REPORT NO. CG-D-75-77

LEVEL II

# COST EFFECTIVENESS STUDY OF WASTEWATER MANAGEMENT SYSTEMS FOR SELECTED U.S. COAST GUARD VESSELS

## Volume III - Installation Analysis

## Part 5 - WHITE SAGE (133')

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February 1977

FINAL REPORT





PREPARED FOR

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**16. Abstract**

Each of the 18 candidate Wastewater Management System (WMS) configurations developed in Volume IV was analyzed for installation aboard the WHITE SAGE (WLM - 544). The following information was developed: vessel conditions including locations of black water (sewage and garbage grinder slurry) and gray water (galley and turbid) waste sources, vessel/resources capacities and estimated usage rates, determination of viable candidate systems based on installation guidelines and assumptions developed in Volume IV, black and gray wastewater (or sludge) holding tank capacities which can be fitted, installation cost estimates for each viable candidate system, arrangement drawings for WMS equipment and waste sources, installation related effectiveness attribute data.

The analysis was performed in three stages. A preliminary installation analysis was made on the basis of vessel plans available. This was followed by a shipcheck of the vessel to determine the viable candidate systems and obtain required vessel data. The final step consisted of a more detailed analysis of each viable candidate system to develop installation cost estimates and other required installation related information including arrangement drawings and effectiveness attribute data. Cost estimates were developed using a form which analyzes each viable candidate system in terms of standard installation cost elements, each of which has an assumed unit cost.

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For

U.S. Dept. of Transportation
U.S. Coast Guard
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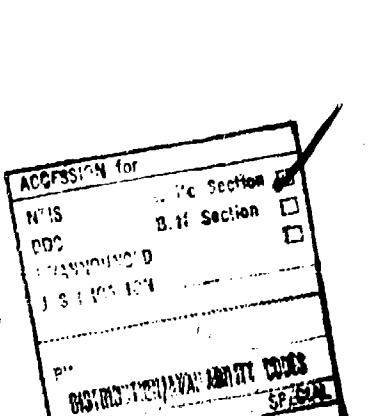
This study was conducted under the technical direction of Mr. Thomas S. Scarano of the Office of Research and Development, U.S. Coast Guard. Mr. Scarano and Lt. Ed Magsig of the Office of Engineering made available the vessel plans and provided valuable assistance in the formulation of the guidelines and assumptions governing this installation analysis.

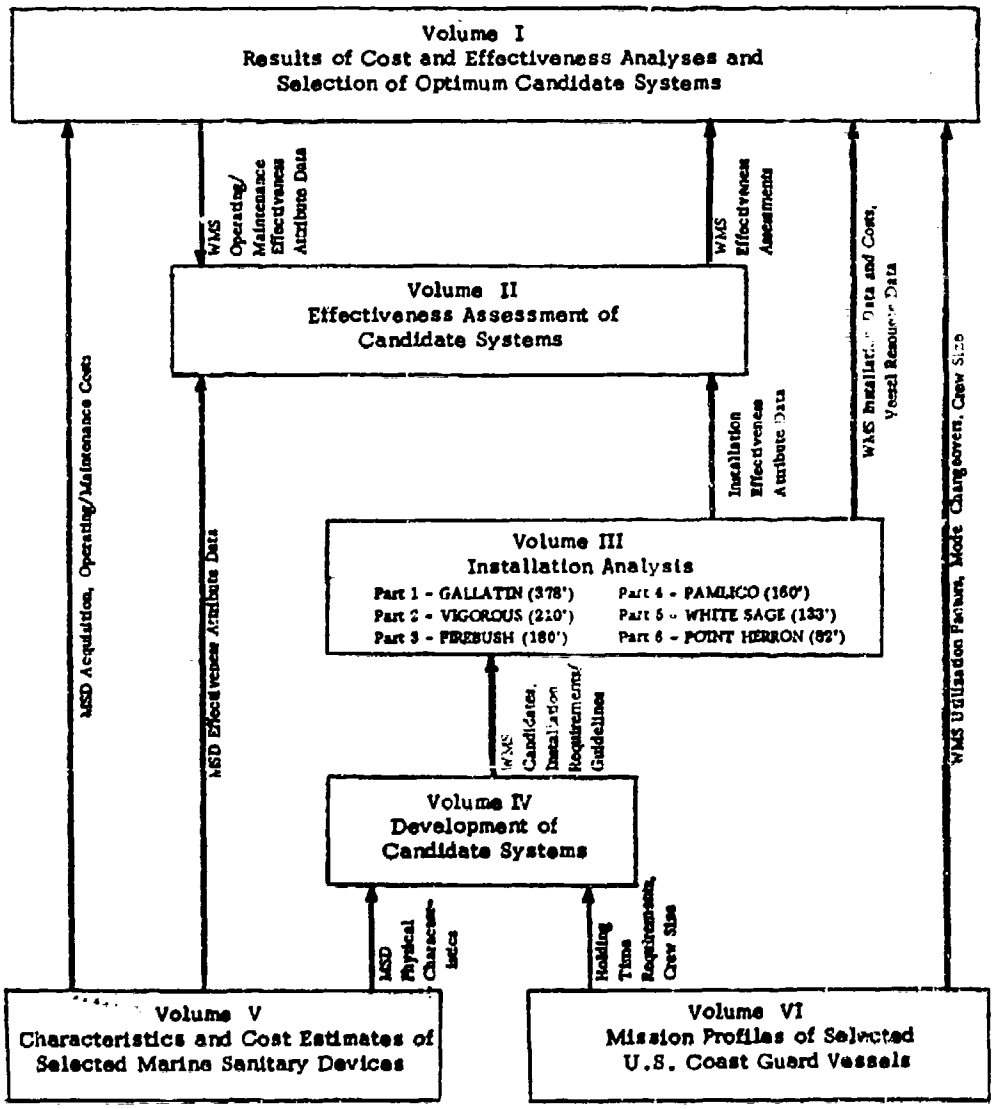
The installation analysis was performed in consultation with George G. Sharp, Inc., 100 Church Street, New York, N.Y. 10007.

