ciments Du Sahel]
  - FUTURE: 68 trucks per day
    [30 for SOCOCIM and 38 for Ciments Du Sahel]
- Daily Avg. Load Time:
  - BASE: 2 and 2.5 hours, respectively for each loading station
  - FUTURE: 3 and 3.75 hours, respectively for each loading station

TEC inc.

Vessel Unloading

IMPORT

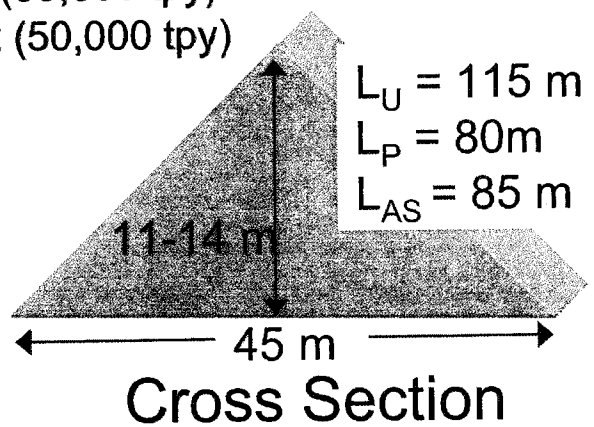
- Annual Volume:
  - BASE - 100,000 tons (33,300 tons each)
  - FUTURE - 150,000 tons (50,000 tons each)
- Type of Ship unloader: Two traveling gantry cranes
- Ship Sizes
  - Maxi-fleet: 10,000 DWT
  - Mini-fleet: 33,300 DWT
- Ship Requirements (Number per Product)
  - BASE: 3 maxi-fleet OR 1 mini-fleet vessels per year
  - FUTURE: 5 maxi-fleet OR 2 mini-fleet vessels per year

TEC inc

Storage Yard Design Criteria

IMPORT

- Imports arrive by ships
  - Each product provided in one grade to a single customer
- Maximum Consignment Size: 30,000 tons
  - Base: 91% of each products annual throughput (33,000 tpy)
  - Future: 60% of each products annual throughput (50,000 tpy)
- Storage Requirements
  - One pile each (Base and Future
    - Urea – 115 m
    - Potash – 80 m
    - Ammonium Sulfate – 85 m
  - One 1,600 t/h grab unloader
  - One 3,500 t/h stacker
  - 500 t/h portal scraper reclaimer with 50 m rail gauge with reclaim conveyor (load trucks@ 350 t/h)



Cross Section

TECinc

Rail Loading

IMPORT

- Base Throughput: 0.1 M tons / 330 days = 303 tpd
- Future Throughput: 0.15 M tons / 330 days = 454 tpd
- Avg. Train Capacity: 700 tons
- Avg. Train Requirements: 0.43 trains per day – BASE
  0.65 trains per day – FUTURE
- Avg. Load Rate: 700 tons at 350 tons/hr = 2 hrs/train
- Avg. Time To Exit Loop: 3 hours per train
- Daily Avg. Load Time:
  - Base: 0.43 trains x 3 hrs = 1.3 h/d or 9hrs for 3 trains per week
  - Future: 0.65 trains x 3 hrs = 2.0 h/d or 15hrs for 4 trains per week

Equipment List

- Stackers
  - 700 t/h Phosphate
  - 400 t/h Fertilizer
  - 700 t/h Attapulgites
  - 600 t/h Clinker
  - 3,500 t/h Sulfur
  - 3,500 t/h Ash
  - 3,500 t/h Gypsum
  - 3,000 t/h Coal
  - 3,500 t/h Urea, Potash, Ammonium Sulfate
- Portal Scraper Reclaimers
  - 2,000 t/h Phosphate
  - 2,000 t/h Fertilizer, Attapulgites
  - 2,000 t/h Clinker
  - 700 t/h Sulfur
  - 400 t/h Ash
  - 400 t/h Gypsum
  - Two 400 t/h Coal
  - 500 t/h Urea, Potash, Ammonium Sulfate
- Stacker/Bucket Wheel Reclaimers
  - Two 9,000 t/h Iron Ore
- Grab Unloaders
  - Two 1,600 t/h Sulfur
  - One 1,600 t/h Ash
  - Two 1,600 t/h Gypsum
  - One 1,600 t/h Urea, Potash, and Ammonium Sulfate
- Coal Unloading Machines
  - Two 1,300 t/h
- Iron Ore Screens
- Shiploaders
- Rail Car Dumper

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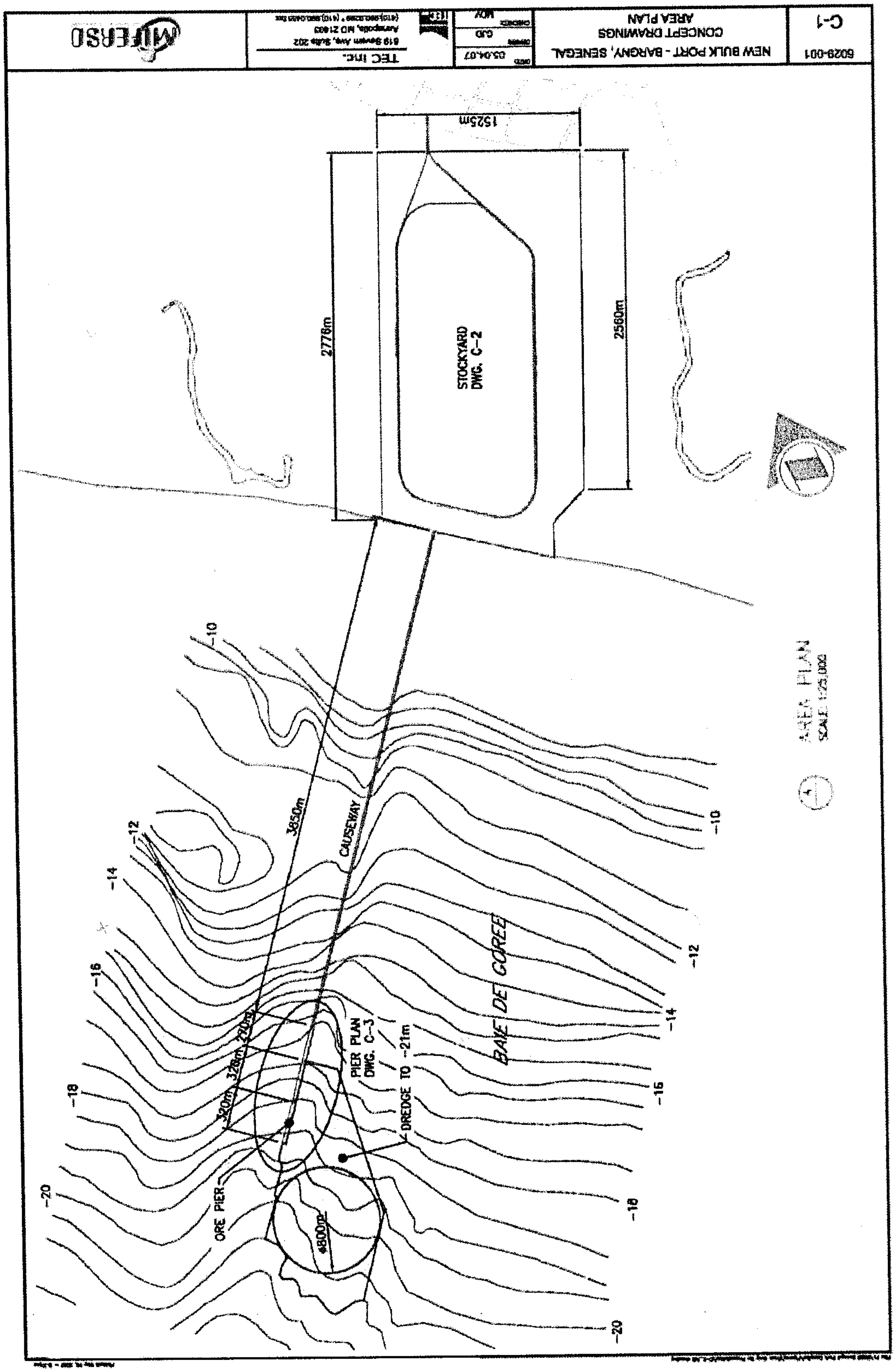
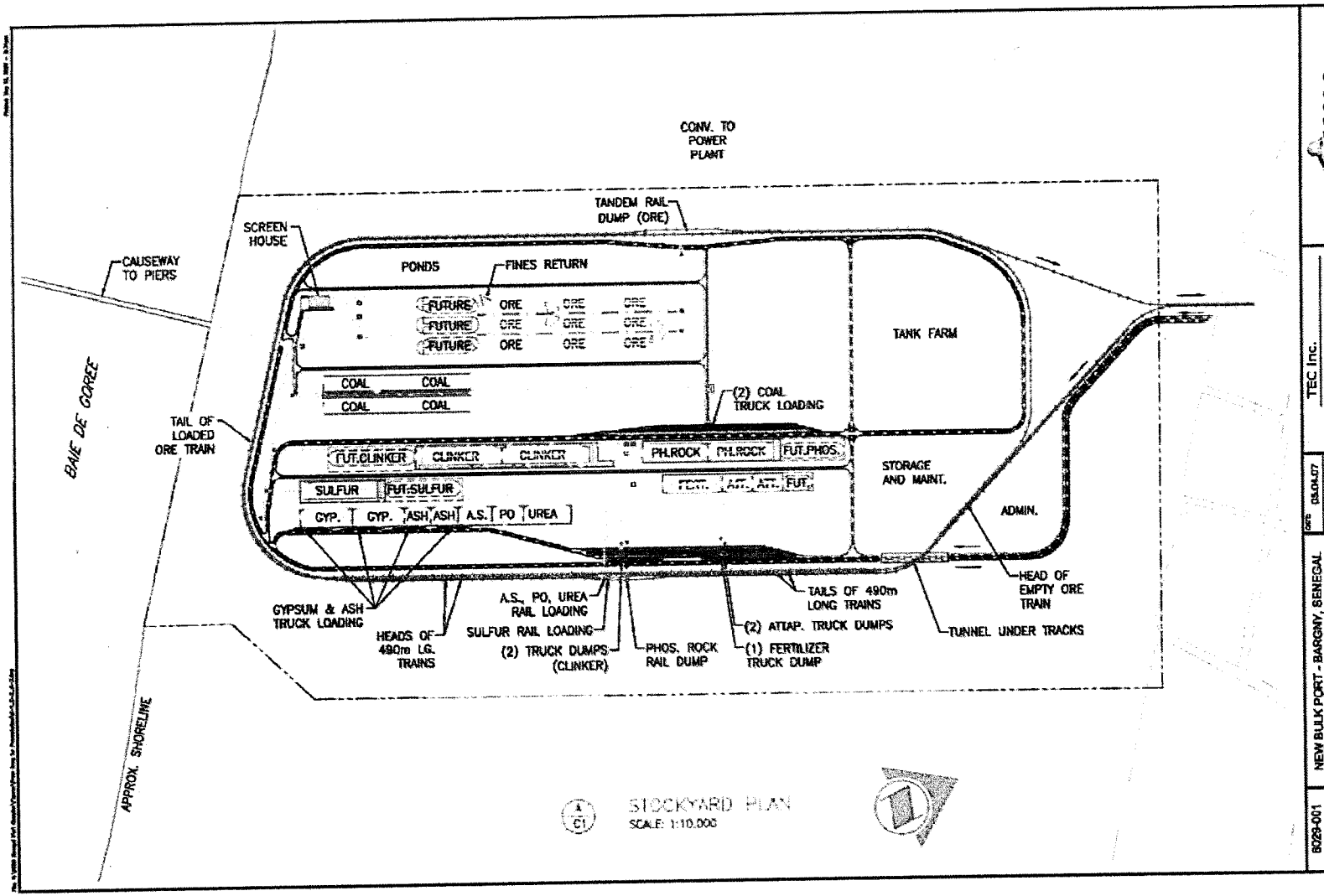

6029-001
C-1
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
AREA PLAN
03.04.07
GJD
MOY
TEC Inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
MIFERSO
1525m
2778m
2560m
STOCKYARD
DWG. C-2
3850m
CAUSEWAY
BAIE DE GOREE
PIER PLAN
DWG. C-3
DREDGE TO -21m
ORE PIER
320m
328m
280m
Φ800m
-10
-12
-14
-16
-18
-20
AREA PLAN
SCALE 1:25,000



C1 STOCKYARD PLAN
SCALE: 1:10,000

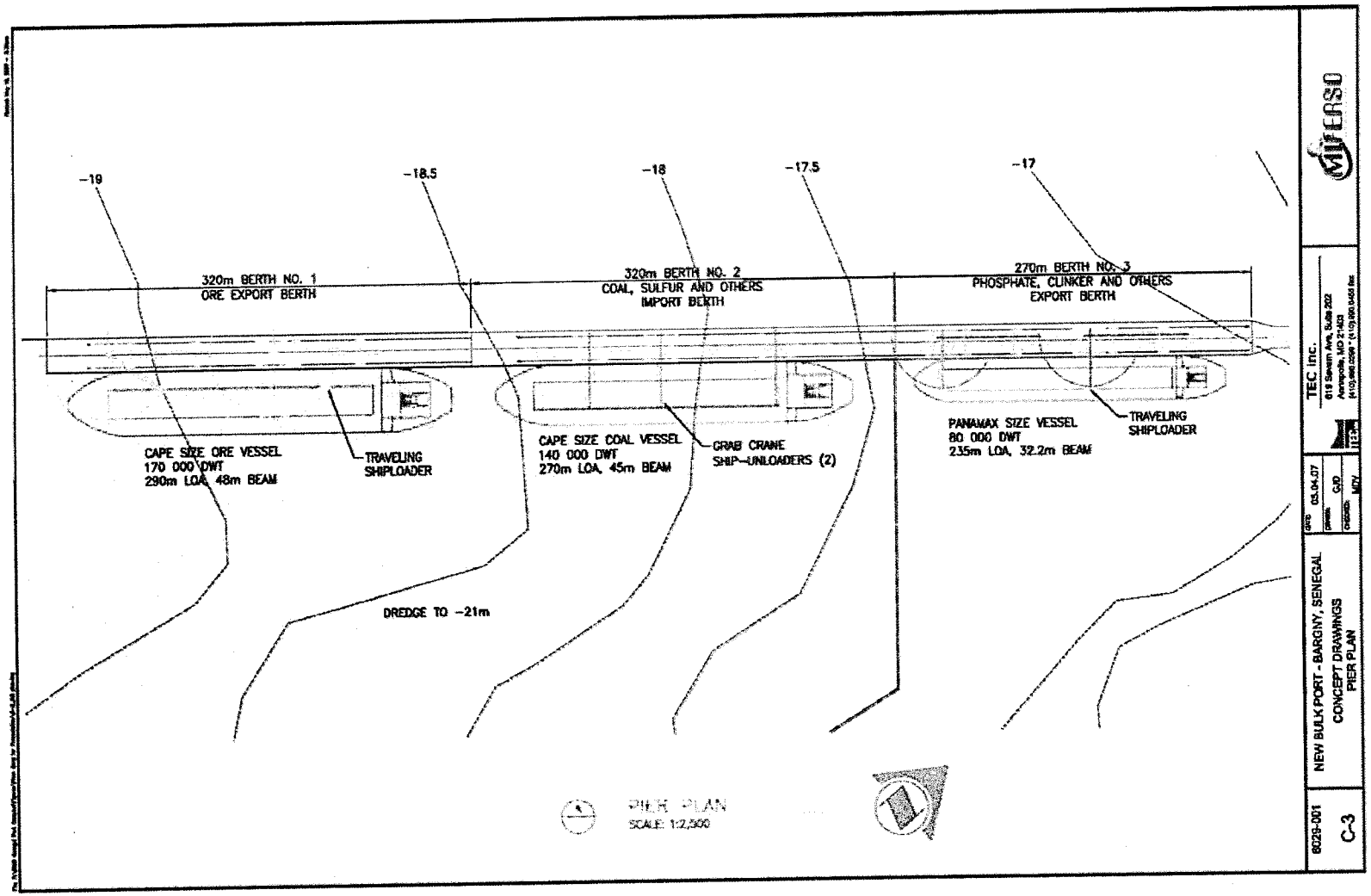
TEC inc.
619 Severn Ave., Suite 202
Annapolis, MD 21403
(410) 990-0202 * (410) 990-0455 fax

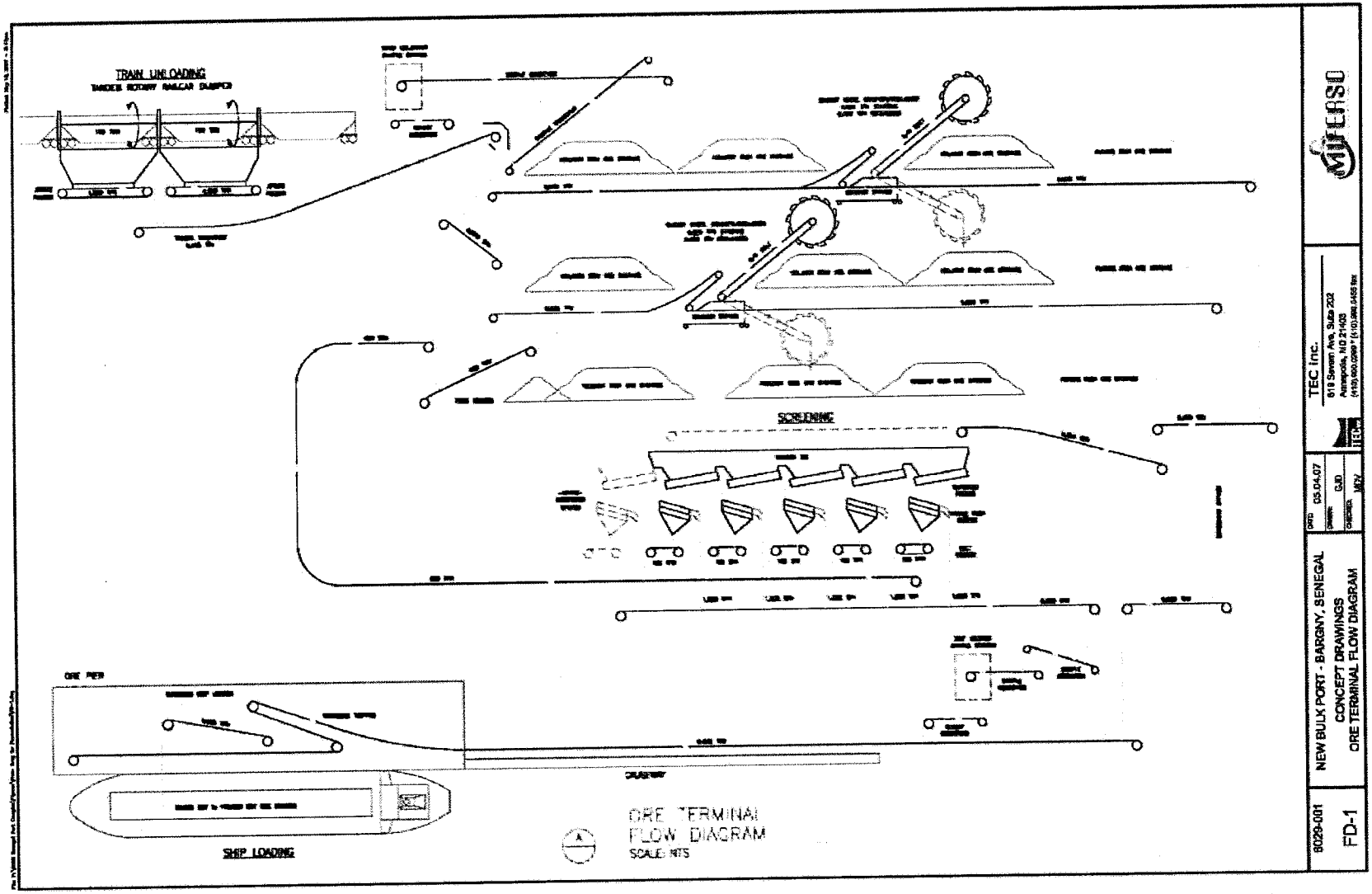
DATE 05.04.07
DRAWN CJD
CHECKED MDV

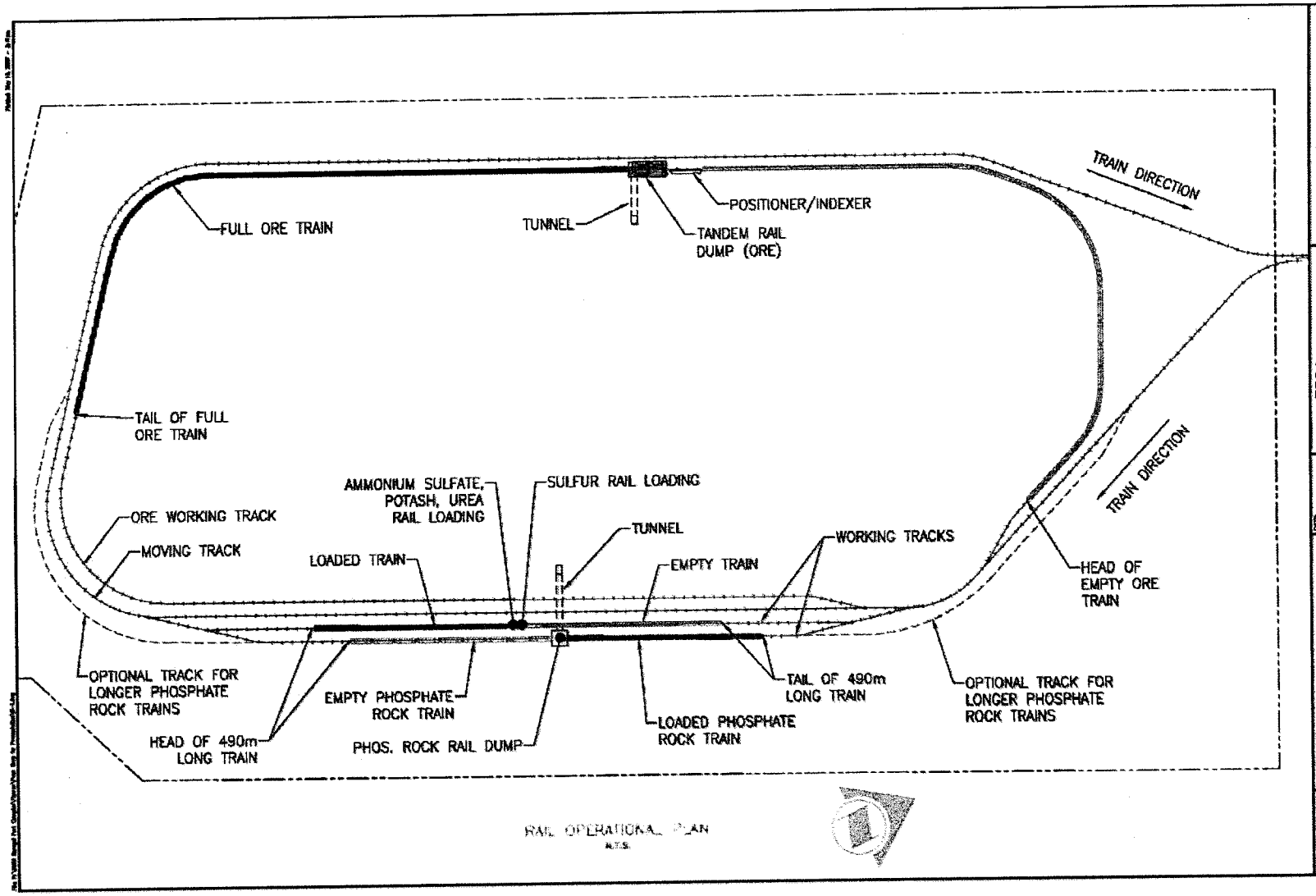
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
STOCKYARD PLAN

8028-001
C-2

TECinc


-19
-18.5
-18
-17.5
-17
320m BERTH NO. 1
ORE EXPORT BERTH
320m BERTH NO. 2
COAL, SULFUR AND OTHERS
IMPORT BERTH
270m BERTH NO. 3
PHOSPHATE, CLINKER AND OTHERS
EXPORT BERTH
CAPE SIZE ORE VESSEL
170 000 DWT
290m LOA, 48m BEAM
TRAVELING
SHIPLOADER
CAPE SIZE COAL VESSEL
140 000 DWT
270m LOA, 45m BEAM
GRAB CRANE
SHIP-UNLOADERS (2)
PANAMAX SIZE VESSEL
80 000 DWT
235m LOA, 32.2m BEAM
TRAVELING
SHIPLOADER
DREDGE TO -21m
PIER PLAN
SCALE: 1:2,500
TEC inc.
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
PIER PLAN
8029-001
C-3


TRAIN UNLOADING
SCREENING
ORE PILES
SHIP LOADING
ORE TERMINAL
FLOW DIAGRAM
SCALE: NTS
TEC Inc.
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
ORE TERMINAL FLOW DIAGRAM
8029-001
FD-1



RAIL OPERATIONAL PLAN
N.T.S.

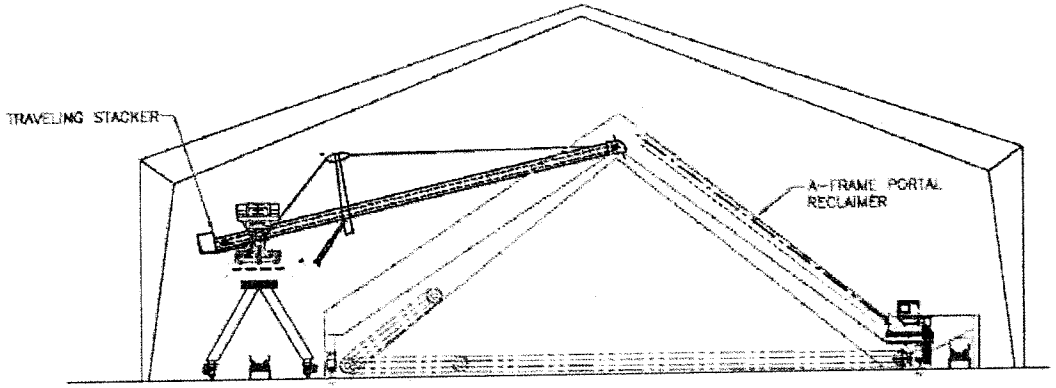
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410) 990-0999 * (410) 990-0455 fax

DATE 5/4/07
DRAWN MED
CHECKED MDV

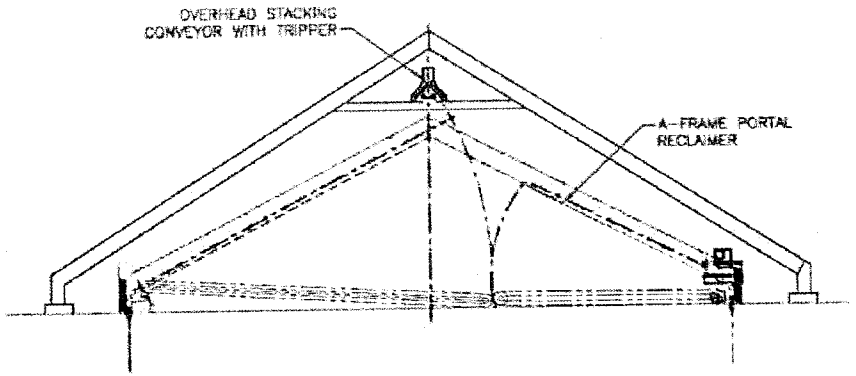
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
RAIL OPERATIONAL PLAN

8029-001
R-1

TECinc



CLINKER
WAREHOUSE SECTION
N.T.S.



PHOSPHATE ROCK
WAREHOUSE SECTION
N.T.S.

MINEASO

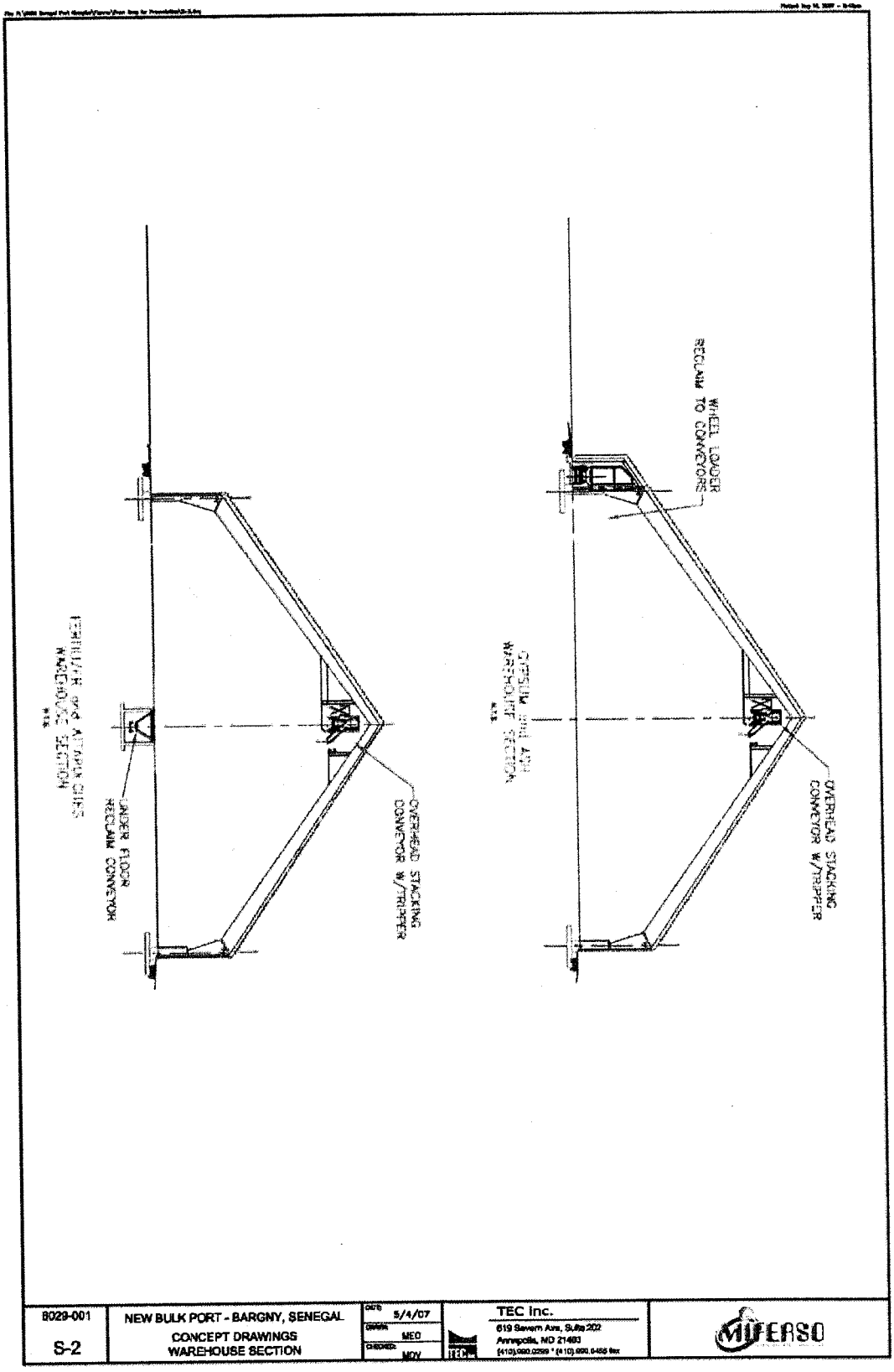
TEC inc.
616 Severn Ave, Suite 202
Annapolis, MD 21403
(410) 990-0099 • (410) 990-0455 fax

DATE 3/4/07
DRAWN MEO
CHECKED MDV

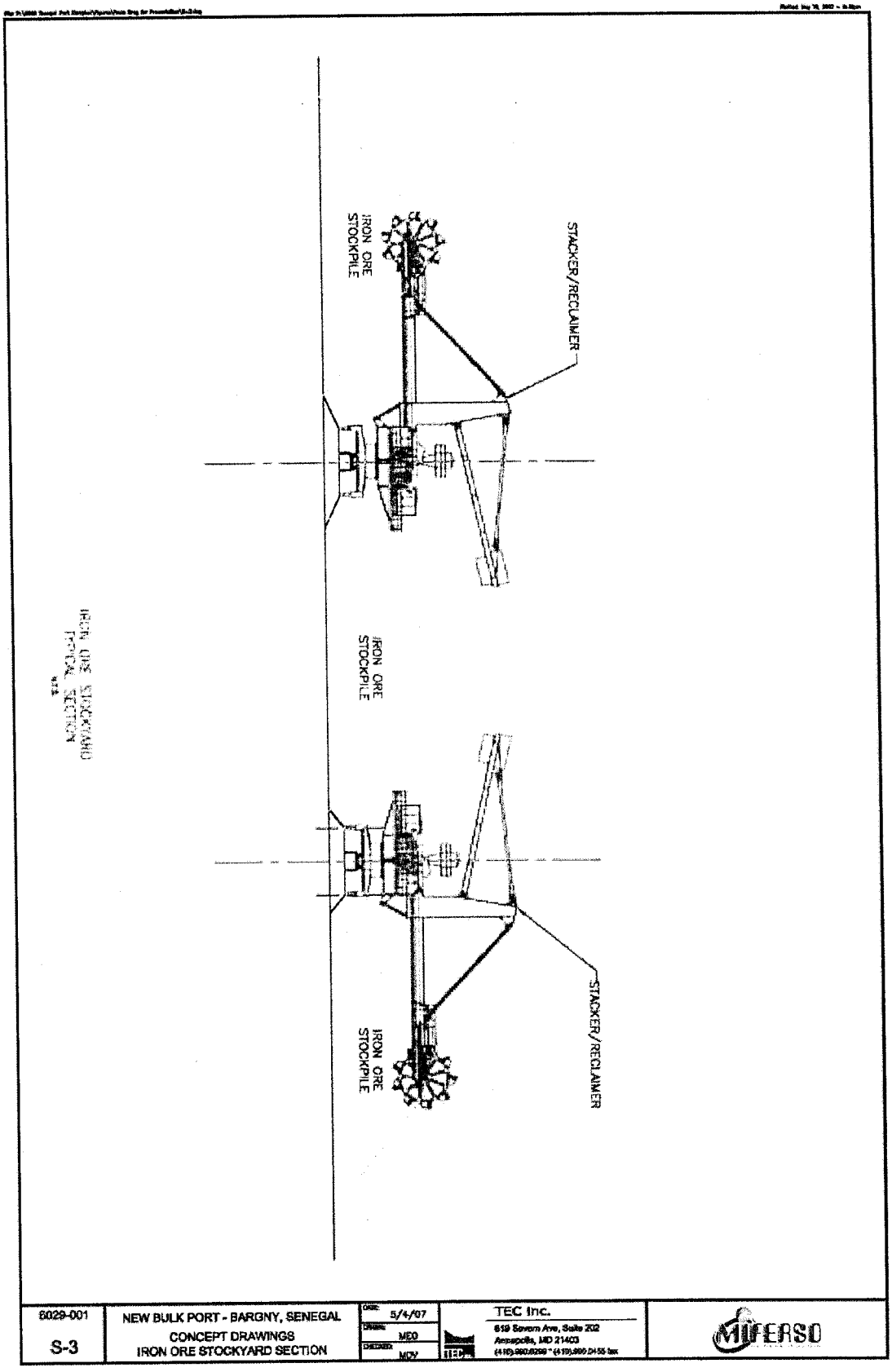
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
WAREHOUSE SECTION

6029-001
S-1

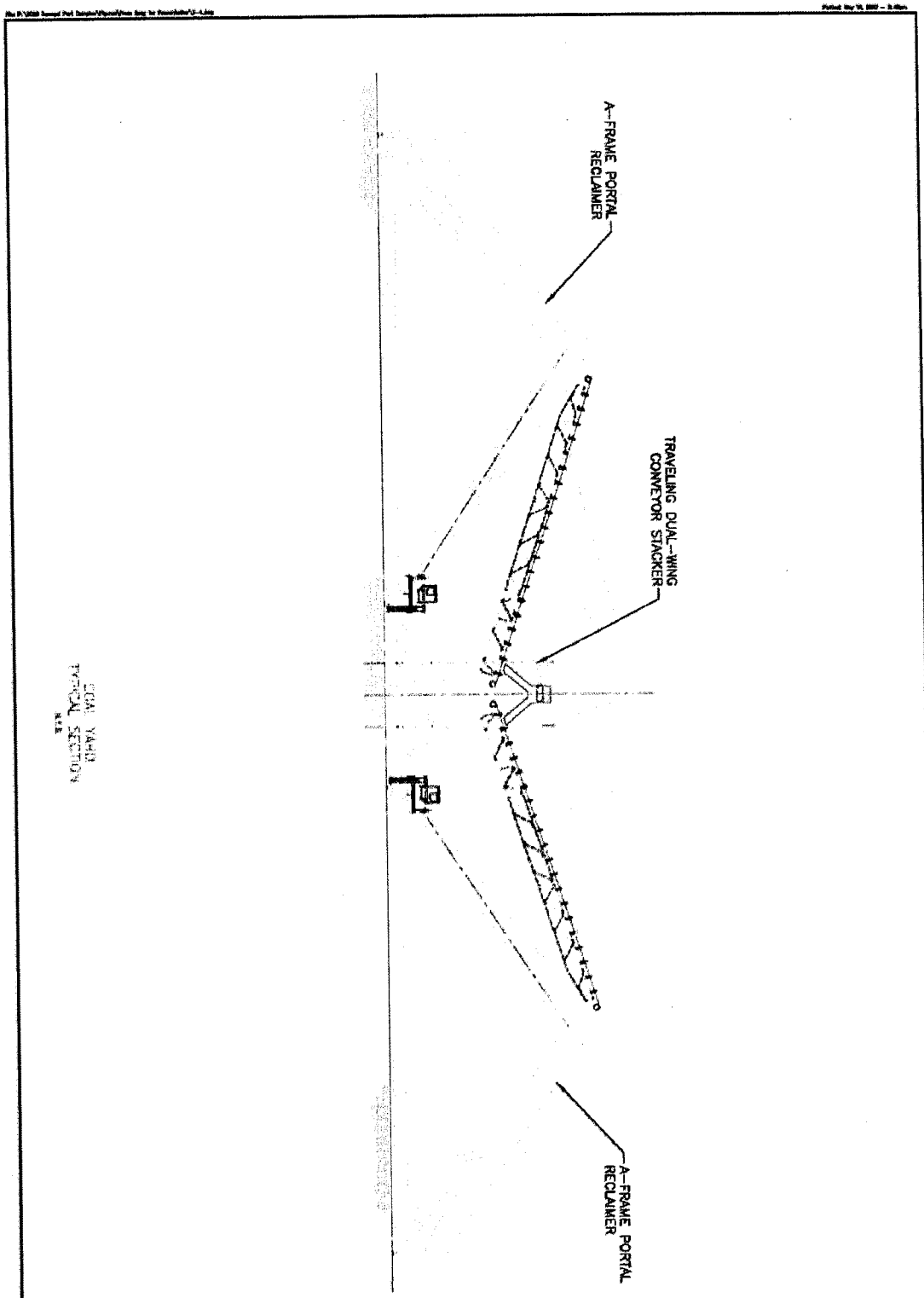
TECinc



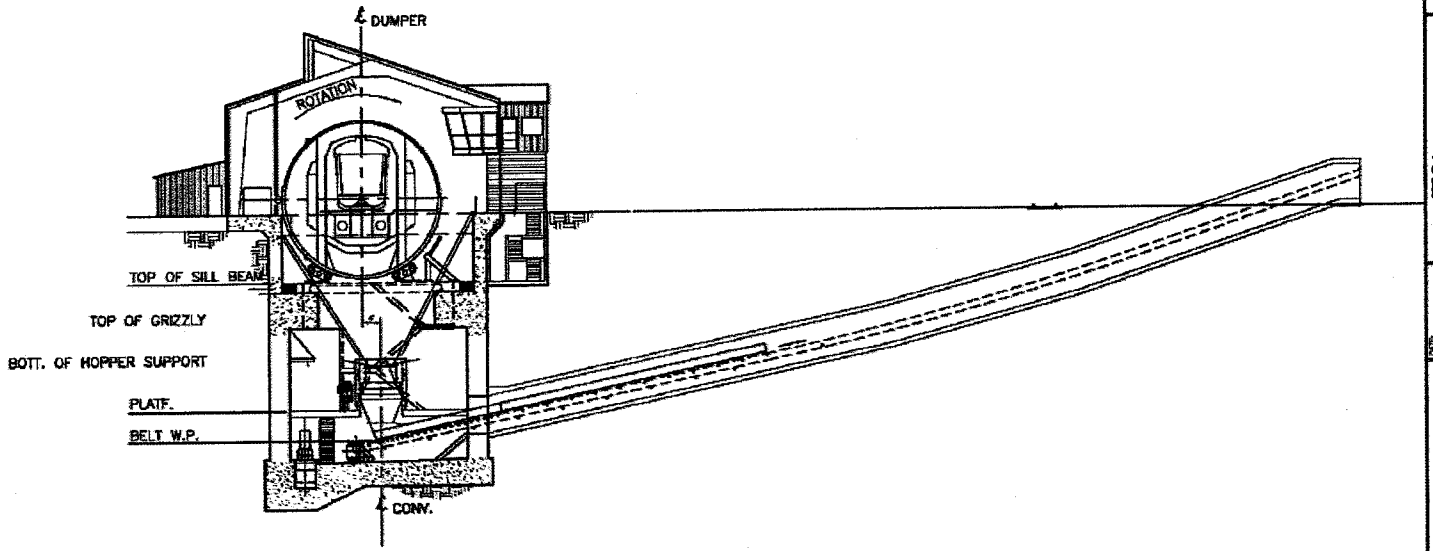
8029-001 S-2	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS WAREHOUSE SECTION	DATE 5/4/07 DRAWN MEC CHECKED MDV	TEC Inc. 619 Severn Ave, Suite 202 Annapolis, MD 21403 (410).990.0259 * (410).990.0458 fax	MIERSO



6029-001 S-3	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS IRON ORE STOCKYARD SECTION	DATE: 5/4/07 DRAWN: MEO CHECKED: MDY	TEC Inc. 619 Severn Ave, Suite 202 Annapolis, MD 21403 (410) 990-9299 * (410) 990-9455 fax



6029-001 S-4	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS DUEL WING STACKER SECTION	DATE: 5/4/07 DRAWN: MEO CHECKED: MDV	TEC Inc. 619 Severn Ave, Suite 202 Annapolis, MD 21403 (410)990-0290 * (410)990-0455 fax



ROTARY RAIL DUMPER
TYPICAL SECTION
N.T.S.

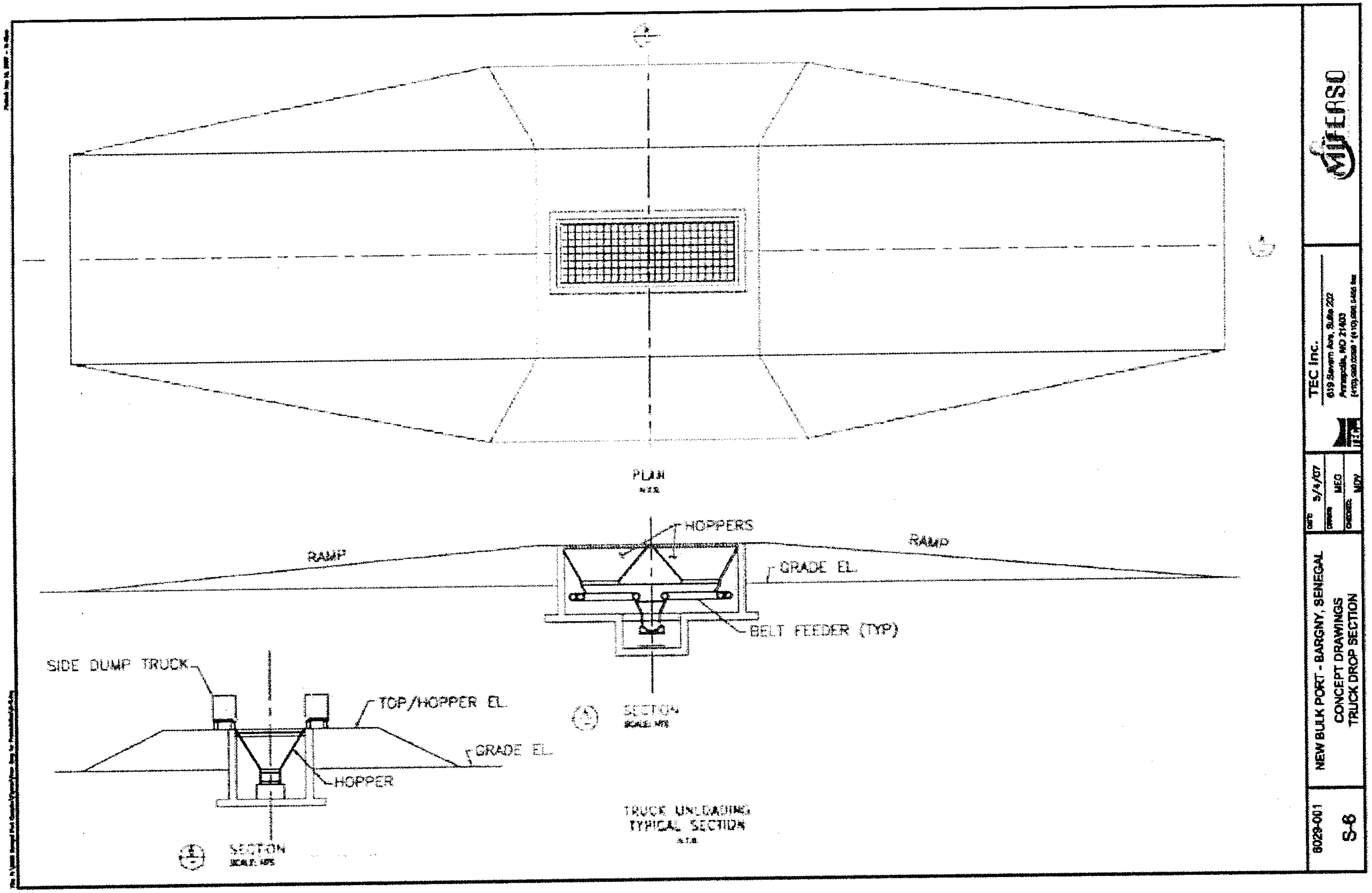
TEC inc.
813 Gleenn Ave, Suite 202
Annapolis, MD 21403
(410) 990-0399 * (410) 990-0455 fax