The cooperation and assistance of the officers of U.S. Coast Guard Cutter WHITE SAGE (WLM-544) in scheduling the shipcheck and providing the requested vessel data is greatly appreciated.

# PREFACE

The relationship among the volumes of the report is depicted below. This relationship does not convey all the information contained within each volume.



## SUMMARY OF WMS INSTALLATION COSTS

### Vessel: WHITE SAGE (133')

| WMS No. | TYPE: Coll/Trans Subsys (Black) | TYPE: Treatment/Disposal Subsystem: Black | TYPE: Treatment/Disposal Subsystem: Gray | Holding Capacity: Black (%) | Holding Capacity: Gray (%) | INSTALLATION COST ($) |
|---|---|---|---|---|---|---|
| 1 | Gravity Collect. | Holding Tank | Holding Tank | 100 | 100 | 13,190 |
| 2 | Oil Recircul. (Chrysler) | Chrysler + Hld Tnk | Holding Tank | 100 | 100 | 13,800 |
| 3 | | Chrysler + Incin. | Holding Tank | 100 | 100 | 16,800 |
| 4 | Gravity Collect. (Grumman) | Grum Flow Thru+HldTk | Holding Tank | 100 | 100 | 17,000 |
| 5 | | Grumman Flow Thru + Holding Tank | | 100 | 100 | 12,890 |
| 6 | Gravity Collect. | Holding Tank | Grum Flow Thru+HldTnk | 100 | 100 | 15,460 |
| 7 | Gravity Collect. (Grumman) | Grum Flow Thru+Incin. | Holding Tank | 100 | 100 | 23,080 |
| 8 | | Grumman Flow Thru + Incinerator | | 100 | 100 | 13,100 |
| 9 | Vacuum Collect. (Jered) | Holding Tank | Holding Tank | 100 | 100 | 12,730 |
| 10 | | Incinerator | Holding Tank | 100 | 100 | 16,300 |
| 11 | | GATX Evap. | Holding Tank | 100 | 100 | 12,220 |
| 12 | | Holding Tank | Grum Flow Thru+Hld Tnk | 100 | 100 | 10,600 |
| 13 | | Incinerator | Grum Flow Thru + Incin. | 100 | 100 | 13,640 |
| 14 | M/T Pump Collect. (GATX) | Holding Tank | Holding Tank | 100 | 100 | 11,990 |
| 15 | | Incinerator | Holding Tank | 100 | 100 | 15,790 |
| 16 | | GATX Evap. | Holding Tank | 100 | 100 | 10,930 |
| 17 | | Holding Tank | Grum Flow Thru+Hld Tnk | 100 | 100 | 10,970 |
| 18 | | Incinerator | Grum Flow Thru + Incin. | 100 | 100 | 15,640 |

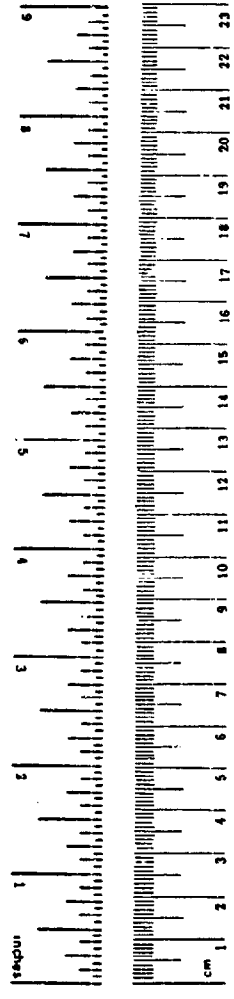
N/A - Not a viable candidate system for this vessel.

# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

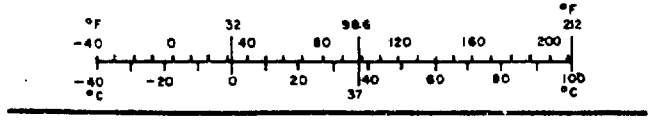
| Symbol | When You Know | Multiply by | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | *2.5 | centimeters | cm |
| ft | feet | 30 | centimeters | cm |
| yd | yards | 0.9 | meters | m |
| mi | miles | 1.6 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 6.5 | square centimeters | $cm^2$ |
| $ft^2$ | square feet | 0.09 | square meters | $m^2$ |
| $yd^2$ | square yards | 0.8 | square meters | $m^2$ |
| $mi^2$ | square miles | 2.6 | square kilometers | $km^2$ |
| | acres | 0.4 | hectares | ha |
| | | **MASS (weight)** | | |
| oz | ounces | 28 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
| | short tons (2000 lb) | 0.9 | tonnes | t |
| | | **VOLUME** | | |
| tsp | teaspoons | 5 | milliliters | ml |
| Tbsp | tablespoons | 15 | milliliters | ml |
| fl oz | fluid ounces | 30 | milliliters | ml |
| c | cups | 0.24 | liters | l |
| pt | pints | 0.47 | liters | l |
| qt | quarts | 0.95 | liters | l |
| gal | gallons | 3.8 | liters | l |
| $ft^3$ | cubic feet | 0.03 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.76 | cubic meters | $m^3$ |
| | | **TEMPERATURE (exact)** | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.




## Approximate Conversions from Metric Measures

| Symbol | When You Know | Multiply by | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.04 | inches | in |
| cm | centimeters | 0.4 | inches | in |
| m | meters | 3.3 | feet | ft |
| m | meters | 1.1 | yards | yd |
| km | kilometers | 0.6 | miles | mi |
| | | **AREA** | | |
| $cm^2$ | square centimeters | 0.16 | square inches | $in^2$ |
| $m^2$ | square meters | 1.2 | square yards | $yd^2$ |
| $km^2$ | square kilometers | 0.4 | square miles | $mi^2$ |
| ha | hectares (10,000 $m^2$) | 2.5 | acres | |
| | | **MASS (weight)** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.2 | pounds | lb |
| t | tonnes (1000 kg) | 1.1 | short tons | |
| | | **VOLUME** | | |
| ml | milliliters | 0.03 | fluid ounces | fl oz |
| l | liters | 2.1 | pints | pt |
| l | liters | 1.06 | quarts | qt |
| l | liters | 0.26 | gallons | gal |
| $m^3$ | cubic meters | 35 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.3 | cubic yards | $yd^3$ |
| | | **TEMPERATURE (exact)** | | |
| °C | Celsius temperature | 9/5 (then add 32) | Fahrenheit temperature | °F |



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# INTRODUCTION

## OBJECTIVES

The objectives of the installation analysis are as follows:

- Development of pertinent vessel information necessary for the cost and effectiveness analyses, including the following:
  - .. Existing physical conditions aboard the vessel, especially in compartments where wastewater management system equipments may be installed.
  - .. Existing wastewater management equipments/systems aboard the vessel (holding tanks, garbage grinders, sewage treatment systems, etc.).
  - .. Location of black and gray wastewater sources aboard the vessel.
  - .. Vessel resource capacities and estimated usage rates (prior to system installation).
- Selection of the viable candidate systems as determined on the basis of the feasibility of installation, using the governing installation guidelines and assumptions.
- Determination of the black/gray wastewater (or sludge) holding tank capacities which can be fitted.
- Development of installation cost estimates for each viable candidate system.
- Development of drawings showing the proposed arrangement of the wastewater management system equipments for each viable candidate as well as the arrangement of the black and gray wastewater sources on board the vessel.
- Development of installation related effectiveness attribute data.