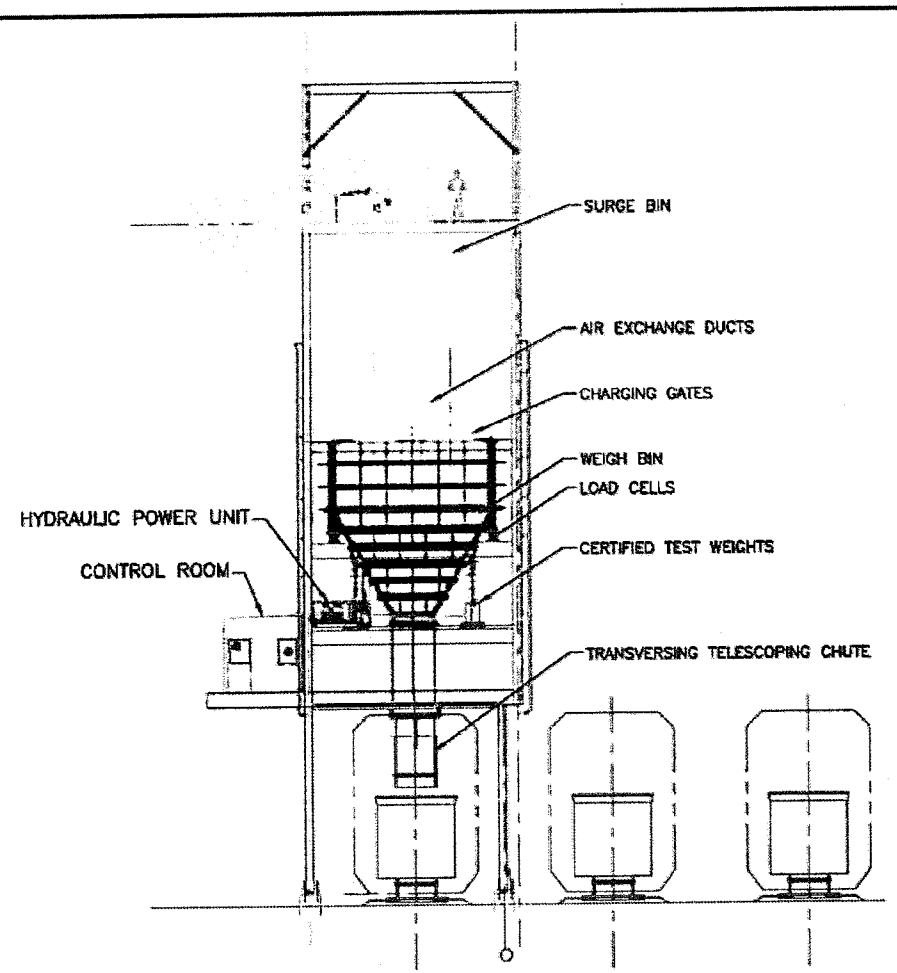
DATE: 5/4/07
DRAWN: MED
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
ROTARY RAIL DUMP STRUCTURE SECTION

6029-001
S-5

TECinc


PLAN
N.T.S.
HOPPERS
RAMP
RAMP
GRADE EL.
BELT FEEDER (TYP)
SECTION
SCALE: NTS
SIDE DUMP TRUCK
TOP/HOPPER EL.
GRADE EL.
HOPPER
SECTION
SCALE: NTS
TRUCK UNLOADING
TYPICAL SECTION
N.T.S.
TEC Inc.
619 Severn Ave, Suite 222
Annapolis, MD 21403
DATE 5/4/07
DRAWN MEO
CHECKED MDV
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
TRUCK DROP SECTION
6029-001
S-6



RAIL LOADING
TYPICAL SECTION

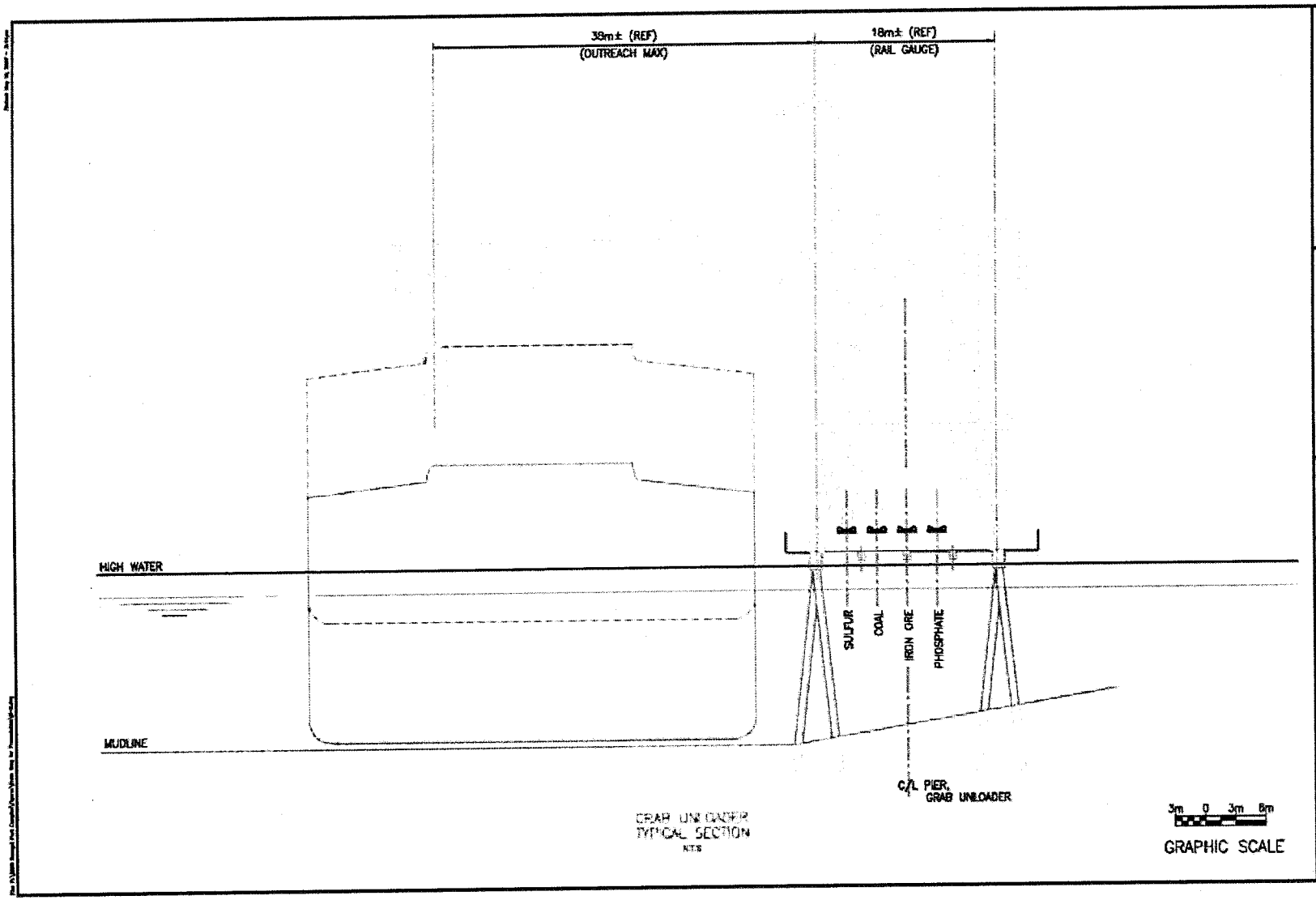
TEC Inc.
619 Severn Ave, Suite 222
Annapolis, MD 21403
(410)280-0090 (410)280-9655 fax

DATE 5/4/07
DRAWN MEO
CHECKED MRV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
RAIL LOAD OUT STATION

8029-001

S-7



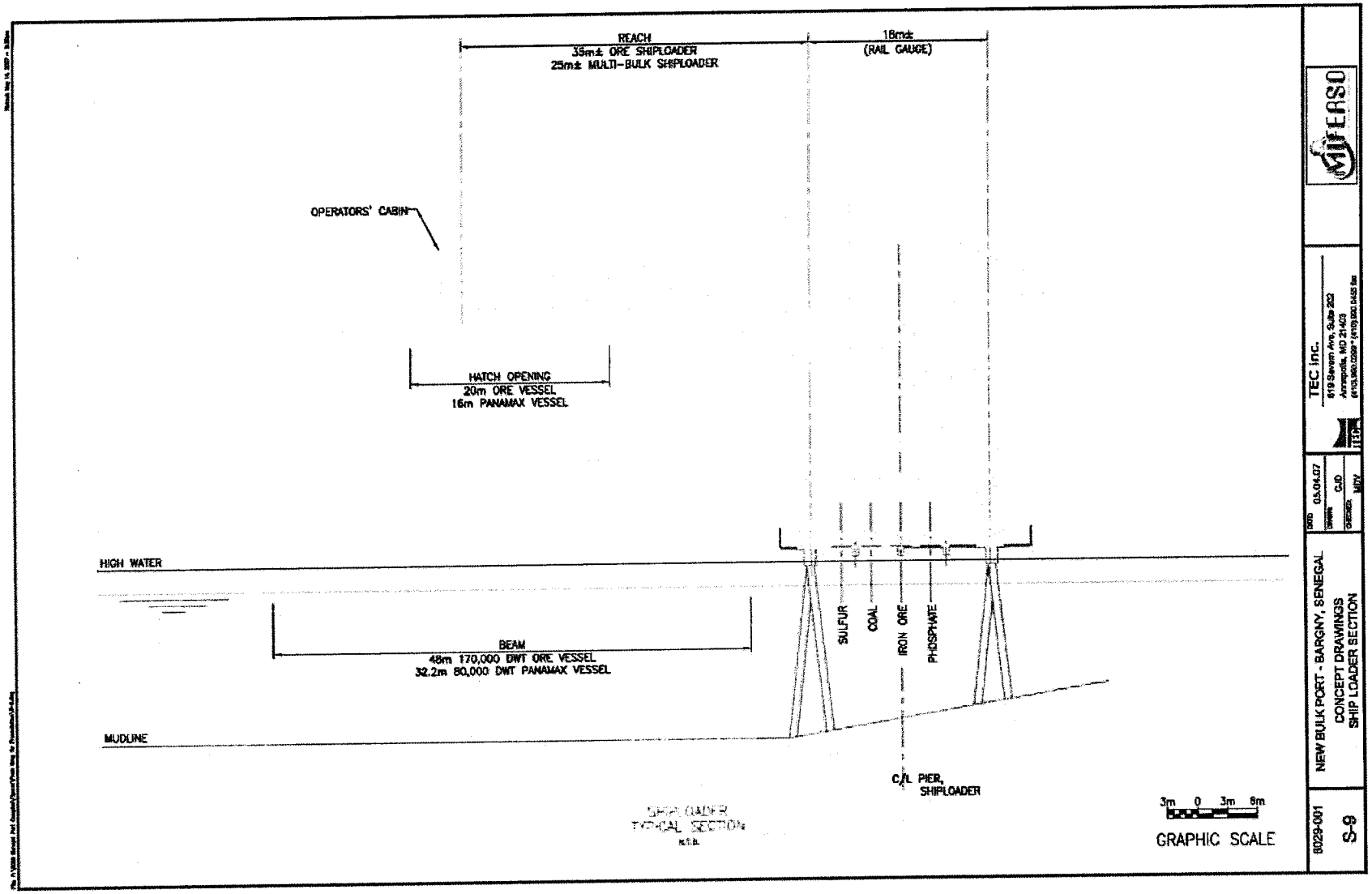
TEC Inc.
910 Severn Ave, Suite 202
Annapolis, MD 21403
(410) 280-0455 fax

DATE 03-04-07
DRAWN GJD
CHECKED MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
SHIP UNLOADER SECTION

6029-001

S-8



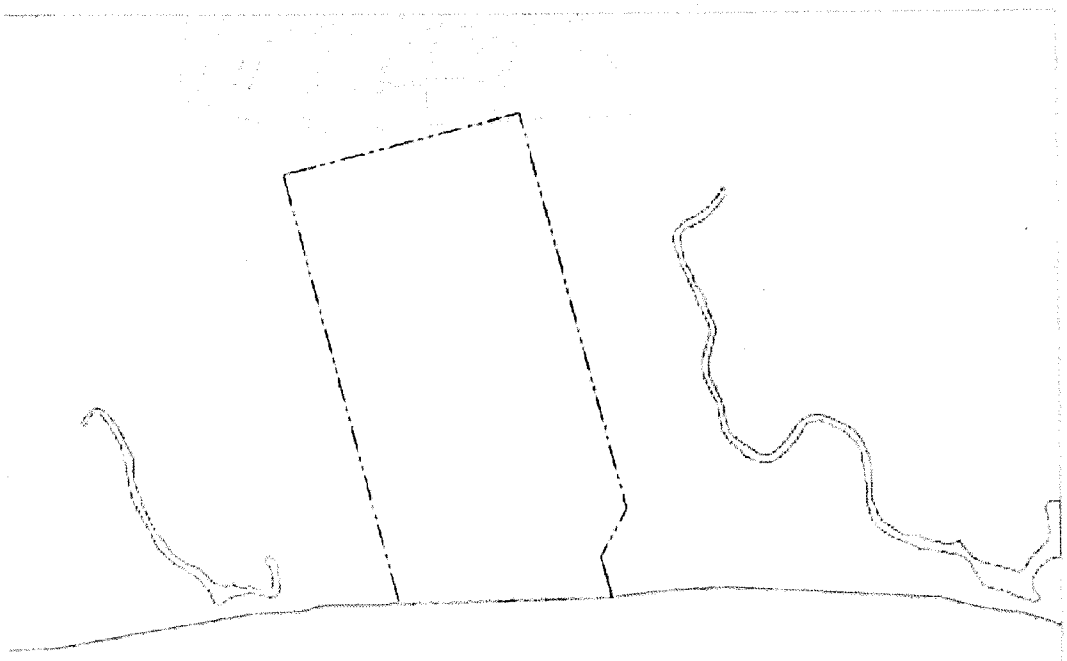
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410) 280-0455 fax

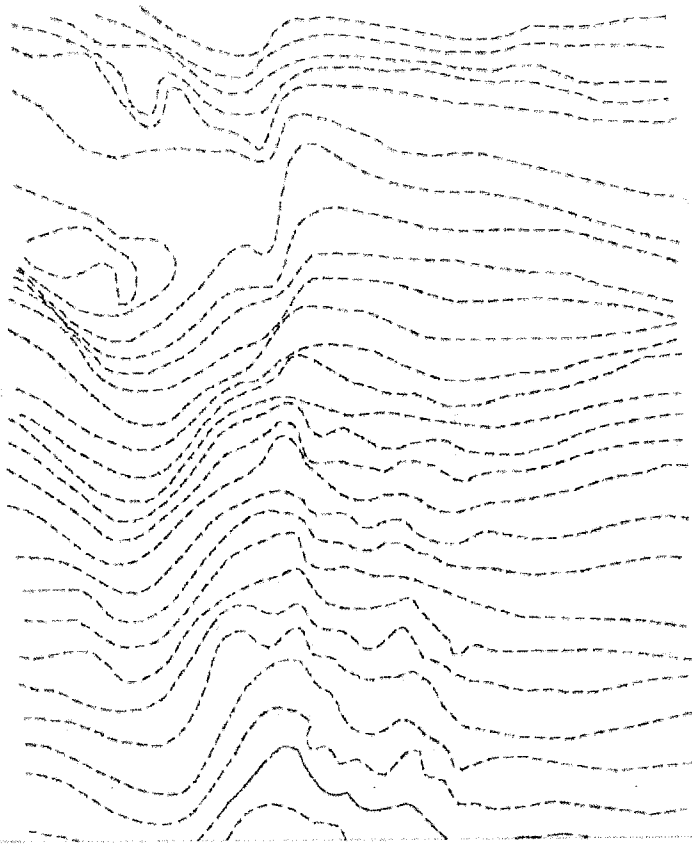
DRB 05.04.07
DRAWN CJD
CHECKED MTV

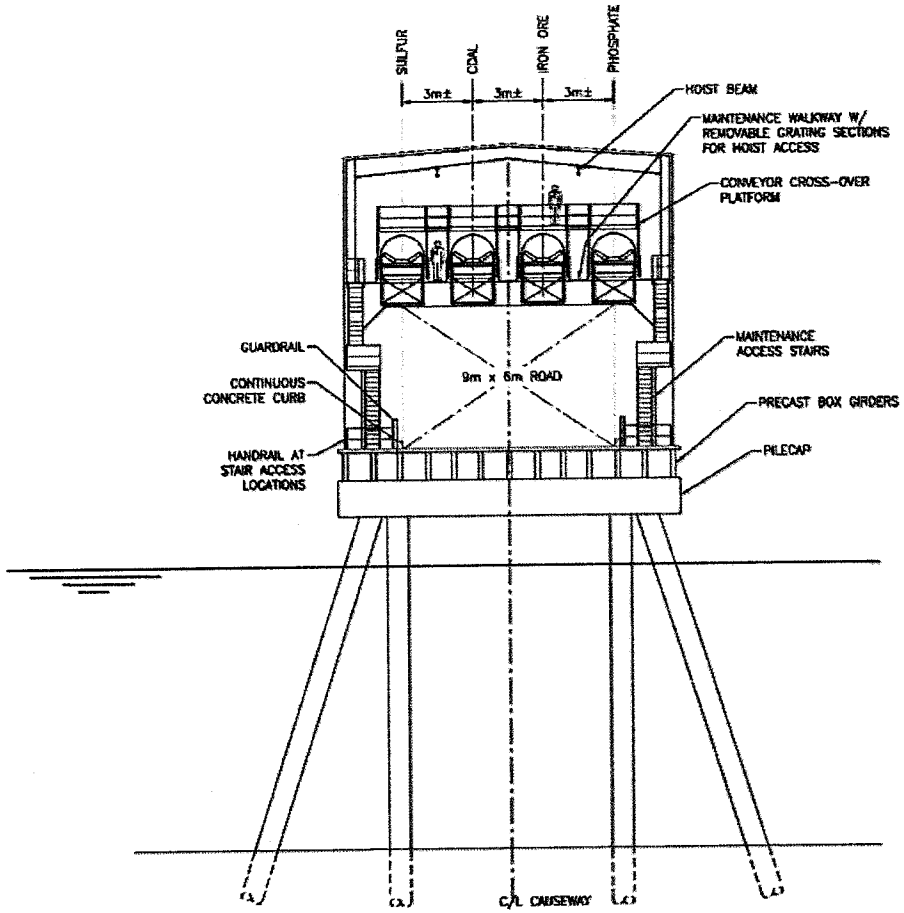
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
SHIP LOADER SECTION

8029-001
S-9

TECinc







A CAUSEWAY SECTION
SCALE: 1:600

3m 0 3m 6m
GRAPHIC SCALE

TEC inc.
610 Sawmill Ave, Suite 202
Annapolis, MD 21403
(410) 280-8455 fax

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
CAUSEWAY SECTION

Date 05-04-07
Drawn SJD
Checked MDV

8029-001
S-10

TEC inc

APPENDIX B

US Sources of Supply

APPENDIX B

Contractor Contact Information

TEC Inc.
619 Severn Avenue, Suite 202
Annapolis, MD 21403
USA
Phone: (410) 990-0299
Fax: (410) 990-0455
Contact: Marcel Veilleux

US Sources of Supply

SERVICES

Port Planning/Design/Construction Management

Firm	Contact	Address	Phone	Fax
TEC Inc	Jim Hunt	619 Severn Ave. Annapolis, MD 21403	(410) 990-0299	(410) 990-0455
Wilbur Smith	Carmenza Becerra	3060 Williams Dr. Suite 300 Fairfax, VA 22031	(703) 208-2166	(703) 280-1631
Moffat Nichol	Eric Nichol	3780 Kilroy Airport Way, Suite 750 Long Beach, CA 90806	(562) 590-6500	(562) 590-6512
Parsons Brinkerhoff	Patrick Lun	One Penn Plaza New York, NY 10119	(212) 465-5000	(212) 465-5096
The Louis Berger Group	Charles Bell	2445 M Street NW Washington, DC 20037	(202) 331-7775	(202) 293-0787
Halcrow HPA		22 Cortlandt Street 33rd Floor New York, NY 10007	(212) 608-3990	(212) 566-5059
CH2MHill		15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	(703) 376-5000	(703) 376-5010
URS Headquarters		600 Montgomery St. 26th Floor San Francisco, CA 94111	(415) 774-2700	(415) 398-1905

Port Construction

Firm	Contact	Address	Phone	Fax
Washington Group International	Stephen Johnson	720 Park Blvd., [P.O. Box 73] Boise ID 83729	(208) 386-5510	
Bechtel Corporation	Riley Bechtel	5275 Westview Drive Frederick, MD 21703	(301) 228-6000	(301) 228-2200
Shaw Group	J.M. Bernhard, Jr.	4171 Essen Lane Baton Rouge, LA 70809	(225) 932-2500	(225) 932-2661
Turner International	Charles Murphy	375 Hudson Street New York, NY 10014	(212) 229-6275	

EQUIPMENT

Material Handling Equipment

Firm	Contact	Address	Phone	Fax
Arch Environmental Equipment, Inc.	Headquarters	P.O. Box 1760 Paducah, KY 42002	270-898-6821	270-898—8061
Boston Gear – Altra Industrial Motion	Global Headquarters	14 Hayward Street Quincy, MA 02171	617-328-3300	617-479-6238
Continental Conveyor & Equipment Co.	James Smothers	438 Industrial Drive Winfield, AL 35594	205-487-6492	205-487-4233
FMC Technologies	Russ Leets	400 Highpoint Drive Chalfont, PA 18914	215-822-4513	215-822-4520

Dearborn Mid-West Conveyor Company	Sudy Vohra	4220 Shawnee Mission Parkway, Suite 301B Fairway, KS. 66205	913-261.2406	
Heyl & Patterson, Inc.		2000 Cliff Mine Rd Park West Two Suite 300 Pittsburgh, PA. 15275	412-788-9810	412-788-9822
ThyssenKrupp Robins, Inc.		7730 East Belleview Ave., Suite # 404 Greenwood Village, Colorado 80111-5820	(303) 770 0808	(303) 770 4522
Jervis B. Webb Company		34375 W. Twelve Mile Road Farmington Hills, MI 48331	(800) 526-9322	(248) 553-1228
Orthman Conveying Systems		601 Bus. 70 West, Columbia, MO 65203		
Innovative Processing Solutions		P.O. Box 299, Aurora, IN 47001	877-926-0040	812-926-3482
Rulmeca Corporation		6508-B Windmill Way, Wilmington, NC 28405		
PEBCO		225 North 4th Street P.O. Box 7506 Paducah, KY 42002-7506		
Arch Environmental Equipment		P.O. Box 1760 Paducah, KY 42002-1760		
Classic Conveyor Components Corp.		197 Conemaugh Street, Blairsville, PA 15717	800-438-2918	
ContiTech Conveyor Belt Group		520 South 18th Street West Des Moines, IA 50265-5532	515.223.5843	515.223.3574
Conveyor Components Company		P.O. Box 167 Croswell, MI 48422		
Dover Conveyor, Inc.		3323 Brightwood Road Midvale, OH 44653	740-922-9390	740-922-9391
Electro-Sensors, Inc.		6111 Blue Circle Drive Minnetonka, MN 55343		
Fenner Dunlop Conveyor Belting Americas		21 Laredo Drive Scottdale, Georgia 30079	404-294-5272	404-297-3174
Goodman Conveyor Company		645 Floyd Wright Drive P.O. Box 866 Belton, SC 29627	(864) 338-7793	(864) 338-8732
Grotto's Tool Works		102 Ramblewood Lane Greenville, SC 29615		
Lynx Products Corp.		4910 14th Street West Bradenton, FL 34207	941-727-9676	941-727-4457
Martin Sprocket and Gear Company		3100 Sprocket Drive Arlington, Texas 76015	817-258-3000	817-258-3333
Martin Engineering		One Martin Place Neponset, IL 61345-9766		
RPS Engineering, Inc.		1300 Crispin Drive Elgin, IL 60123	847-931-1950	847-931-7435
Superior Industries, Inc.		315 East State Highway 28 P.O. Box 684 Morris, MN 56267	800-321-1558	320-589-3892

Wheel Loader

Firm	Contact	Address	Phone	Fax
Caterpillar Inc.	Headquarters	100 North East Adams St. Peoria, IL 61629	(309) 675-1000	
White Oak Equipment (CASE)	Dealer	9115 Industry Drive Manassas Park, VA 20111	(703) 330-1333	(703) 330-5193
John Deere	World Headquarters	One John Deere Place Moline, IL 61265	309-765-8000	

Control System

Firm	Contact	Address	Phone	Fax
Rockwell Automation (Allen-Bradley)	Global Headquarters	1201 South Second Street Milwaukee, WI 53204	414-382-2000	414-382-4444
Siemens Automation	Tom Kopanski	3333 Old Milton Parkway Alpharetta, GA 30005	800-964-4114	
GE Fanuc Automation, Inc.	Maryrose Sylvester	2500 Austin Drive Charlottesville, VA 22911	800-433-2682	

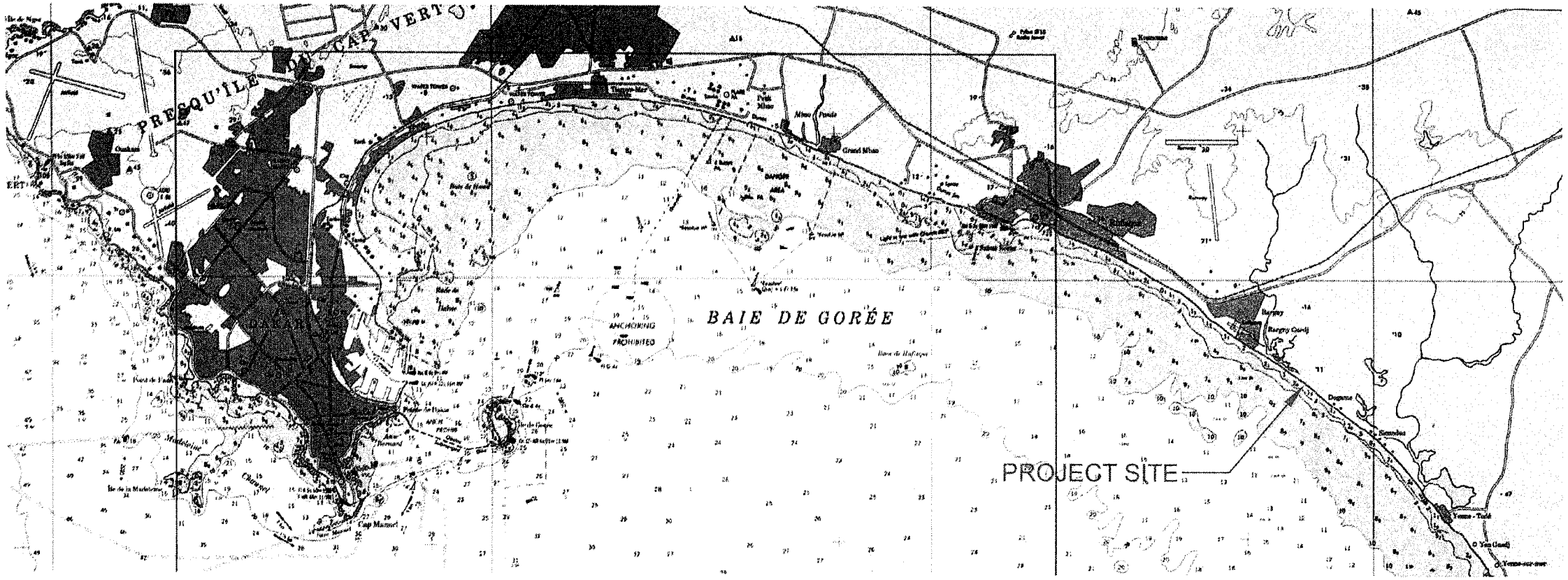
Navigational Aids

Firm	Contact	Address	Phone	Fax
Tideland Signal Corp.	Yan Lingh	P.O. Box 52430 Houston, TX 77052	713-681-6101	713-681-6233
OkSolar	Headquarters	5011 SW 152 Ave. Hollywood FL 33027	347-624-5693	347-534-9155
Automatic Power, Inc.	Headquarters	P.O. Box 230738 Houston, TX 77223	713-228-5208	713-228-3717

APPENDIX C

Concept Drawings

NEW MULTI-COMMODITY BULK PORT
BARGNY, SENEGAL



GENERAL/SITE PLANS

G-1	COVER SHEET
SP-1A rev.1	AREA PLAN – PHASE 1 ALTERNATIVE 'A'
SP-1B rev.1	AREA PLAN – PHASE 1 ALTERNATIVE 'B'
SP-2A rev.1	PIER PLAN – PHASE 1 ALTERNATIVE 'A'
SP-2B rev.1	PIER PLAN – PHASE 1 ALTERNATIVE 'B'
SP-3 rev.1	PHASE 1 STOCKYARD PLAN
SP-4	AREA PLAN – PHASE 2
SP-5 rev.1	PHASE 2 STOCKYARD PLAN
SP-6	STOCKYARD PLAN – ENLARGED AREA 1
SP-7	STOCKYARD PLAN – ENLARGED AREA 2
SP-8	RAIL OPERATION PLAN
SP-9	TRESTLE & BERTH PLAN ALTERNATIVE 'A'

GENERAL ARRANGEMENTS

GA-1	ICS COMBINATION SHIP LOADER/UNLOADER
GA-2	ICS WAREHOUSE SECTIONS
GA-3	ICS RAILCAR LOADING STATION
GA-4	CEMENT COMPANIES SHIP UNLOADER SECTION
GA-5	CEMENT COMPANIES SHIP LOADER SECTION
GA-6	POWER PLANTS SHIP UNLOADER SECTION
GA-7	CEMENT COMPANIES TRUCK DUMP SECTION
GA-8	CEMENT COMPANIES WAREHOUSES SECTIONS
GA-9	CEMENT COMPANIES COAL YARD STACKER SECTION
GA-10	BARGE LOADING AND UNLOADING ALT. 'B'
GA-11 rev.1	TRESTLE SECTIONS – ENCLOSED CONV.
GA-11-1	TRESTLE SECTIONS – ENCLOSED CONV. (ICS CONVEYOR REMOVED)

FLOW DIAGRAMS

FD-1	ICS UREA/SULFUR IMPORTS FLOW DIAGRAM
FD-2	ICS FERTILIZER/ATTAPULGITE FLOW DIAGRAM
FD-3	CEMENT COMPANIES COAL/GYPSUM/SLAG IMPORTS FLOW DIAGRAM
FD-4	CEMENT COMPANIES SOCOIM/CIMENT DU SAHEL FLOW DIAGRAM
FD-5	POWER PLANT SENELEC/PPP IMPORT COAL FLOW DIAGRAM

MERSO
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 • (410).990.0455 fax

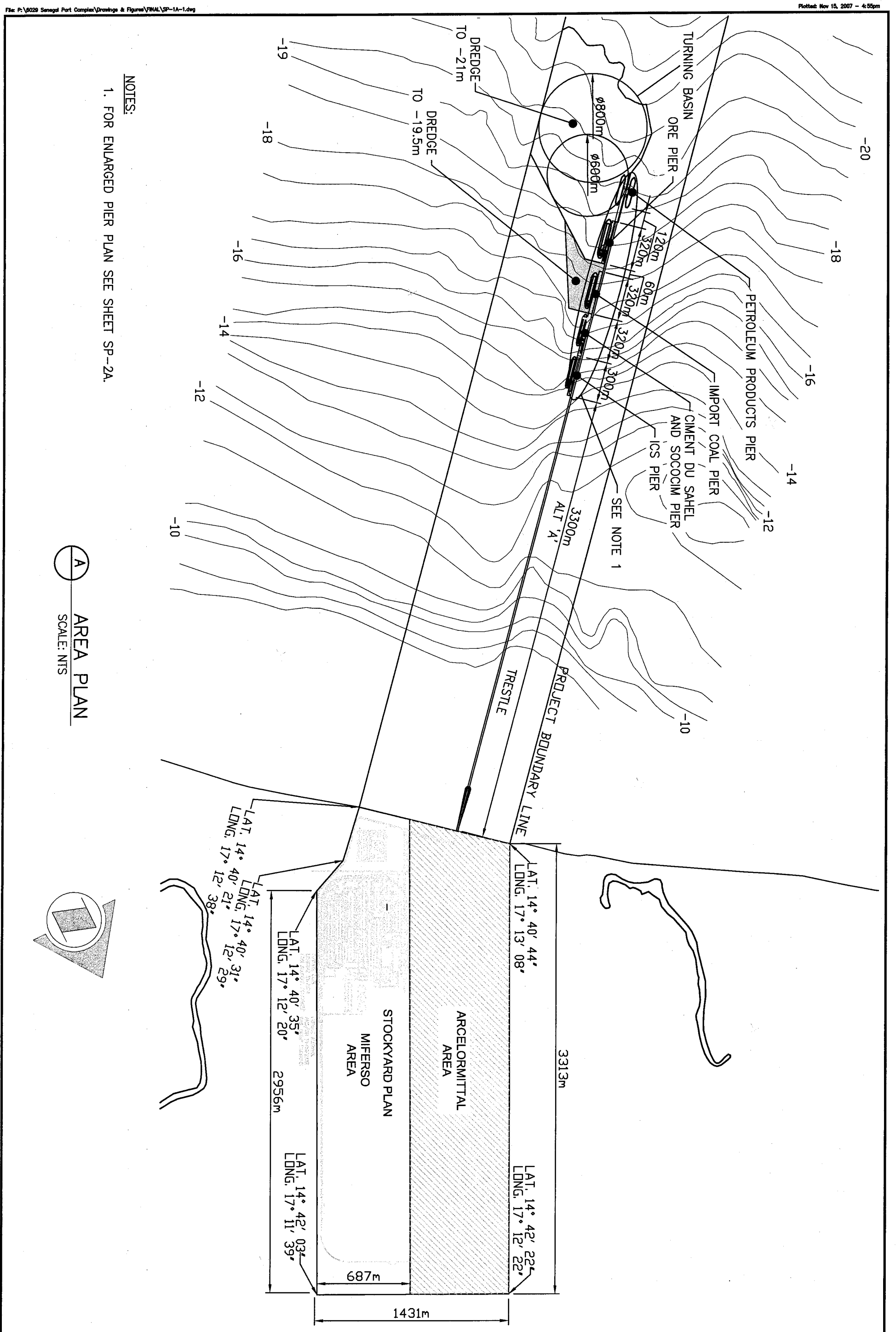
DATE: 06.06.07
DRAWN: HJ
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL

COVER SHEET

6029-001

G-1

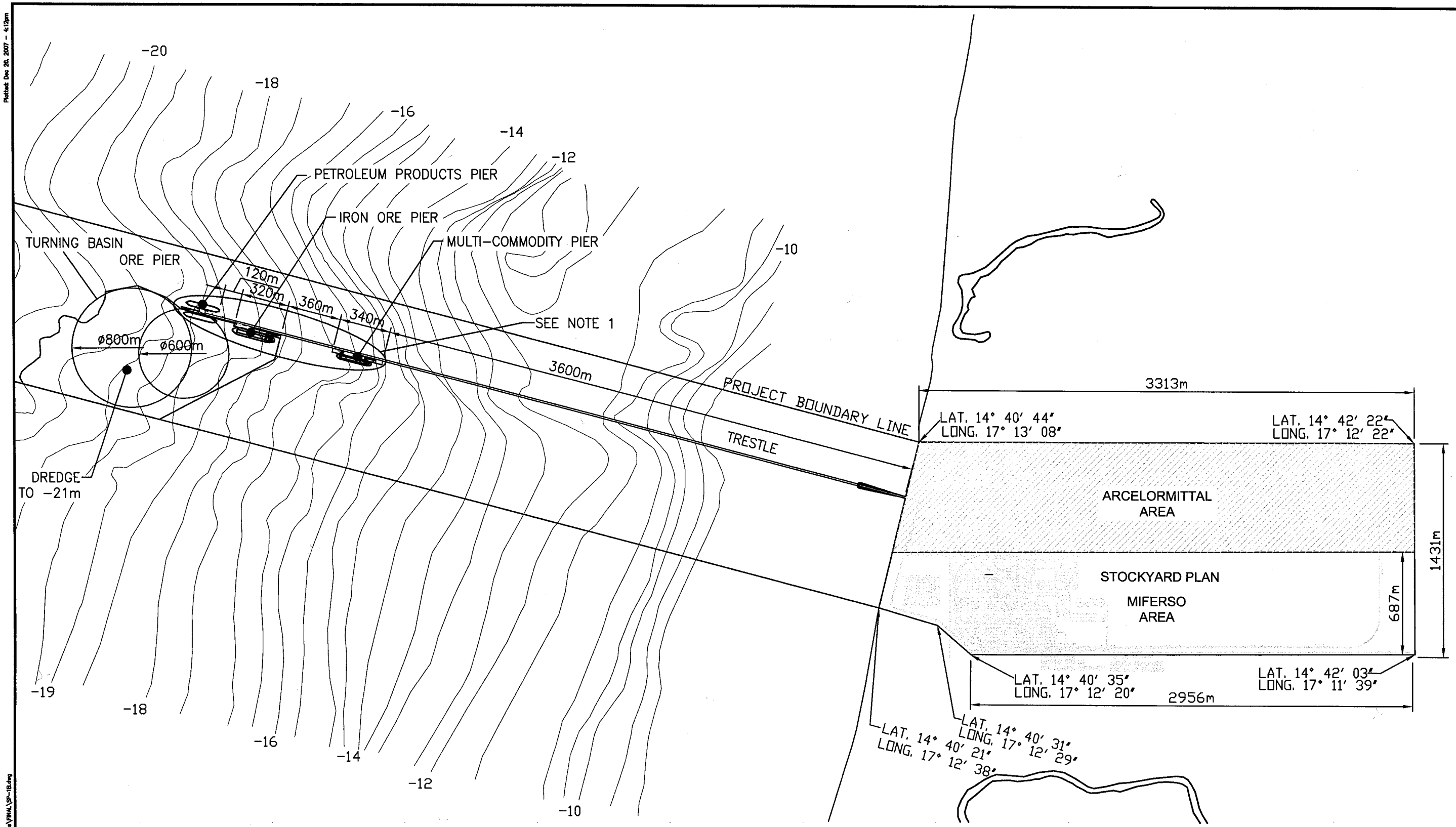


NOTES:

1. FOR ENLARGED PIER PLAN SEE SHEET SP-2A.

A AREA PLAN
SCALE: NTS

6029-001 SP-1A	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS AREA PLAN - PHASE 1 ALTERNATIVE `A'	DATE: 07.20.07 DRAWN: GJD CHECKED: MDV	TEC inc. 619 Severn Ave, Suite 202 Annapolis, MD 21403 (410).990.0299 * (410).990.0455 fax	MIFERSO Société des Mines de Fer du Sénégal Oriental



NOTES:

1. FOR ENLARGED PIER PLAN SEE SHEET SP-2B.

A AREA PLAN
SCALE: NTS

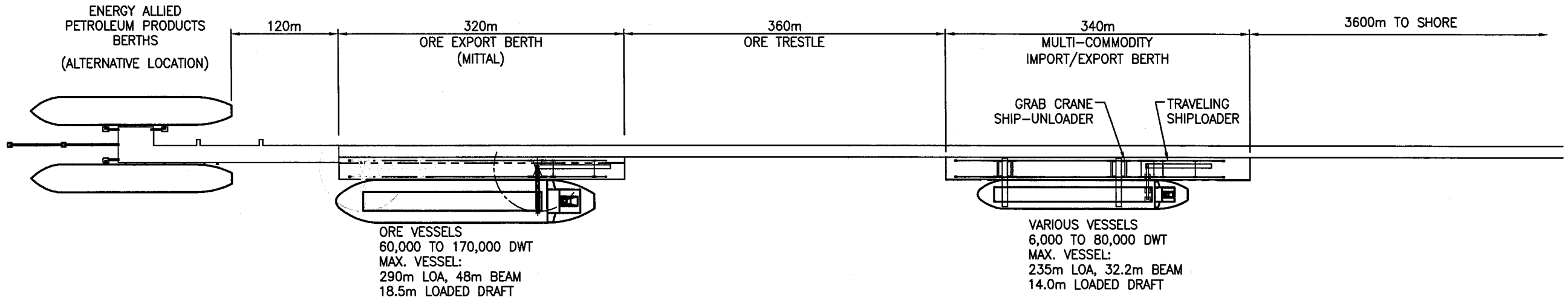
MIFERSO
Société des Mines de Fer de Mauritanie

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 07.20.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
AREA PLAN - PHASE 1 ALTERNATIVE 'B'

6029-001
SP-1B



A PIER PLAN
SCALE: NTS

MITTAL
Société des Mines de Fer du Sénégal Oriental

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 • (410).990.0455 fax

DATE: 07.19.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
PIER PLAN - PHASE 1 ALTERNATIVE 'B'

6029-001
SP-2B

Plotted: Dec 20, 2007 - 4:11pm
File: P:\6029 Senegal Port Complex\Drawings & Figures\FINAL\SP-2B.dwg, 12/20/2007 4:11:53 PM, \\annapolis\RICOH AP3800C PS

BAIE DE GOREE

PROPERTY BOUNDARY

LAT. 14° 40' 44"
LONG. 17° 13' 08"

LAT. 14° 42' 22"
LONG. 17° 12' 22"

TRESTLE TO ORE PIER

IRON ORE EXPORT CONVEYOR

ARCELORMITTAL AREA

726m

RAIL LOADING(ICS)

TRESTLE TO PETROLEUM PRODUCTS TERMINAL PIER

PETROLEUM PRODUCTS TERMINAL

SULFUR

A.S.

PO

UREA

FERT.

EXPL. ROAD

ATT.

ATT.

PORT ROAD

GYPSUM

GYPSUM

SLAG

SLAG

CLINKER

CLINKER

COAL

COAL

PORT ROAD

SEE NOTE

50 HA

ROAD TO TERMINALS

100 HA

AVAILABLE FOR PETROSEN PETROLEUM PRODUCTS STORAGE

687m

LAT. 14° 40' 21"
LONG. 17° 12' 38"

LAT. 14° 40' 31"
LONG. 17° 12' 29"

COAL CONVEYOR TO POWER PLANTS

LAT. 14° 40' 35"
LONG. 17° 12' 20"

LAT. 14° 42' 03"
LONG. 17° 11' 39"

APPROX. SHORELINE

NOTE:
AREA AVAILABLE FOR MDL AND OTHER BULK COMMODITY STORAGE.

A/C1 STOCKYARD PLAN
SCALE: NTS

MIFERSO
Société des Mines de fer de Mauritanie

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 • (410).990.0455 fax

DATE: 07.20.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
PHASE 1 STOCKYARD PLAN

6029-001
SP-3
rev. 1

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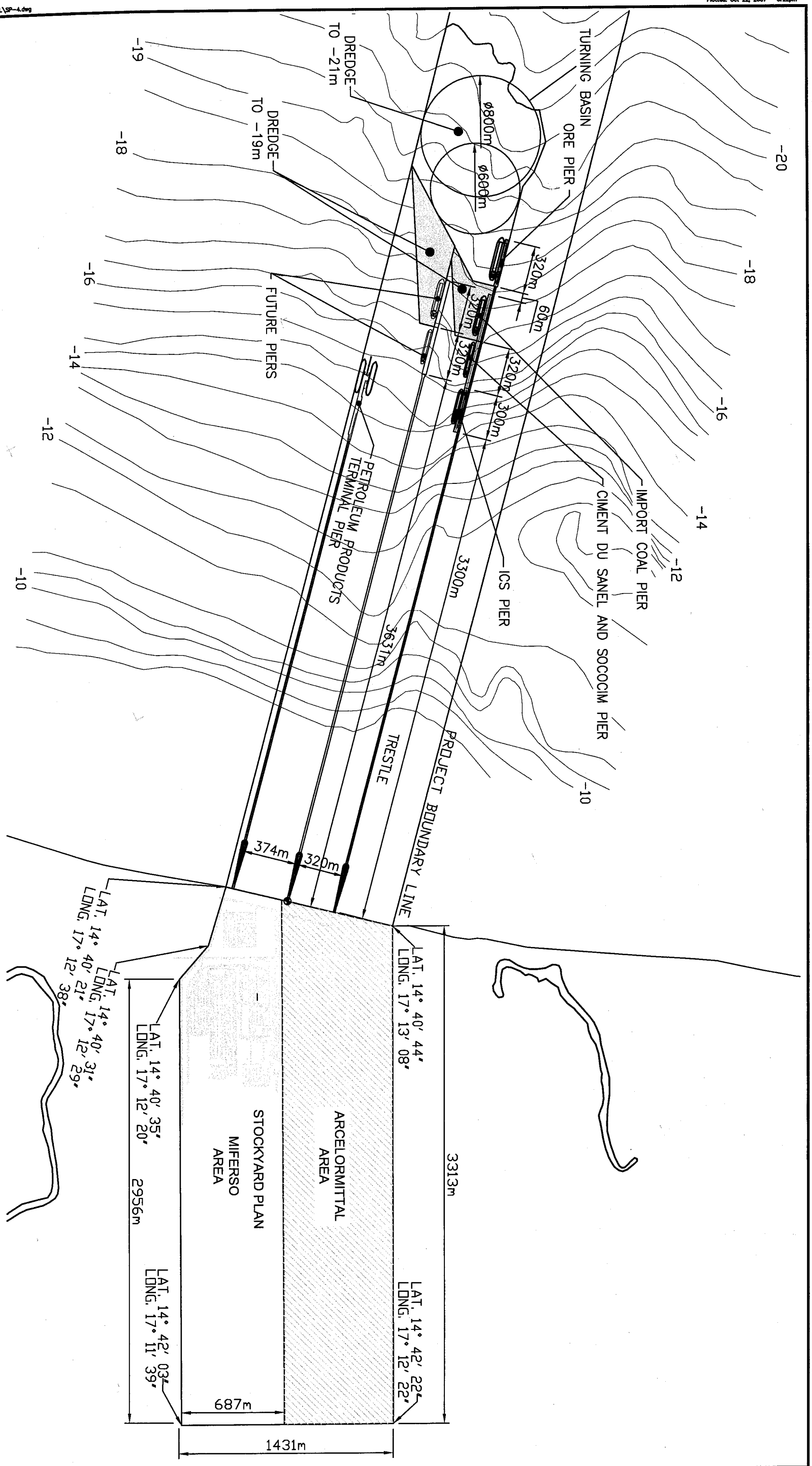
Plotted: Oct 22, 2007 - 3:22pm



A AREA PLAN

SCALE: 1:25,000

6029-001 SP-4	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS AREA PLAN - PHASE 2	DATE: 07.17.07 DRAWN: GJD CHECKED: MDV	TEC inc. 619 Severn Ave, Suite 202 Annapolis, MD 21403 (410).990.0299 * (410).990.0455 fax

BAIE DE GOREE

PROPERTY BOUNDARY

LAT. 14° 40' 44"
LONG. 17° 13' 08"

LAT. 14° 42' 22"
LONG. 17° 12' 22"

TRESTLE TO ORE PIER

IRON ORE EXPORT CONVEYOR

ADD PHASE 2 PIER

ARCELORMITTAL AREA

726m

RAIL LOADING(ICS)

TRESTLE TO PETROLEUM PRODUCTS TERMINAL PIER

PETROLEUM PRODUCTS TERMINAL

SULFUR
PORT ROAD
A.S.
PO
UREA
ATT.
FERT.
FUT. PHOS.
FUT. PHOS.
ATT.
PORT ROAD
GYPSUM
GYPSUM
SLAG
SLAG
FUT. ALUMINA
CLINKER
CLINKER
FUT. PHOS.
PORT ROAD
COAL
FUT. COAL
COAL
FUT. COAL

SEE NOTE

42 HA

ROAD TO TERMINALS

100 HA

AVAILABLE FOR PETROSEN PETROLEUM PRODUCTS STORAGE

687m

LAT. 14° 40' 21"
LONG. 17° 12' 38"

LAT. 14° 40' 31"
LONG. 17° 12' 29"

COAL CONVEYOR TO POWER PLANTS

LAT. 14° 40' 35"
LONG. 17° 12' 20"

FUTURE COAL LOADING STATION FOR ALUMINA CUSTOMER

FUTURE COAL LOADING STATION FOR ALUMINA CUSTOMER

LAT. 14° 42' 03"
LONG. 17° 11' 39"

APPROX. SHORELINE

NOTE:
AREA AVAILABLE FOR MDL AND OTHER BULK COMMODITY STORAGE.

A / C1 STOCKYARD PLAN
SCALE: NTS

MITTERSO
Société des Mines de Fer de Senegal Oriental

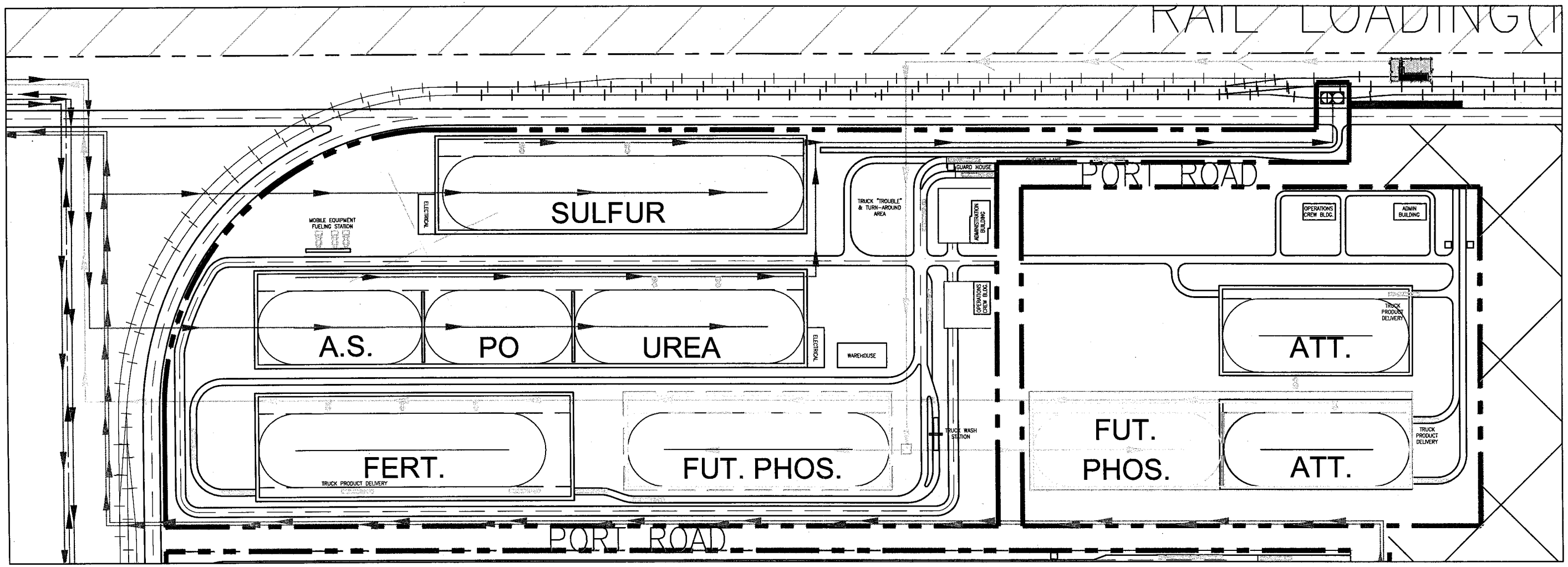
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 07.20.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
PHASE 2 STOCKYARD PLAN

6029-001
SP-5
rev. 1

Plotted: Oct 22, 2007 – 3:23pm



LEGEND

- COAL
- CLINKER
- GYPSUM, SLAG
- SULFUR, AMMONIUM SULFATE, POTASH, UREA
- FERTILIZER, PHOSPHATE (FUTURE)
- ALUMINA (FUTURE), PHOSPHATE (FUTURE)

A STOCKYARD PLAN
SCALE: 1:10,000

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 07.20.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
STOCKYARD PLAN - ENLARGED AREA 1

6029-001
SP-6

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PORT ROAD

GYPSUM | GYPSUM | SLAG | SLAG

CLINKER | CLINKER

COAL | COAL

FUT. COAL | FUT. COAL

PORT ROAD

FUT. ALUMINA

FUT. PHOSPHATES DE MATAM

COAL CONVEYOR TO POWER PLANTS

FUTURE COAL LOADING STATION FOR ALUMINA CUSTOMER

FUTURE ALUMINA AND/OR PHOSPHATE RAIL DUMP STATIONS

LEGEND

- COAL
- CLINKER
- GYPSUM, SLAG
- SULFUR, AMMONIUM SULFATE, POTASH, UREA
- FERTILIZER, PHOSPHATE (FUTURE)
- ALUMINA (FUTURE), PHOSPHATE (FUTURE)

A STOCKYARD PLAN
SCALE: 1:10,000

MITTERSO
Société des Mines de Fer du Sénégal Oriental

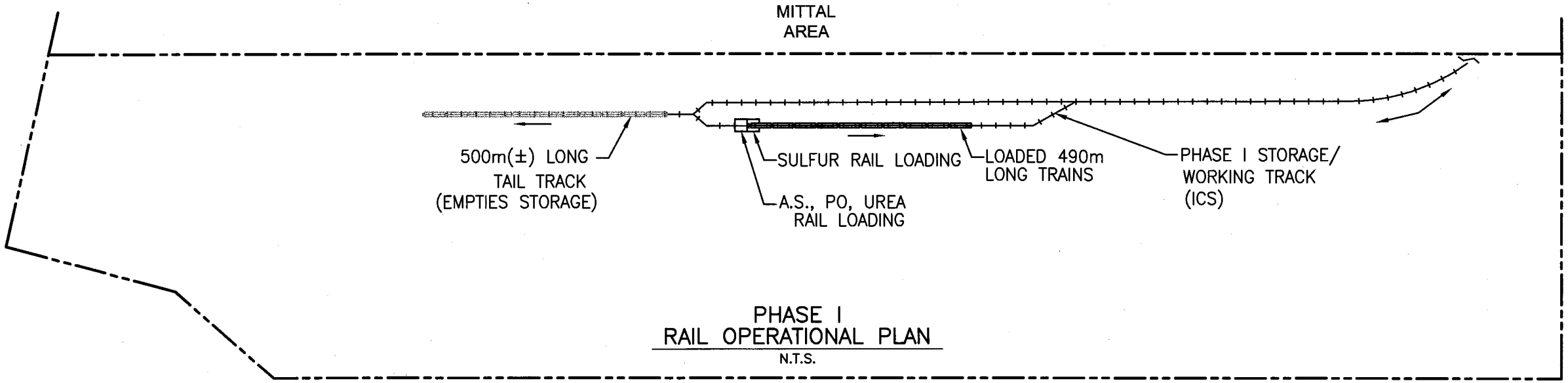
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 07.20.07
DRAWN: GJD
CHECKED: MDV

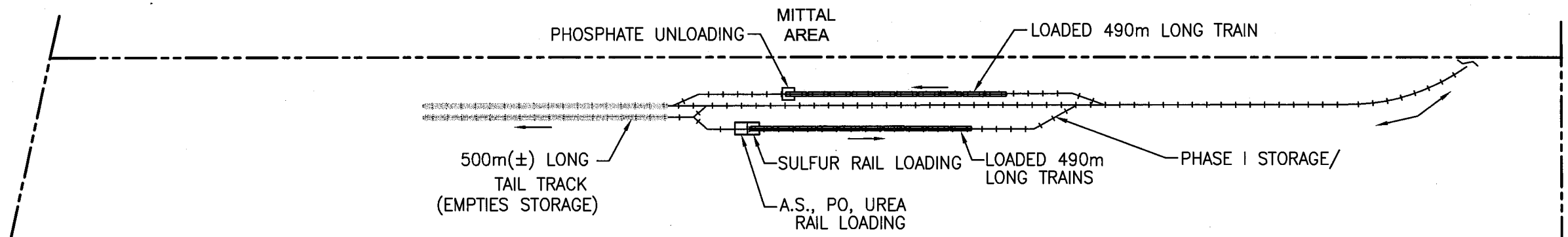
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
STOCKYARD PLAN - ENLARGED AREA 2

6029-001

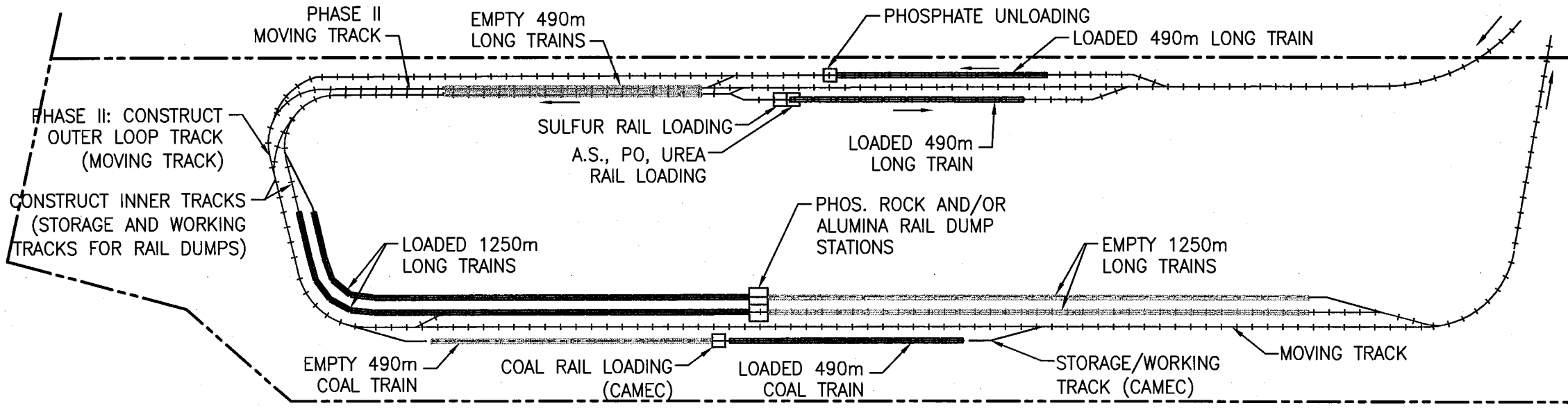
SP-7



PHASE I
RAIL OPERATIONAL PLAN
N.T.S.



PHASE II
RAIL OPERATIONAL PLAN
N.T.S.



PHASE III
RAIL OPERATIONAL PLAN
N.T.S.

Plotted: Oct 22, 2007 - 3:24pm

File: P:\6029 Senegal Port Complex\Drawings & Figures\VRNA\SP-8.dwg

MITTAL STEEL
Serving Customers & the Steel Industry

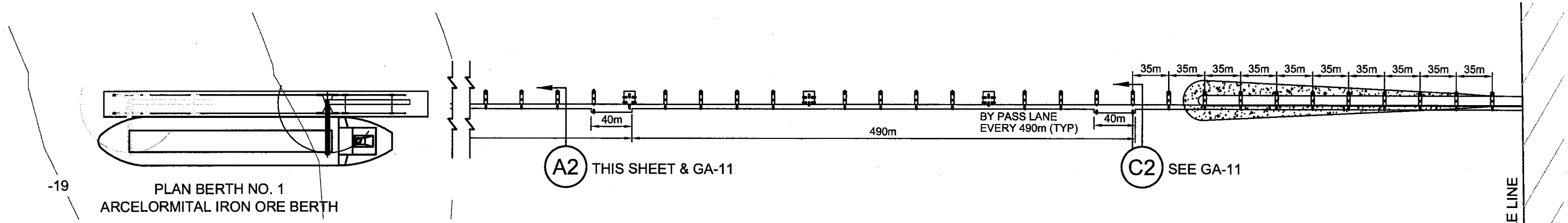
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 6/11/07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
RAIL OPERATIONAL PLAN

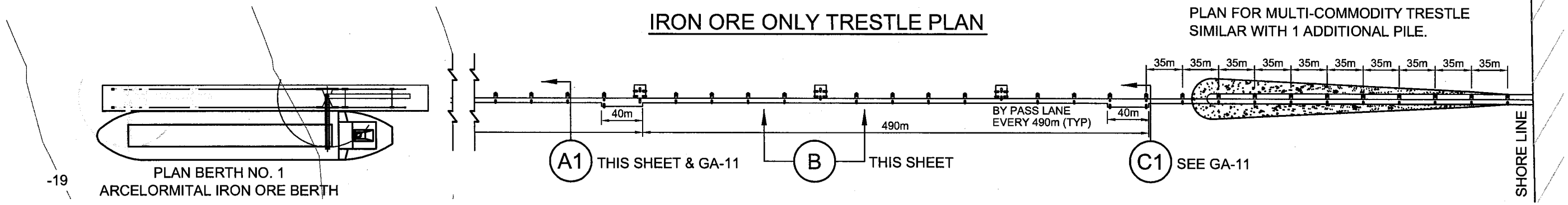
6029-001
SP-8

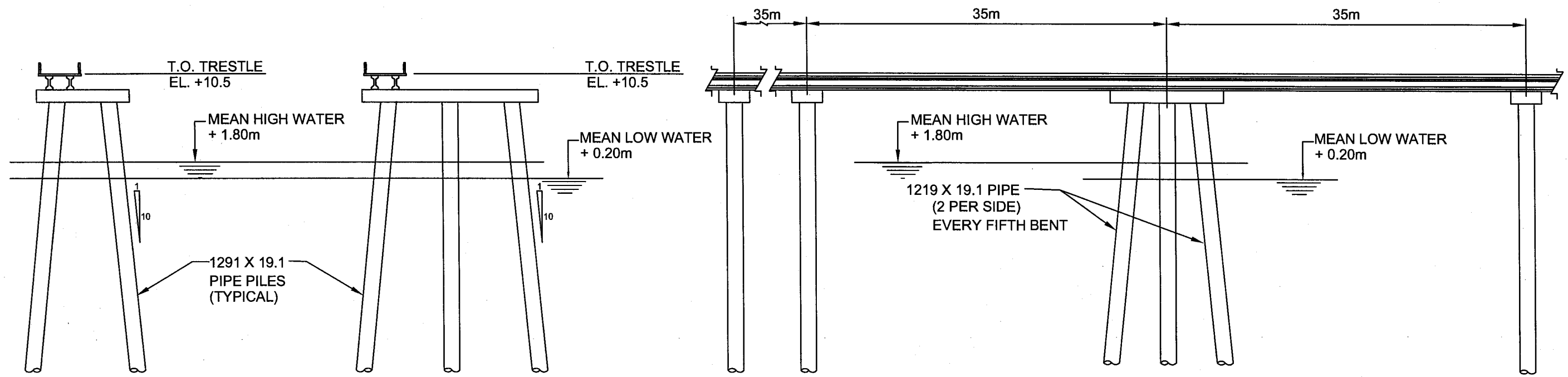
MULTI-COMMODITY TRESTLE



IRON ORE ONLY TRESTLE PLAN

NOTE:
PLAN FOR MULTI-COMMODITY TRESTLE
SIMILAR WITH 1 ADDITIONAL PILE.





A1 IRON ORE ONLY TRESTLE
TYPICAL SECTION

A2 MULTI-COMMODITY TRESTLE
TYPICAL SECTION

B ELEVATION

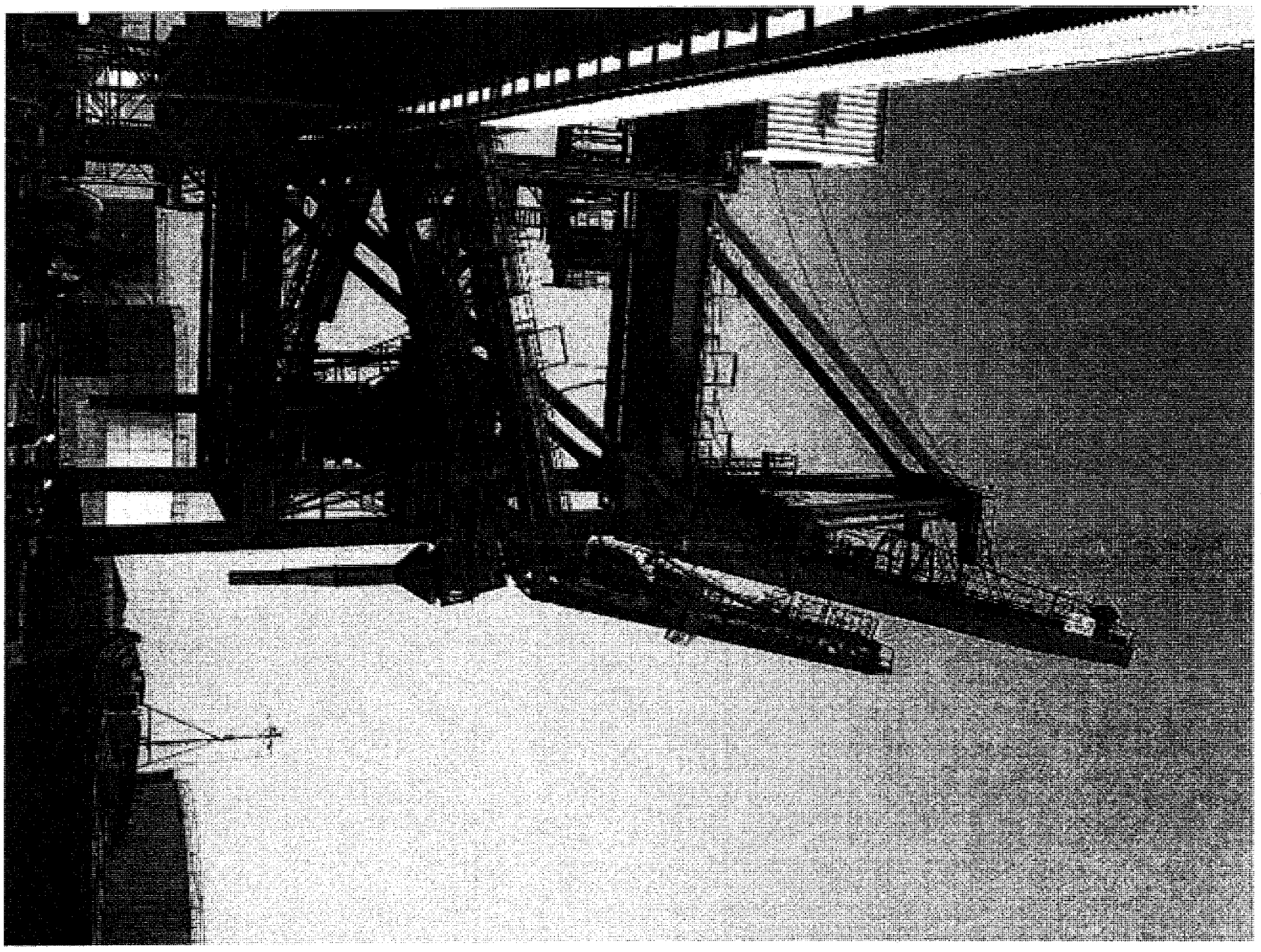
MOFFERSO
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 07.17.07
DRAWN: HJ
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
TRESTLE & BERTH PLAN ALTERNATIVE 'A'

6029-001

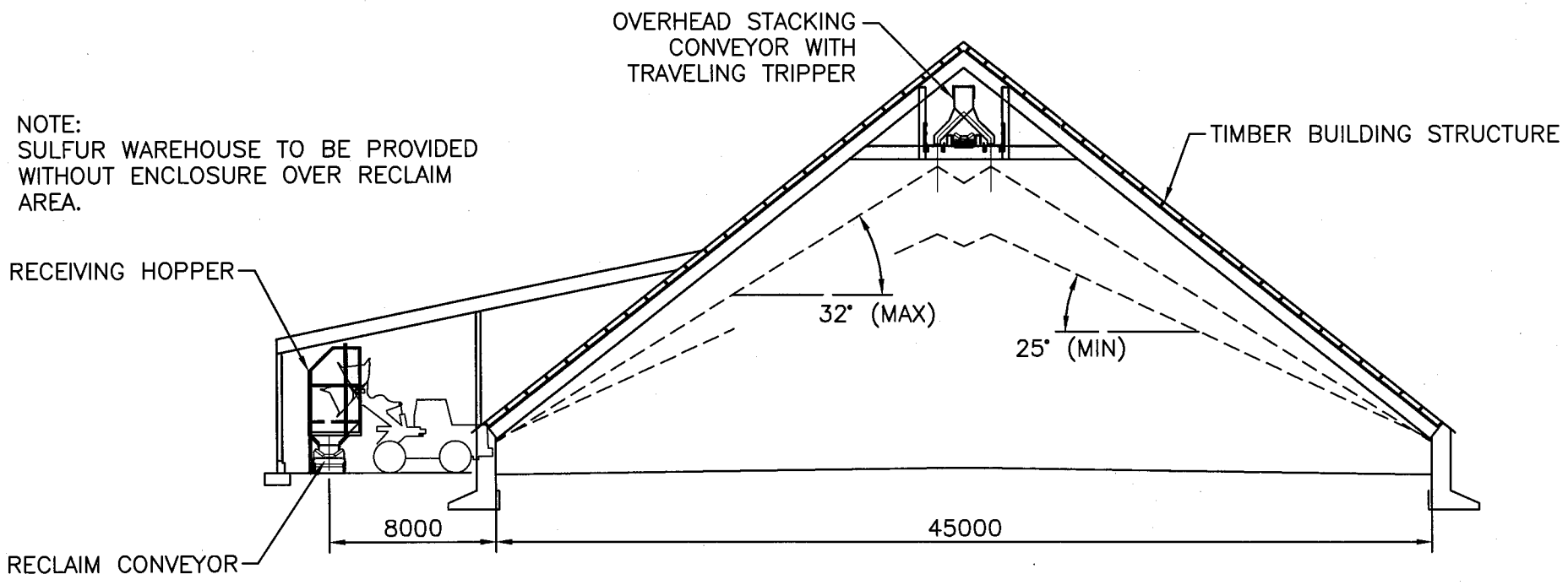
SP-9



ICS COMBINATION SHIP
UNLOADER / LOADER

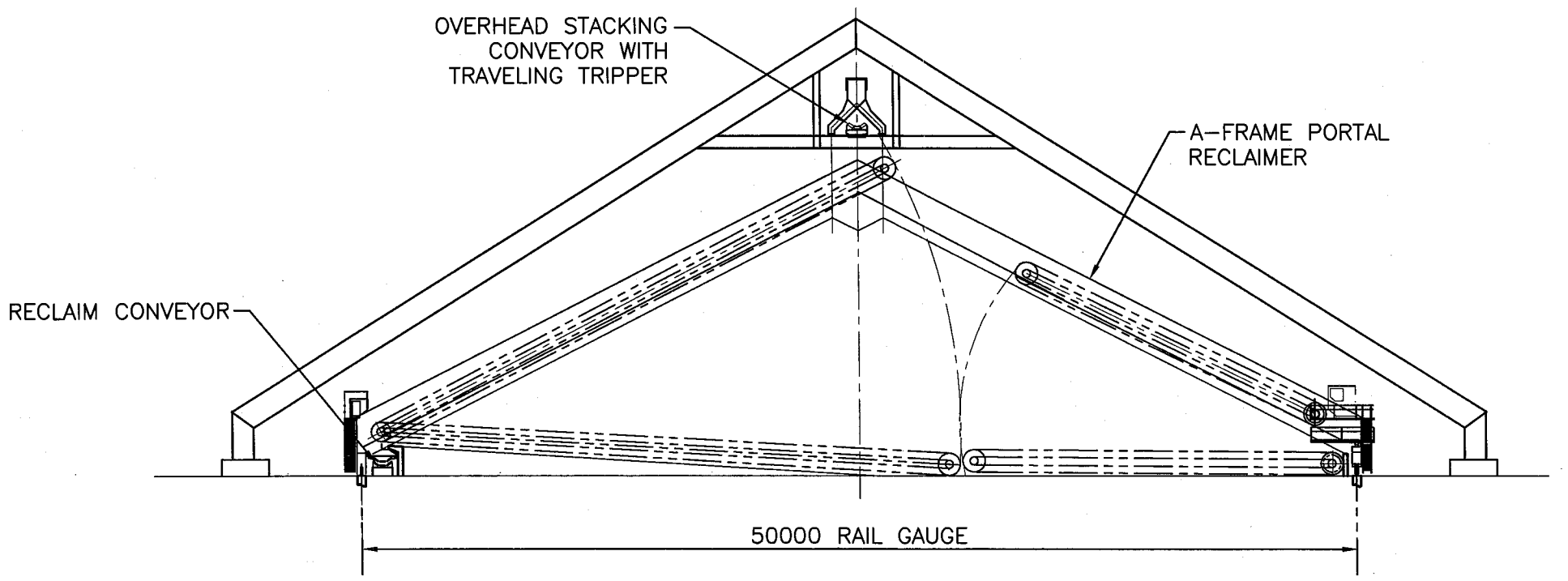
N.T.S.

6029-001 GA-1	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS - ICS COMBINATION SHIP LOADER/UNLOADER	DATE: 8/7/07 DRAWN: GJD CHECKED: MDV	TEC inc.	619 Severn Ave, Suite 202 Annapolis, MD 21403 (410).990.0299 * (410).990.0455 fax	MIFERSO Société des Mines de Fer du Sénégal Oriental



SULFUR, FERTILIZER, AMMONIUM SULFATE, POTASH AND UREA
WAREHOUSE SECTION

N.T.S.



ALTERNATIVE SULFUR WAREHOUSE
WITH PORTAL RECLAIMER SECTION

N.T.S.

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

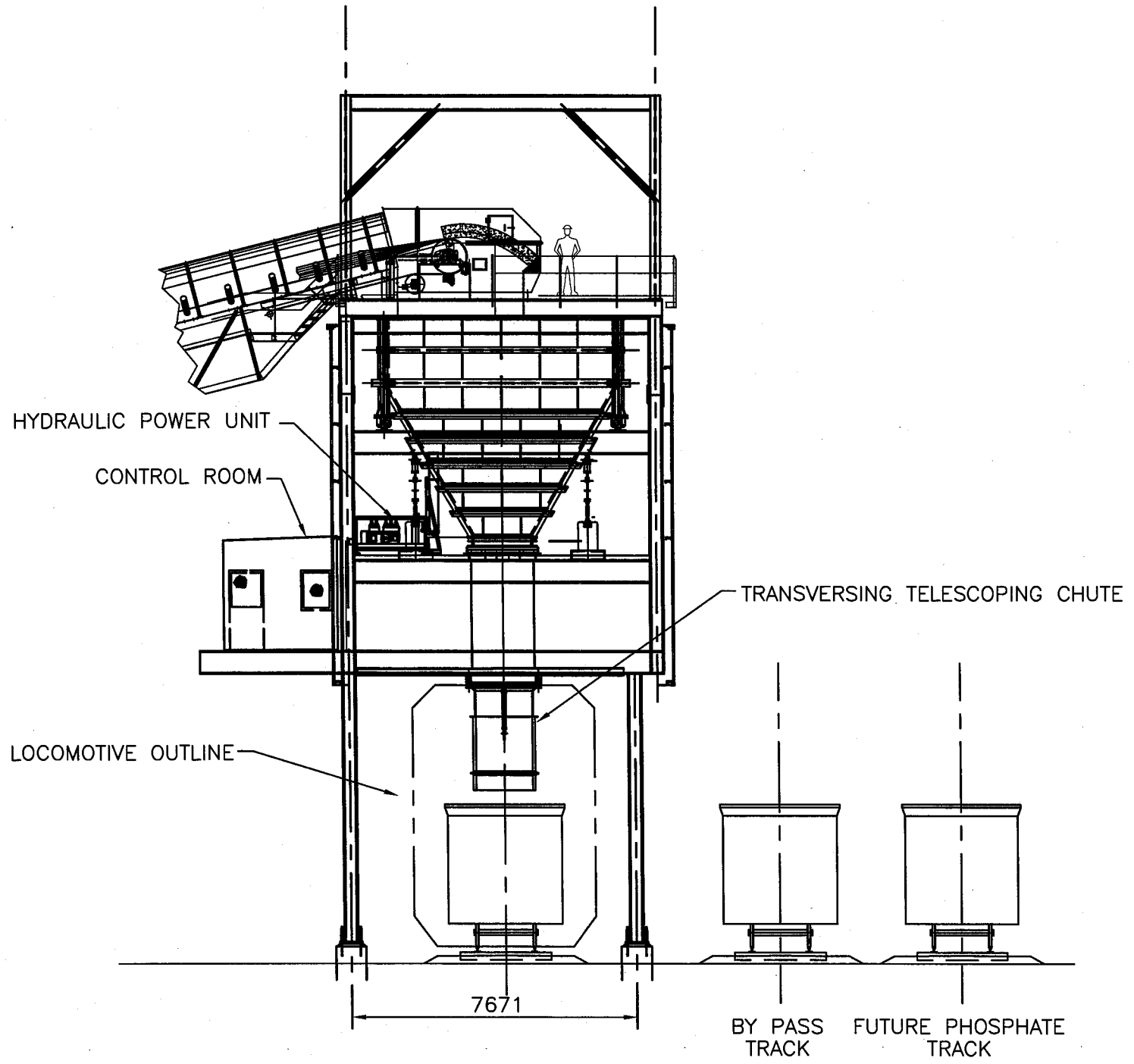
DATE: 8/7/07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS - ICS
WAREHOUSE SECTIONS

6029-001

GA-2

Plotted: Oct. 22, 2007 - 3:27pm



RAIL LOADING TYPICAL SECTION

N.T.S.

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

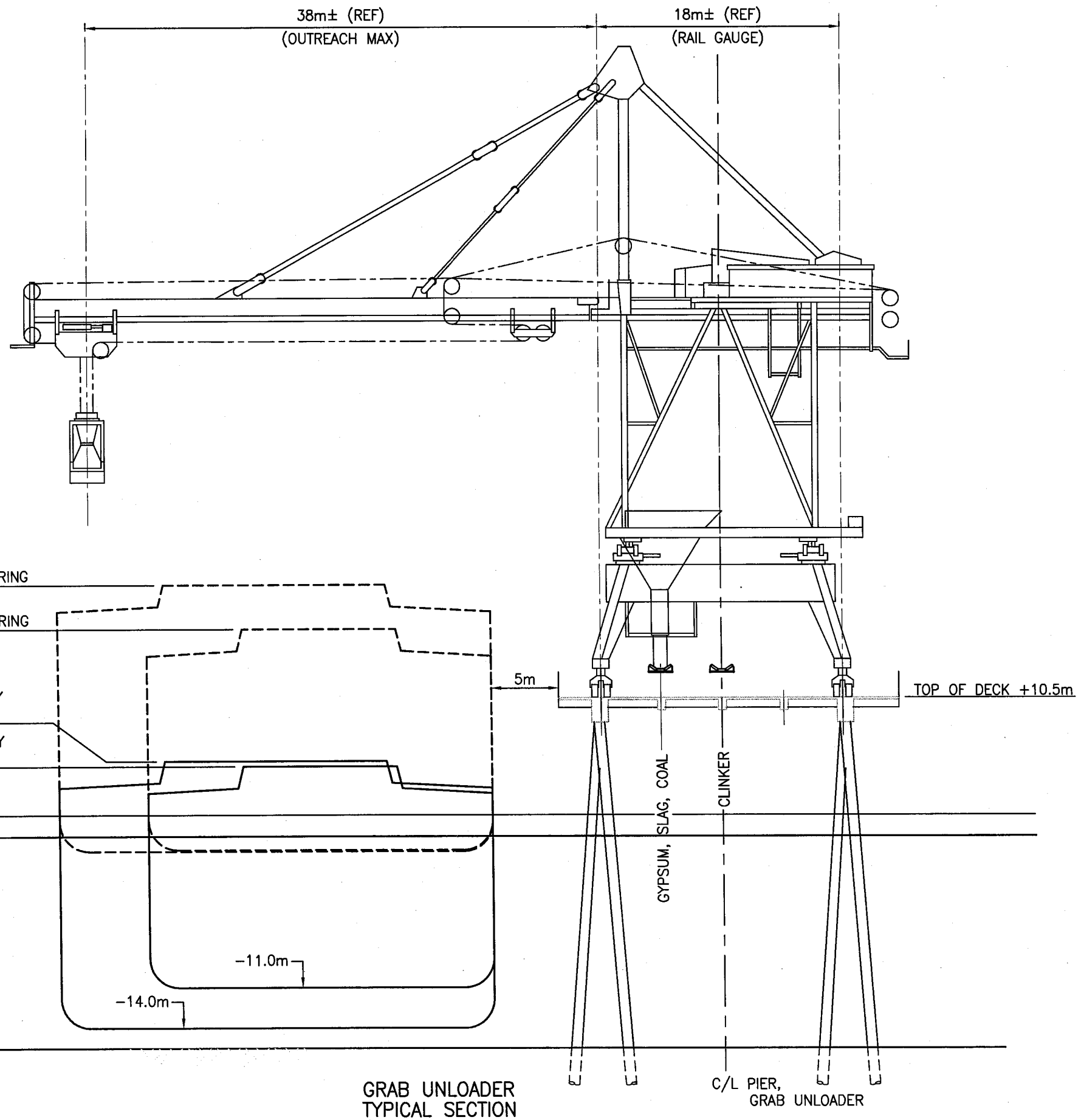
DATE: 5/4/07
DRAWN: MEO
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS - ICS
RAIL CAR LOADING STATION

6029-001

GA-3

File: P:\6029 Senegal Port Complex\Drawings & Figures\FINAL\GA-3.dwg



GRAB UNLOADER
TYPICAL SECTION
N.T.S.

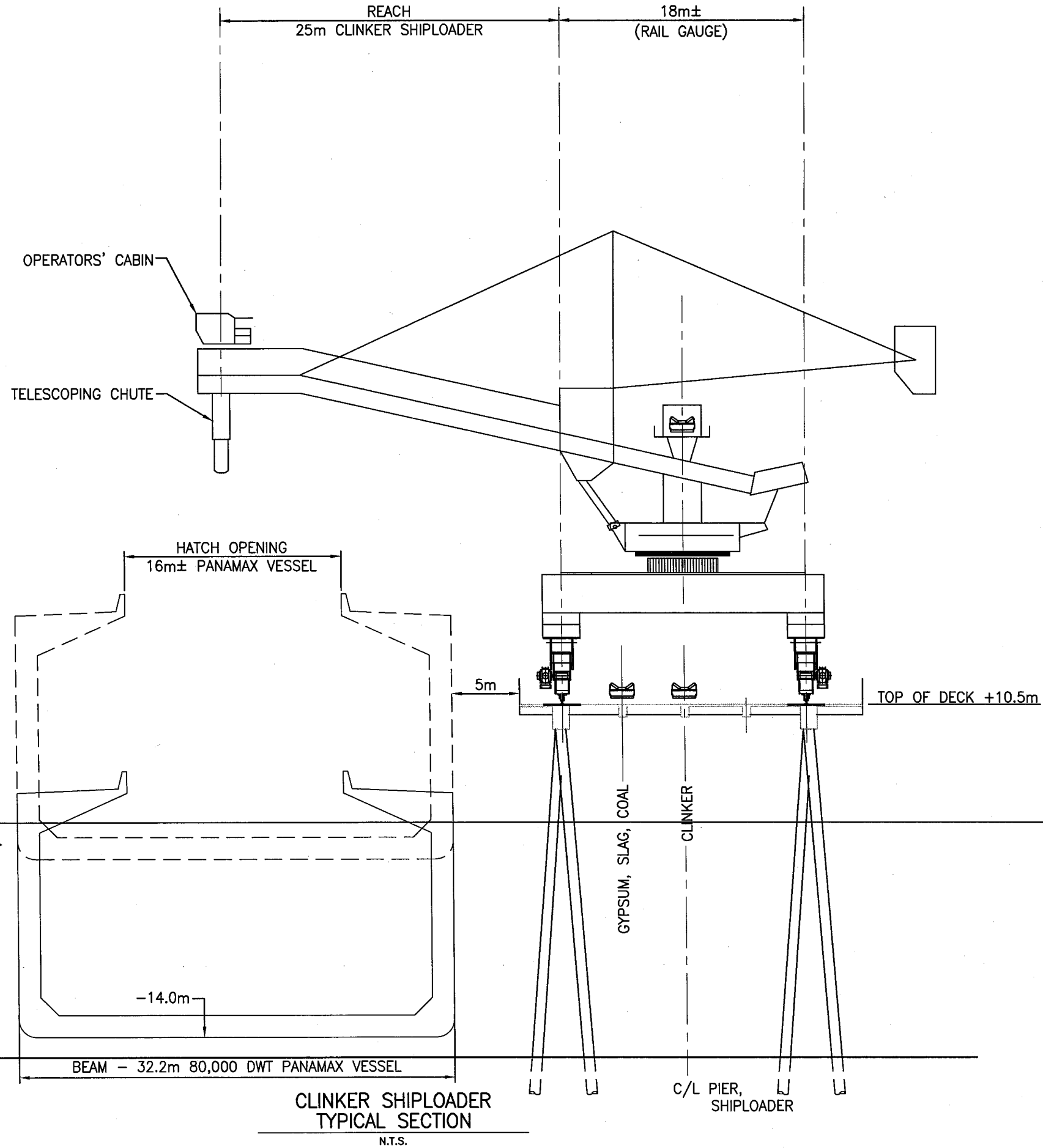
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 • (410).990.0455 fax

DATE: 05.04.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS - Cement Companies
SHIP UNLOADER SECTION

6029-001

GA-4



CLINKER SHIPLOADER
TYPICAL SECTION

N.T.S.

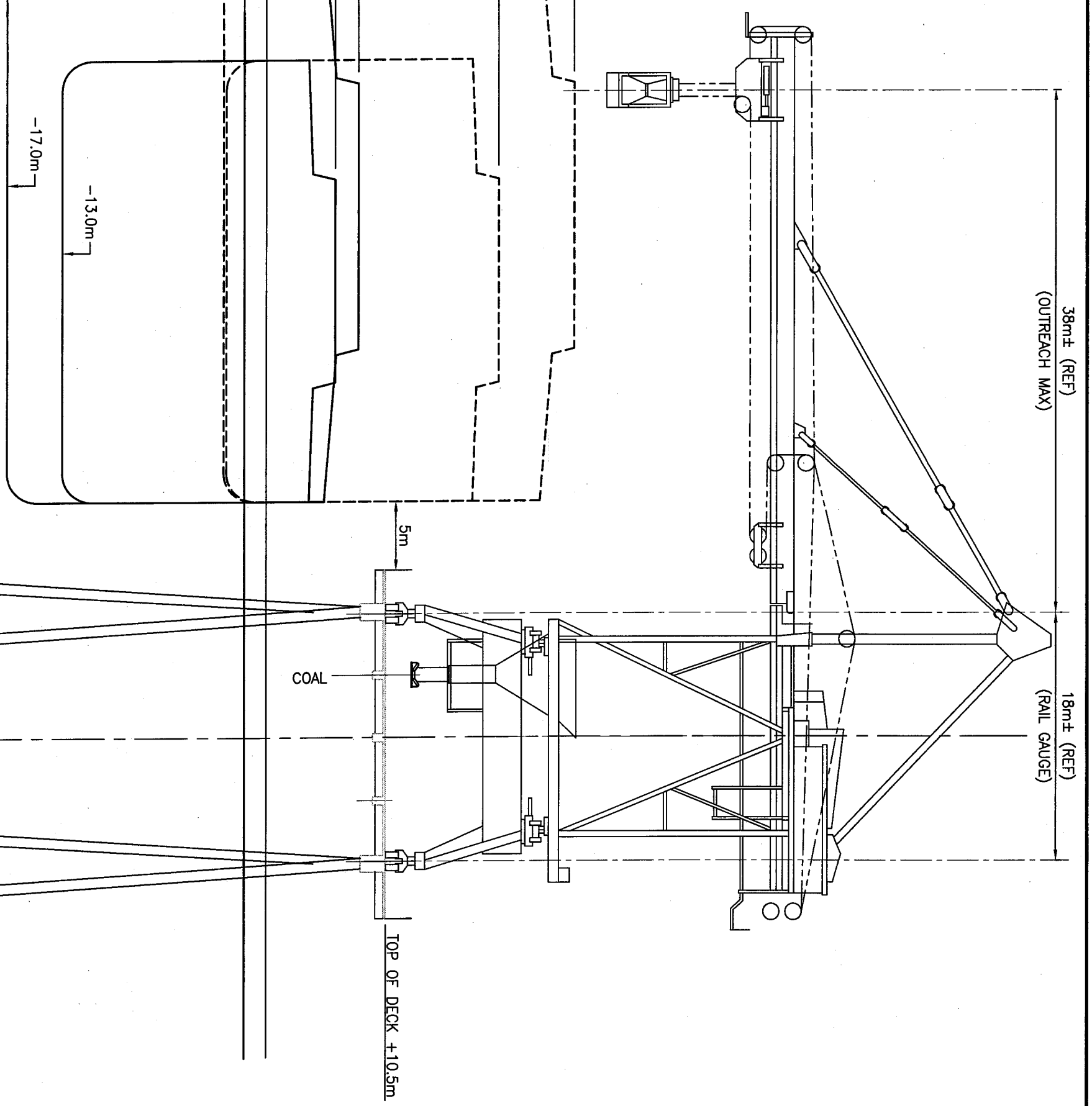
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 05.04.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS - Cement Companies
SHIP LOADER SECTION

6029-001

GA-5

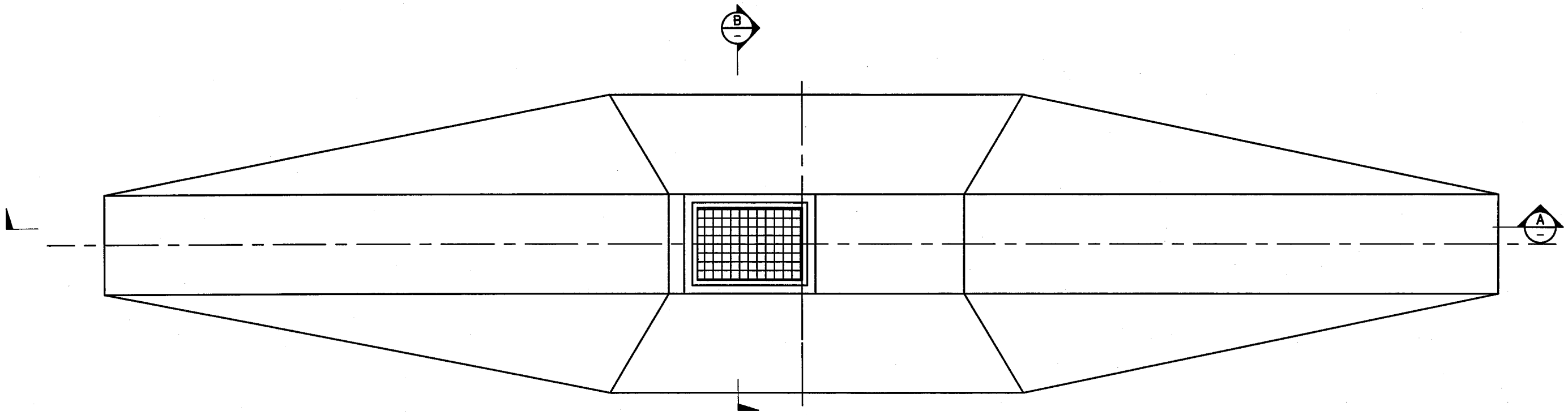


POWER PLANT
GRAB UNLOADER
TYPICAL SECTION

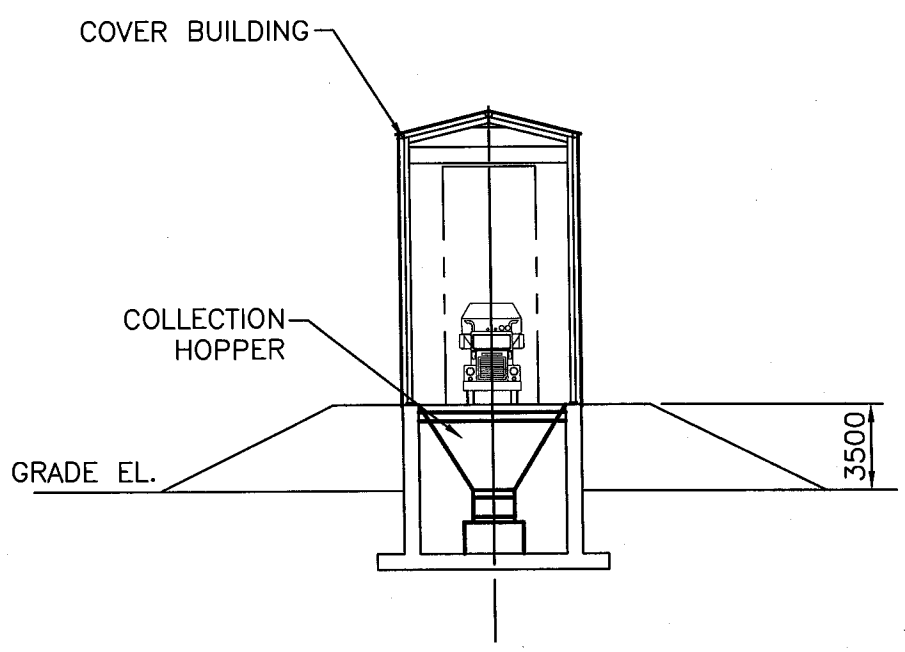
N.T.S.

6029-001 GA-6	NEW BULK PORT - BARGNY, SENEGAL CONCEPT DRAWINGS - SENELEC FUTURE SHIP UNLOADER SECTION	DATE: 05.04.07 DRAWN: GJD CHECKED: MDV	TEC inc. 619 Severn Ave, Suite 202 Annapolis, MD 21403 (410).990.0299 * (410).990.0455 fax

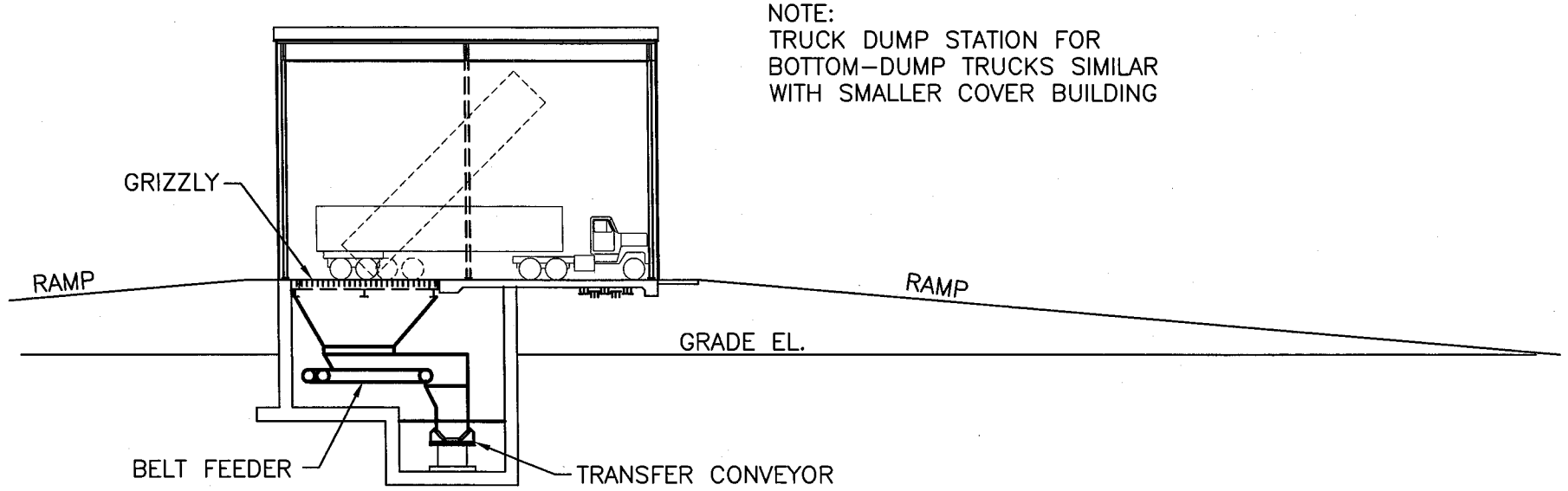
Plotted: Oct 22, 2007 – 3:29pm



PLAN
N.T.S.



B SECTION
SCALE: NTS



NOTE:
TRUCK DUMP STATION FOR BOTTOM–DUMP TRUCKS SIMILAR WITH SMALLER COVER BUILDING

A SECTION
SCALE: NTS

TYPICAL TRUCK UNLOADING STATION
N.T.S.

File: P:\6029 Senegal Port Complex\Drawings & Figures\VWA\GA-7.dwg

MOFFERSO

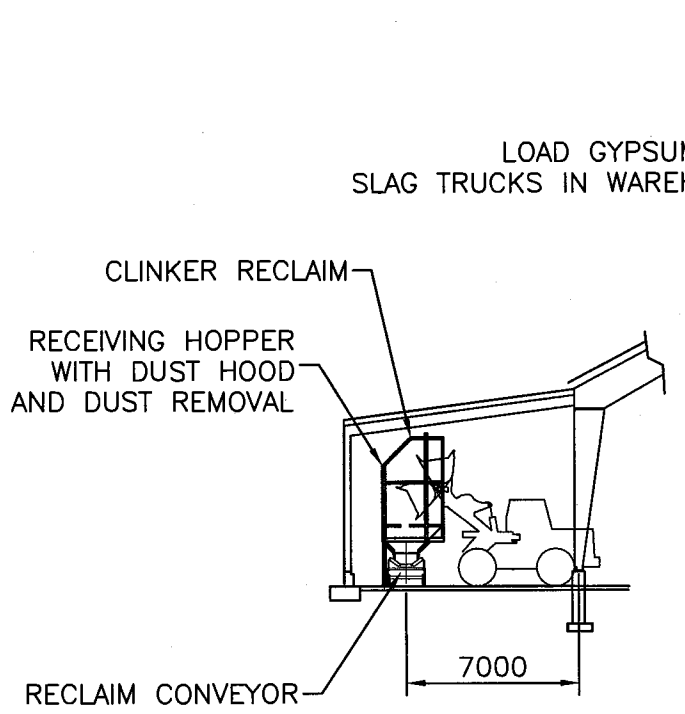
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 5/4/07
DRAWN: MEO
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS - Cement Companies
TRUCK DUMP SECTION

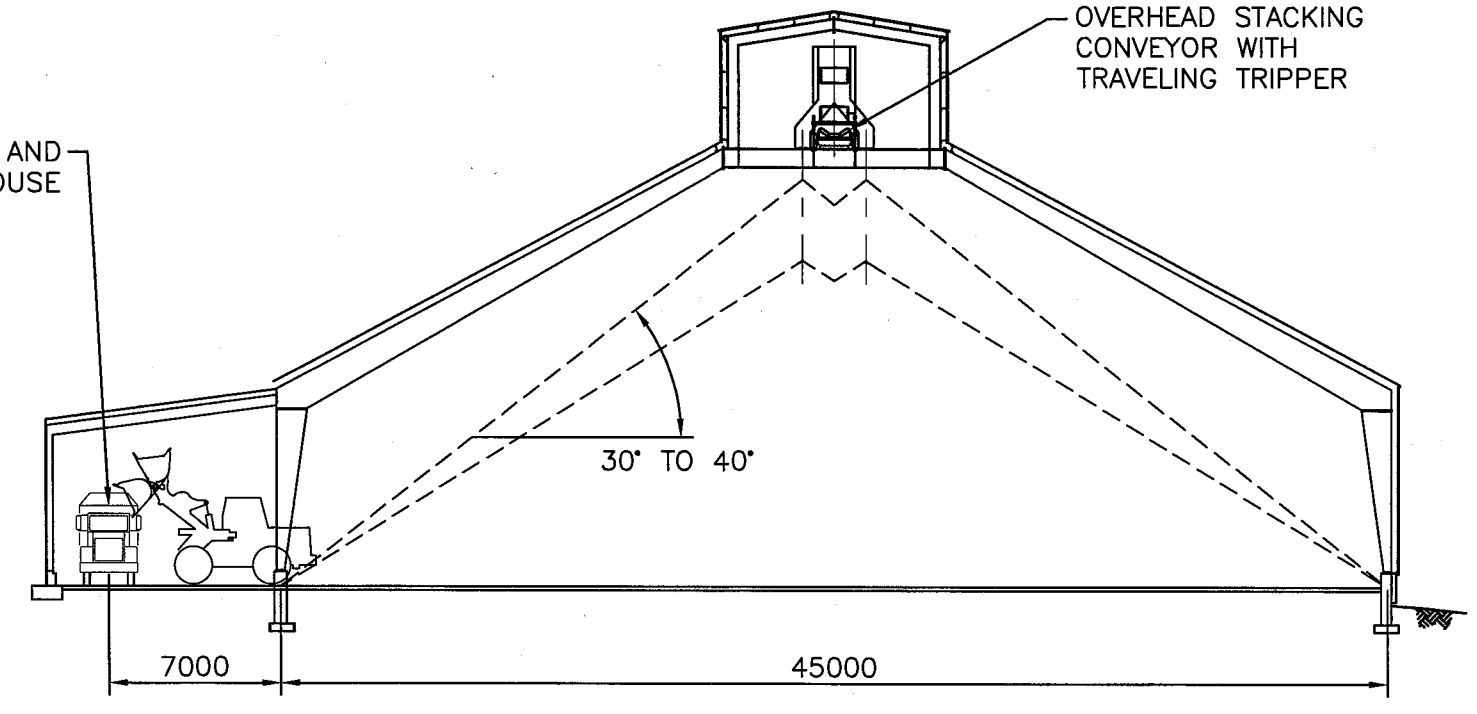
6029-001

GA-7



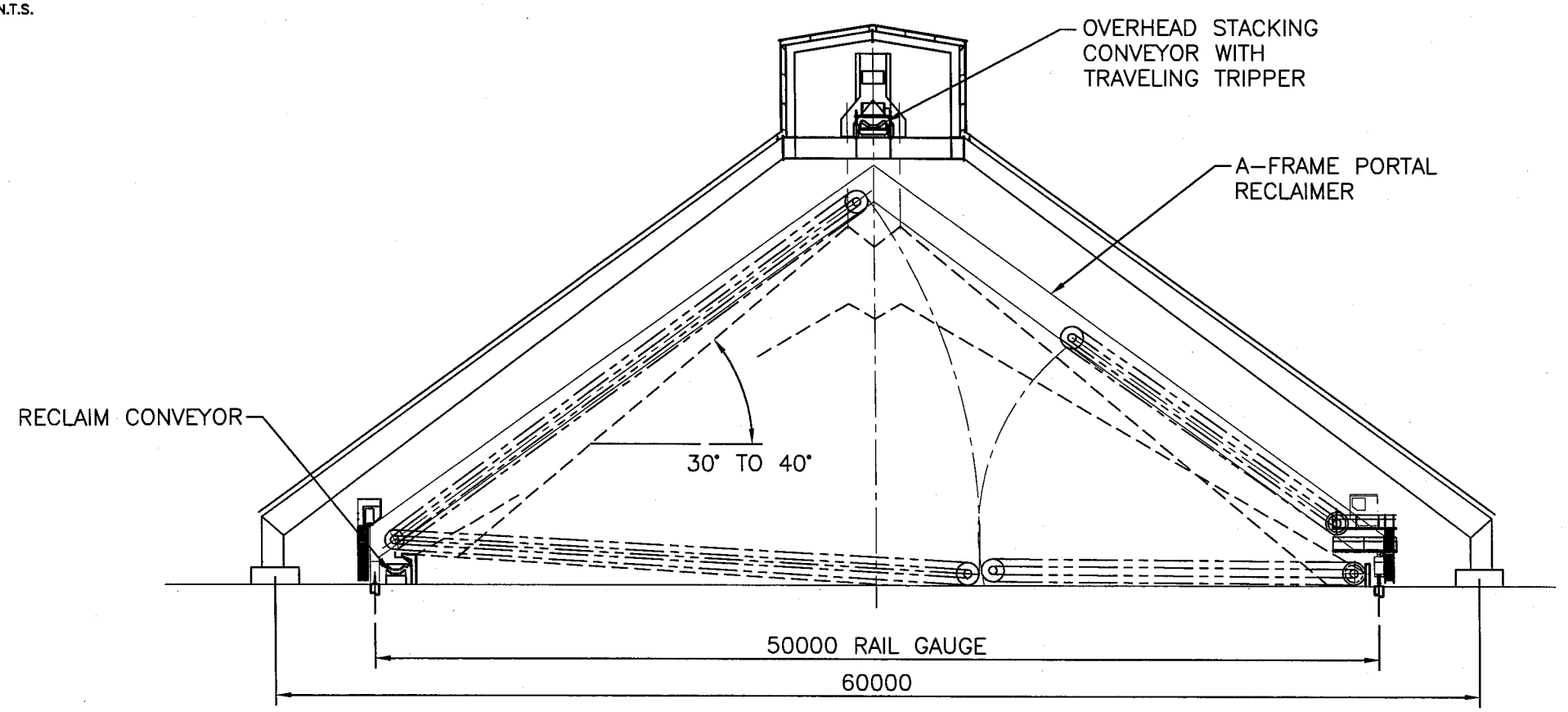
RECLAIM HOPPER WITH CONVEYOR SECTION

N.T.S.



CLINKER, GYPSUM AND SLAG WAREHOUSE SECTION

N.T.S.



ALTERNATIVE CLINKER WAREHOUSE WITH A-FRAME RECLAIMER SECTION

N.T.S.

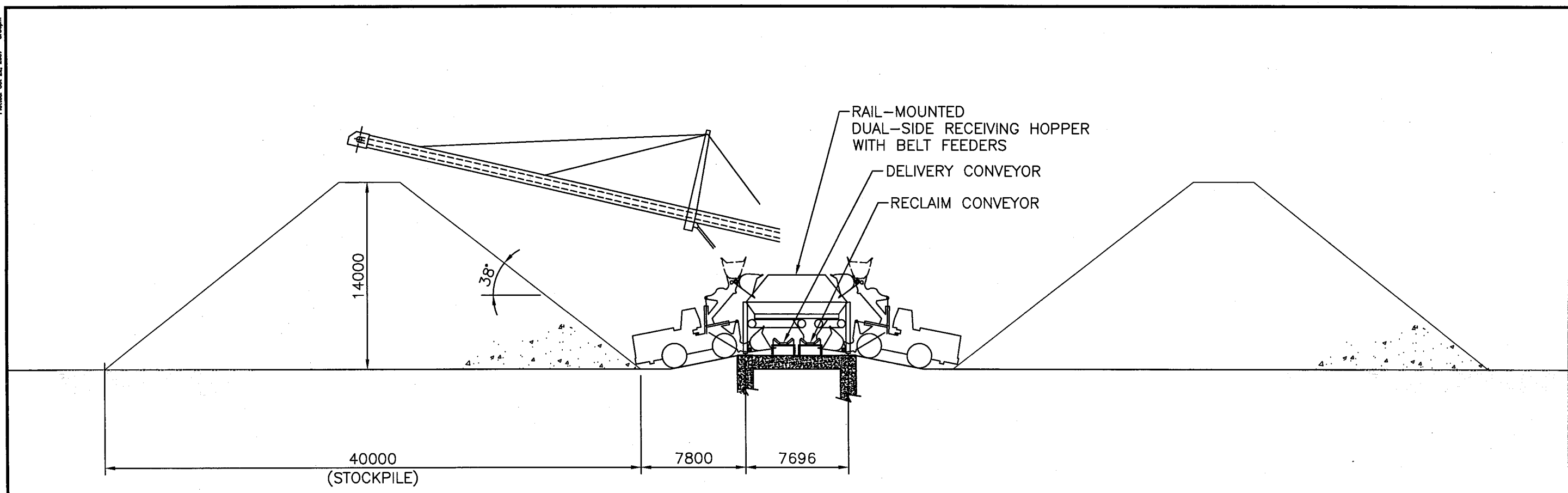
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 8/7/07
DRAWN: GJD
CHECKED: MDV

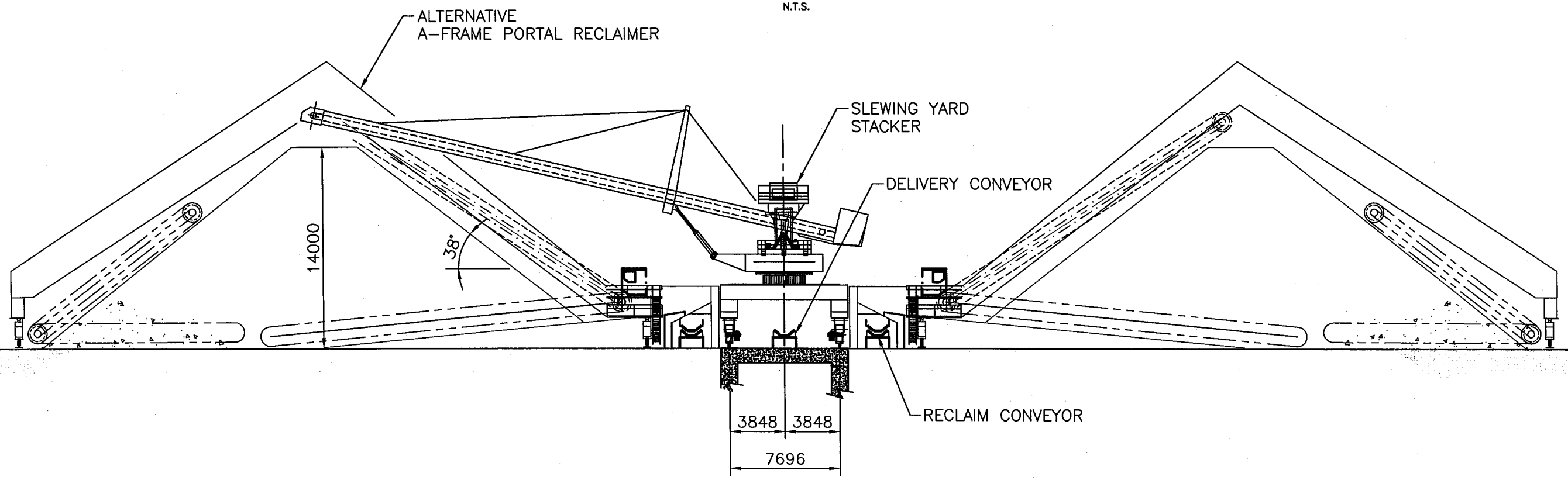
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS- Cement Companies
WAREHOUSES SECTIONS

6029-001

GA-8



COAL YARD SECTION
WHEEL LOADER RECLAIM
N.T.S.



ALTERNATIVE COAL YARD SECTION
A–FRAME RECLAIMERS OPTION
N.T.S.

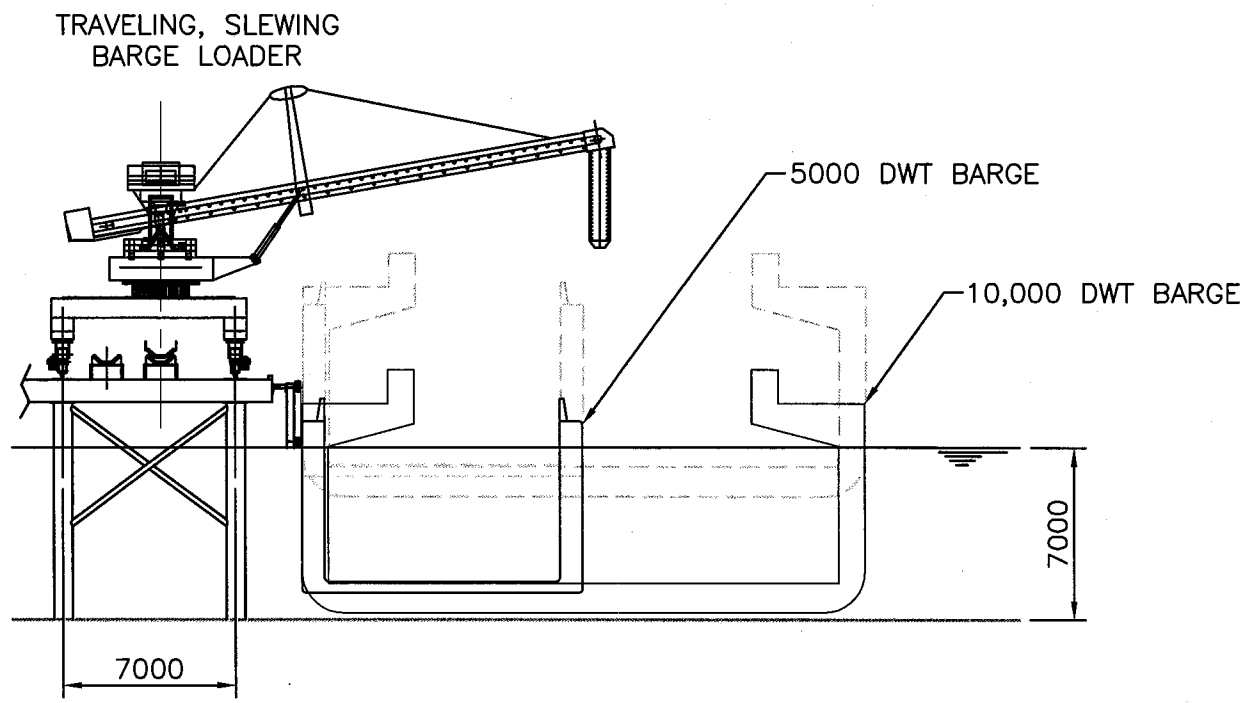
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 8/7/07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS- Cement Companies
COAL YARD STACKER SECTION

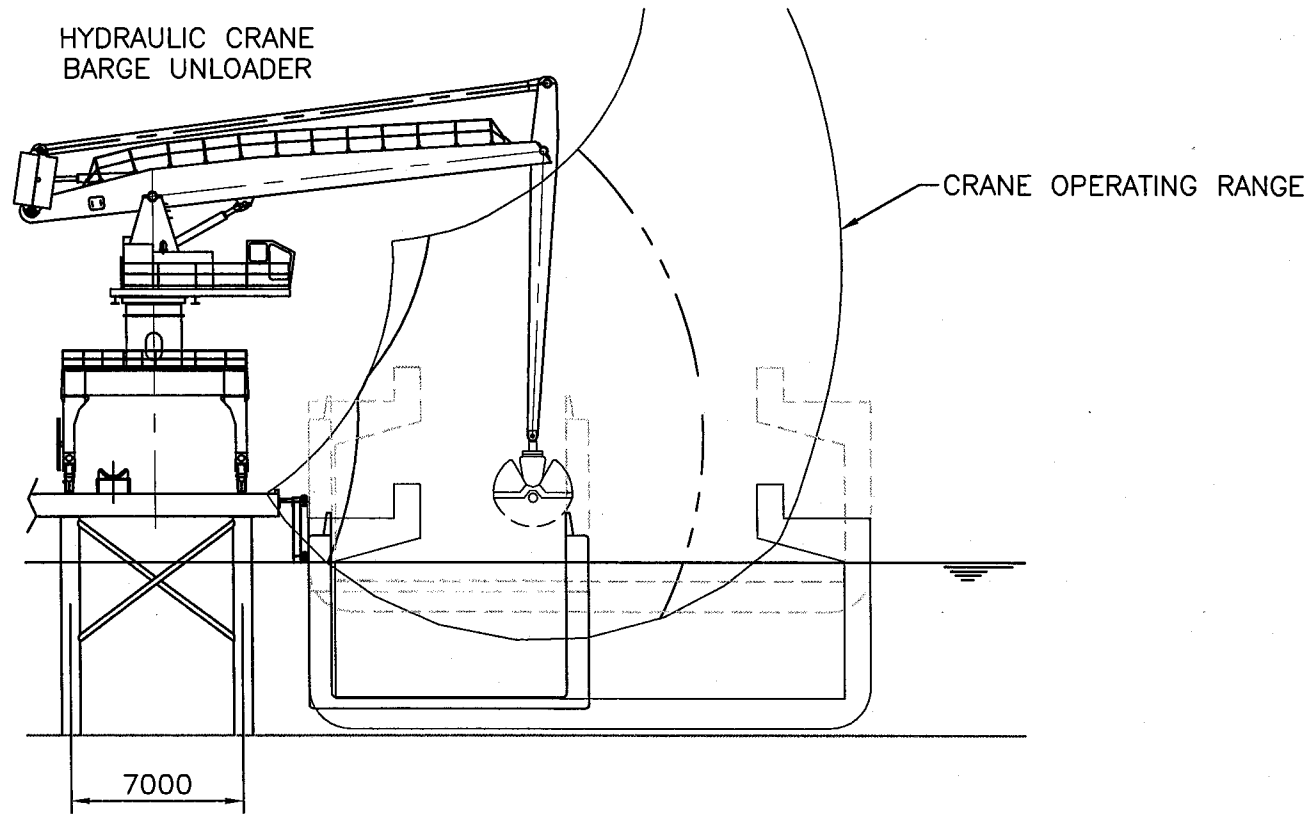
6029-001

GA-9



TYPICAL BARGE LOADER

N.T.S.



TYPICAL BARGE UNLOADER

N.T.S.

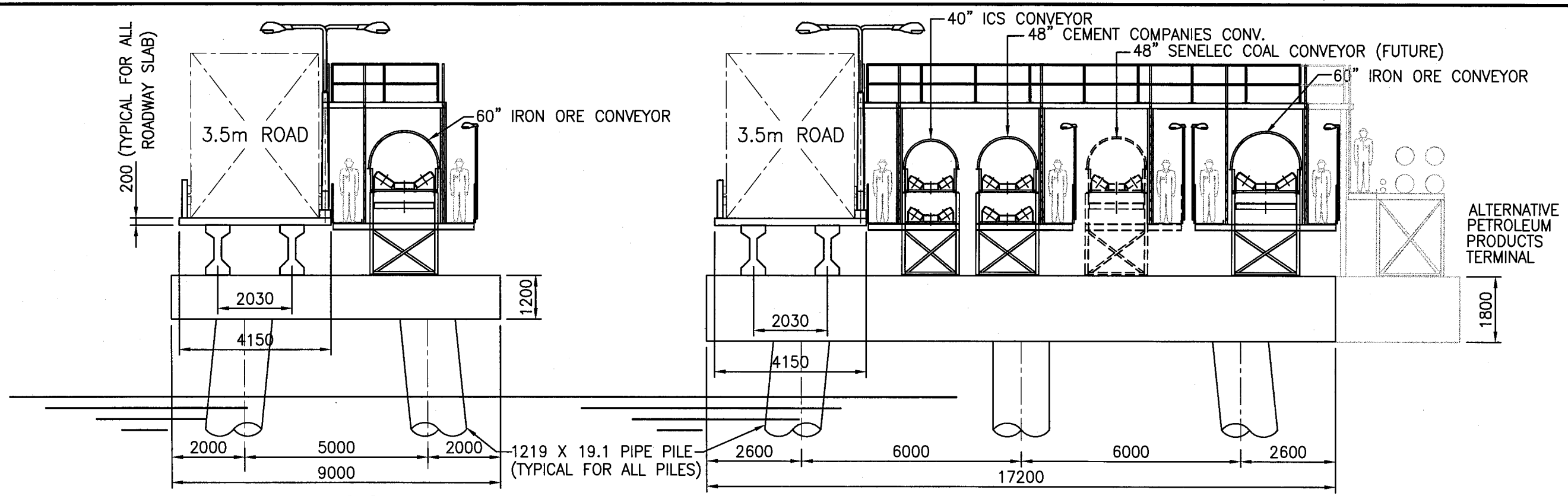
MITERSO
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 9/4/07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
BARGE LOADING AND UNLOADING ALT. 'B'

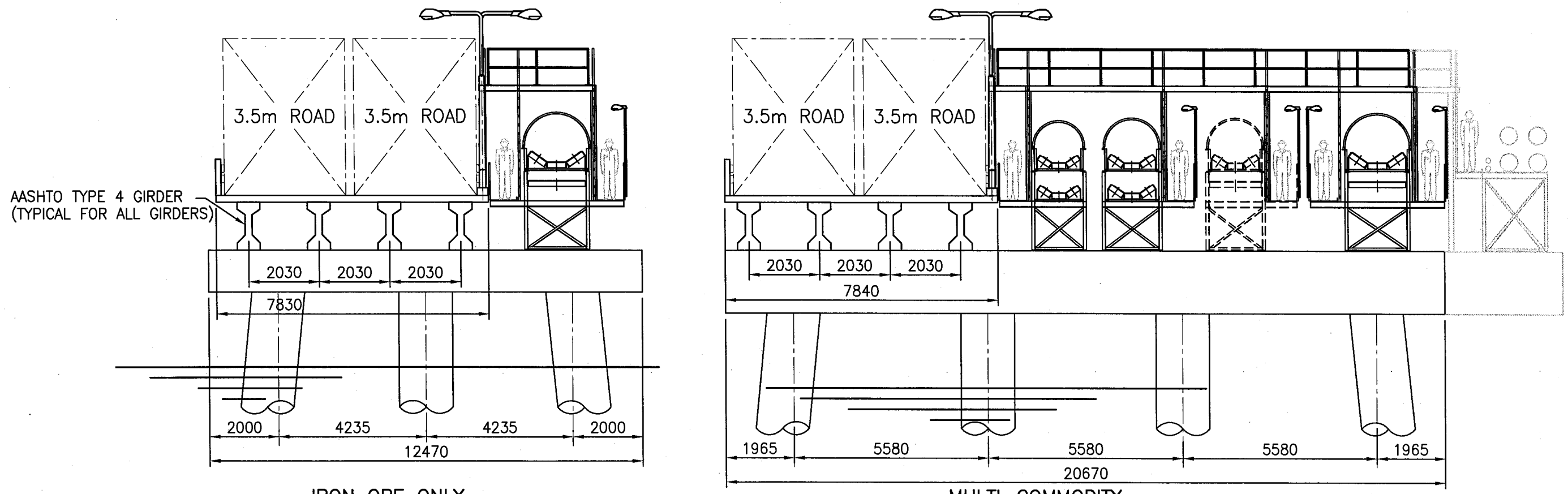
6029-001

GA-10



A1 SP-9 IRON ORE ONLY TRESTLE SECTION
SCALE: 1:120

A2 SP-9 MULTI–COMMODITY TRESTLE SECTION
SCALE: 1:120



C1 SP-9 IRON ORE ONLY TRESTLE SECTION AT BYPASS
SCALE: 1:120

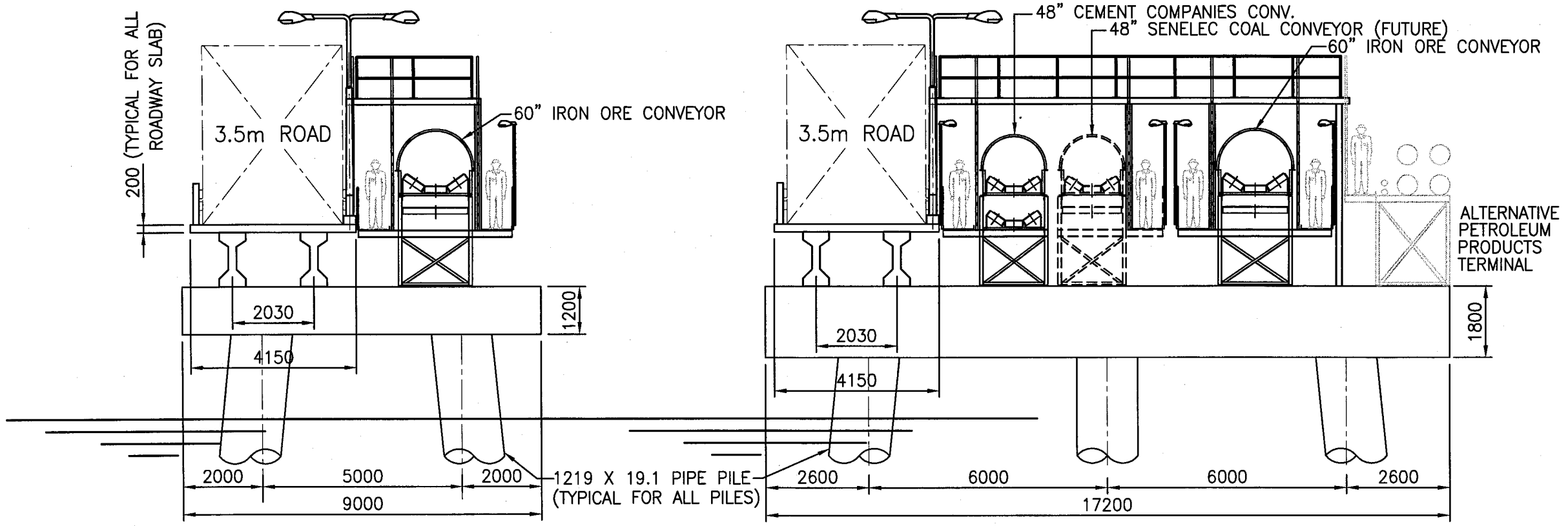
C2 SP-9 MULTI–COMMODITY TRESTLE SECTION AT BYPASS
SCALE: 1:120

MIFERSO
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 06.06.07
DRAWN: HJ
CHECKED: MDV

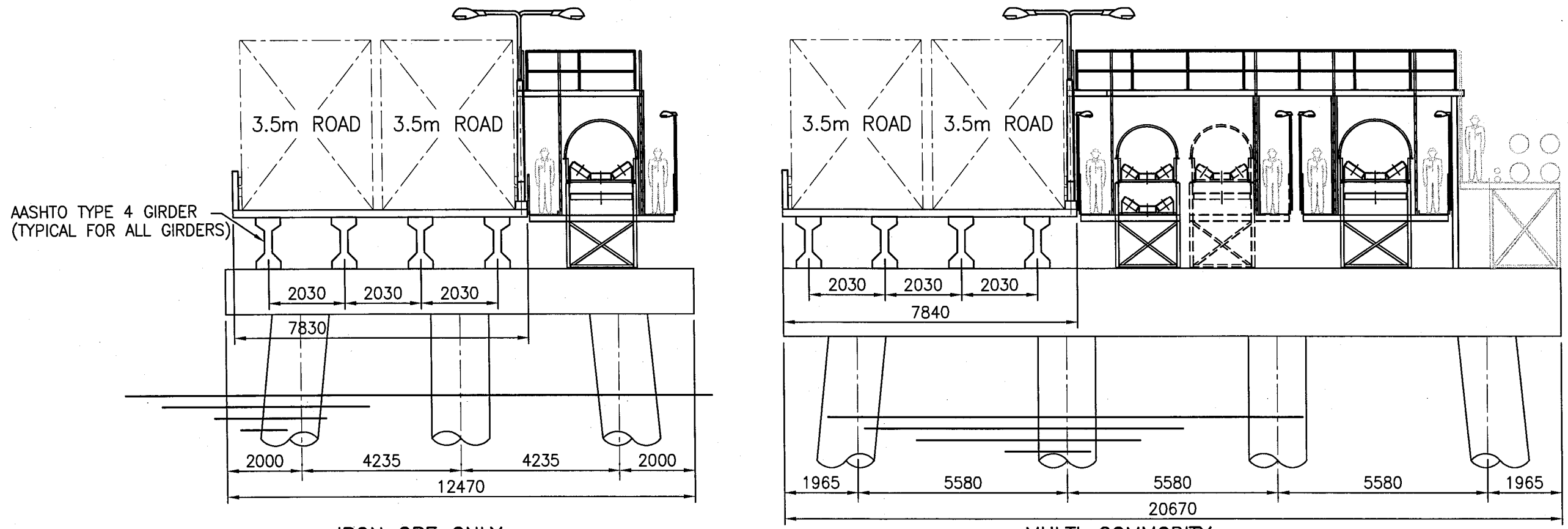
NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
TRESTLE SECTIONS - ENCLOSED CONV.

6029-001
GA-11
rev. 1



A1 SP-9 IRON ORE ONLY TRESTLE SECTION
SCALE: 1:120

A2 SP-9 MULTI–COMMODITY TRESTLE SECTION
SCALE: 1:120



C1 SP-9 IRON ORE ONLY TRESTLE SECTION AT BYPASS
SCALE: 1:120

C2 SP-9 MULTI–COMMODITY TRESTLE SECTION AT BYPASS
SCALE: 1:120

MITERSO
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 06.06.07
DRAWN: HJ
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS
TRESTLE SECTIONS - ENCLOSED CONV.

6029-001
GA-11-1

Plotted: Oct 22, 2007 - 3:39pm

REFURBISHED, EXISTING
COMBINATION SHIP
LOADER/UNLOADER
800 TPH LOADING
600 TPH UNLOADING

APRON FEEDER

B4–S1
1,000 mm
800 TPH

MAGNETIC SEPARATOR

B4–S2
1,000 mm
800 TPH

B4–S3
1,000 mm
800 TPH

B4–S4
1,000 mm
800 TPH

B4–S5
1,000 mm
800 TPH

B5–S6
1,000 mm
800 TPH

TRIPPER

DIVERTER GATE

CROSS CONVEYOR

CROSS CONVEYOR

SHIP BERTH NO. 4

20–75,000 DWT VESSELS

BELT SCALE

TRESTLE

BERTH CONVEYOR

BERTH CROSS CONVEYOR

TRESTLE CONVEYOR

SHIP UNLOADING

TRAVELING O/H TRIPPER

B4–U1

1,000 mm
800 TPH

SAMPLING STATION

S

RETRACTABLE LOADING SPOUT

20,000T
AMM. SULF. (ICS)

20,000T
POTASH (ICS)

20,000T
UREA (ICS)

WHEEL LOADER RECLAIM

FLOW CONTROL GATE

MOBILE HOPPER

B4–U2

1,000 mm
800 TPH

TRAVEL

IMPORT UREA, PA, AS STORAGE BUILDING

B4–U3
1,000 mm
800 TPH

B4–S9
1,000 mm
800 TPH

B4–S8
1,000 mm
800 TPH

SURGE BIN

BELT SCALE

TRAVELING O/H TRIPPER

B4–S7
1,000 mm
800 TPH

SAMPLING STATION

S

RETRACTABLE LOADING SPOUT

75,000T
SULFUR (ICS)

ALTERNATIVE A–FRAME
PORTAL RECLAIMER 800TPH

HOPPER

BELT FEEDER

HOPPER

BELT FEEDER

RAILCAR LOADING STATION

IMPORT SULFUR STORAGE BUILDING

ICS IMPORTS FLOW DIAGRAM

N.T.S.

File: P:\6029 Senegal Port Complex\Drawings & Figures\FINAL\FD-1.dwg

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 05.04.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS- ICS
UREA/SULFUR IMPORTS FLOW DIAGRAM

6029-001

FD-1

Plotted: Oct 22, 2007 - 3:31pm

ALTERNATIVE ATTAPULGITE TRUCK UNLOADING

ALTERNATIVE FERTILIZER TRUCK UNLOADING

ALTERNATIVE CONVEYOR 800 mm ⌀ 400 TPH

ALTERNATIVE CONVEYOR 800 mm ⌀ 400 TPH

FUTURE CONVEYOR 800 mm ⌀ 400 TPH

BELT SCALE

BELT SCALE

ALTERNATIVE TRAVELING TRIPPER

ALTERNATIVE CONVEYOR 800 mm ⌀ 400 TPH

UNLOAD TRUCKS DIRECTLY IN WAREHOUSE

45,000T FERTILIZER ICS

WHEEL LOADER RECLAIM

ALTERNATIVE TRAVELING TRIPPER

ALTERNATIVE CONVEYOR 800 mm ⌀ 400 TPH

UNLOAD TRUCKS DIRECTLY IN WAREHOUSE

20,000T ATTAPULGITE (SSPT)

ALTERNATIVE TRAVELING TRIPPER

ALTERNATIVE CONVEYOR 800 mm ⌀ 400 TPH

UNLOAD TRUCKS DIRECTLY IN WAREHOUSE

20,000T ATTAPULGITE (SENEGAL MINES)

1,000 mm ⌀ 800 TPH B4-A1

1,000 mm ⌀ 800 TPH B4-A2

1,000 mm ⌀ 800 TPH B4-F1

REFURBISHED, EXISTING COMBINATION SHIP LOADER/UNLOADER 800 TPH LOADING 600 TPH UNLOADING

LUFFING

1,000 mm ⌀ 800 TPH

RETRACTABLE LOADING SPOUT

TRAVELING TRIPPER

1,000 mm ⌀ 800 TPH B4-F7

B4-F6

OVERLAND CONVEYOR 1,000 mm ⌀ 800 TPH B4-F5

B4-F4 1,000 mm ⌀ 800 TPH

B4-F3 1,000 mm ⌀ 800 TPH

1,000 mm ⌀ 800 TPH B4-F2

SHIPLOADING BERTH #4

TRESTLE

20-80,000 DWT VESSELS

SHIP LOADING

FERTILIZER/ATTAPULGITE FLOW DIAGRAM

N.T.S.

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

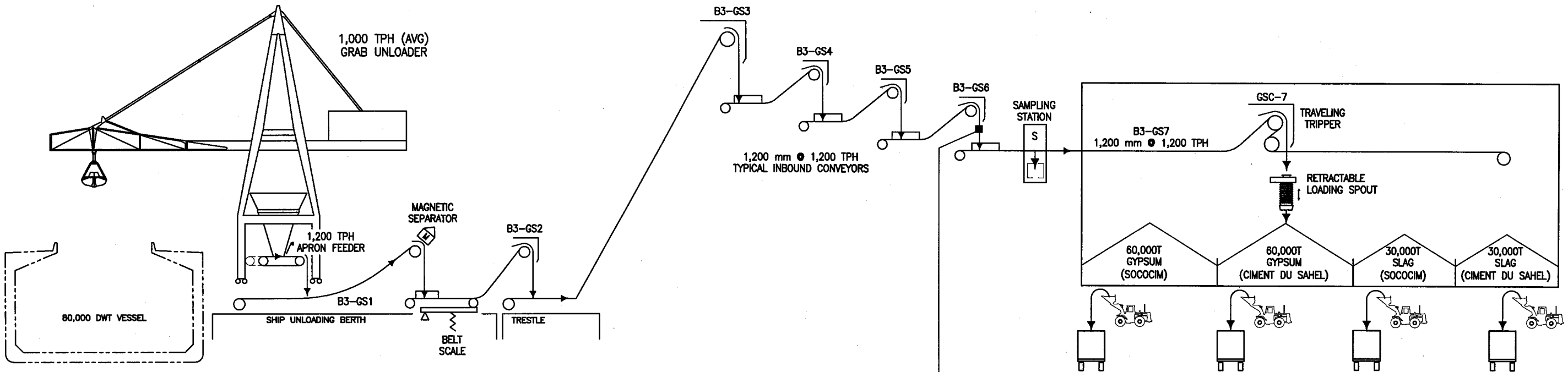
DATE: 05.04.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS - ICS
FERTILIZER/ATTAPULGITE FLOW DIAGRAM

6029-001

FD-2

File: P:\6029 Senegal Port Complex\Drawings & Figures\FINAL\FD-2.dwg



SHIP UNLOADING

IMPORT GYPSUM AND SLAG STORAGE BUILDING AND TRUCK LOADING

TRUCK LOADING

COAL YARD "A"

COAL YARD "B"
(FUTURE)

FUTURE RAIL LOADING

FLOW DIAGRAM
N.T.S.

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 05.04.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS- Cement Companies
COAL/GYPSUM/SLAG IMPORTS FLOW DIAGRAM

6029-001
FD-3

Plotted: Oct 22, 2007 - 3:32pm

DUST COLLECTOR FAN
DUST COLLECTOR
AIRLOCK
DUST
DUST
DUST
B3–CL1A
800 mm
600 TPH
B3–CL1B
800 mm
600 TPH
B3–CL2
800 mm
600 TPH
BELT SCALE
DUST
DIVERTER
REVERSIBLE SHUTTLE
B3–CL3
800 mm 600 TPH
TRAVEL
FILTER MODULE
DUST COLLECTION
RETRACTABLE
LOADING
SPOUT
ALTERNATIVE A–FRAME
PORTAL RECLAIMER
1000TPH
120,000T
CLINKER
120,000T
CLINKER
PORTABLE RECLAIM
HOPPERS WITH FEEDERS
AND DUST COLLECTION
(DUST SYSTEM NOT SHOWN
FOR CLARITY)
B3–CL4
1,200 mm 1,000 TPH
SAMPLING
STATION
S
BELT SCALE
B3–CL5
1,200 mm
1,000 TPH
LAND
B3–CL6
1,200 mm
1,000 TPH
LAND
B3–CL6A
1,200 mm
1,000 TPH
TRESTLE CONVEYOR
B3–CL7
1,200 mm
1,000 TPH
B3–CL8
1,200 mm
1,000 TPH
SURGE BIN
CONTROL GATE
B3–CL9
B3–CL9
1,200 mm
1,000 TPH
SHIPLOADER
1,200TPH
(SLEWING BOOM STYLE)
FLEXIBLE DUCT
SHIP LOADER
1,200 TPH
1,200 mm 1,000 TPH
LUFFING
RETRACTABLE
LOADING SPOUT
BERTH No.3
TRESTLE
35–80,000 DWT
CLINKER SHIP

TRUCK UNLOADING

SHIPLOADING

SOCOCIM/CIMENT DU SAHEL FLOW DIAGRAM

N.T.S.

File: P:\6029 Senegal Port Complex\Drawings & Figures\FINAL\FD-4.dwg

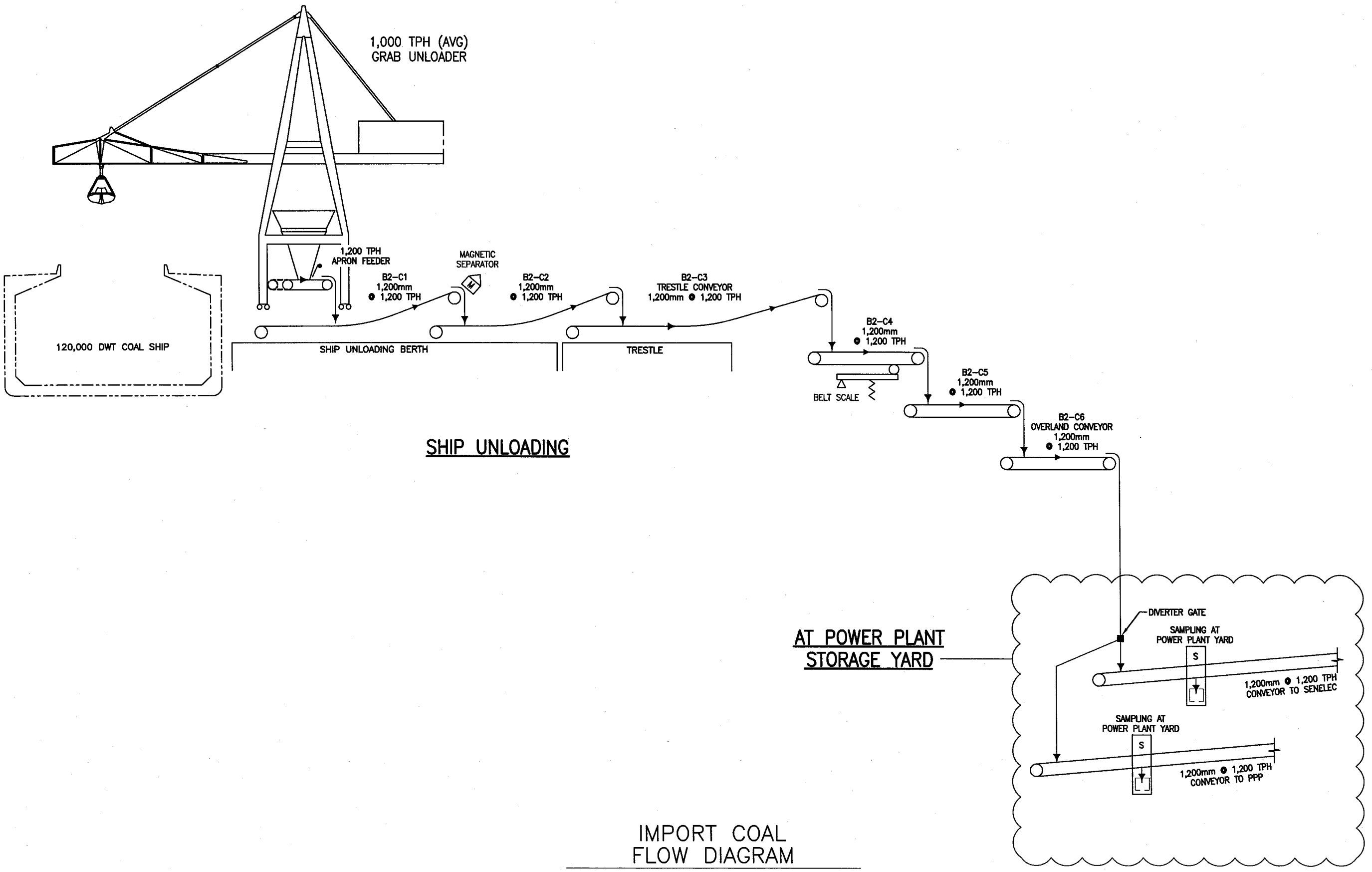
TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 05.04.07
DRAWN: GJD
CHECKED: MDV

NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS- Cement Companies
SOCOCIM/CIMENT DU SAHEL FLOW DIAGRAM

6029-001

FD-4



SHIP UNLOADING

IMPORT COAL FLOW DIAGRAM

N.T.S.

MITERSO
Societe des Mines de Fer du Senegal Oriental

TEC inc.
619 Severn Ave, Suite 202
Annapolis, MD 21403
(410).990.0299 * (410).990.0455 fax

DATE: 05.04.07
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NEW BULK PORT - BARGNY, SENEGAL
CONCEPT DRAWINGS- POWER PLANT
SENELEC/PPP IMPORT COAL FLOW DIAGRAM

6029-001

FD-5