## ASSUMPTIONS

The pertinent assumptions and guidelines governing the installation analysis are presented in Volume IV of this report, along with the details of each of the 18 candidate wastewater management system concepts in configurations suitable for each vessel included in this study.

## APPROACH

The installation analysis was performed in three stages consisting of a preliminary installation analysis, a shipcheck to establish viable system/vessel combinations, and an installation cost analysis all of which are discussed below. Prior to this analysis, visits were made to a number of vessels to inspect installations of the wastewater management subsystems and equipments included in this study.

### Preliminary Installation Analysis

The candidate ship's general arrangement drawings and piping diagrams as furnished by the U.S. Coast Guard were reviewed at length to determine existing conditions so that the WMS requirements delineated in Volume IV could be applied to the vessel and a preliminary installation analysis made prior to an actual visit to the ship. This approach was intended to maximize familiarity with the vessel and to determine any possible questionable areas of interest. Each system was investigated as to space requirements, possible equipment locations, relationship to ship's functions (operation, mission, fuel stowage, water capacity, support systems, etc.) and its relationship to the reportedly existing waste disposal system.

In order to obtain as accurate a picture as possible, arrangement drawings to scale were made from the ship's plans of the possible installation spaces and "dummy cut-outs" of WMS equipment (also to scale) were used to determine if a proposed arrangement was feasible and if any problems could be anticipated. The results of the preliminary installation analysis are presented in Appendix A.

### Shipchecks To Determine Viable Candidate Systems

Upon completion of the preliminary installation analysis, a detailed shipcheck of the vessel was made. During this visit various factors bearing on the investigation were considered, e.g., support systems (compressed air, sanitary flushing medium, electrical power generation, salt water systems, fresh water systems, fuel oil systems, etc.), correlation between actual ship arrangement and that shown in ship's drawings furnished for the study, relationship of other ship's systems and equipment to the location

and installation of WMS components to determine interferences and relocations, access for shipping WMS equipment aboard, removals, relocations, etc. The drawings prepared during the preliminary installation study were checked out and modified to reflect actual shipboard conditions.

The discussion of the shipcheck results presents a verbal picture of what conditions actually exist aboard the vessel and how these conditions affect the viability determination of each wastewater management system. The installation acceptance or rejection rationale for each candidate WMS is presented, complete with estimated tank sizes, equipment locations, possible space modifications, relocations, limitations, exclusions, and any other such considerations as may be necessary to obtain a lucid understanding of the situation.

Vessel resource capacities (including the source of fresh water) and estimates of usage rates (prior to WMS installation) were obtained from interviews with cognizant officers. The locations of all black water (sewage and garbage grinder slurry) and gray water (galley and turbid) waste sources were determined.

The shipcheck also provided the necessary information to determine the capacities (in gallons) of required black and gray wastewater (or sludge) holding tanks (not part of manufacturer supplied wastewater treatment equipment) which can be accommodated, as well as their configurations (heights). This information was used to determine the black and gray wastewater holding capacities of each viable candidate system (expressed as a percentage of the required holding time). These results are presented on the WMS Equipment Requirements form together with the other equipment types and quantities required in order to synthesize each viable candidate system on the vessel. This WMS Equipment Requirements form served as the starting point for the cost and effectiveness assessments of each viable candidate system.

## Installation Cost Analysis

The following were generated as part of the installation cost analysis:

- WMS equipment arrangement drawings for each viable candidate system and arrangement drawings for the black and gray wastewater sources aboard the vessel.
- Installation related effectiveness attribute data.
- Installation cost estimates for each viable candidate system.

The starting point for the installation cost estimates was the condition of the vessel at the time of the shipcheck inspection. Each viable candidate system installation was then analyzed in terms of a fixed set of installation cost elements. The Installation Cost Estimate Form shown in Figure 1 was used to record the estimated requirements for each cost element and the associated cost was computed. Each installation cost element in Figure 1 is discussed below.

(a) Piping - Wherever possible and applicable, existing piping runs were retained for reuse as installed. Pertinent information contained in the available ship's piping plans was used insofar as practicable. New piping runs were estimated from these drawings and the system equipment arrangement drawing prepared.

For estimating purposes of this nature, it is usual marine practice to use a dollars per pound of material to be installed. Therefore, an estimated present-day price, including material and labor to install, was placed at $4.50/lb.

For the sake of uniformity and simplification since the WMS evaluations are comparative, the piping material used is copper-nickel. It is recognized that most waste disposal piping systems under consideration in the U.S. Coast Guard vessels are of copper-nickel, although some PVC (plastic) piping and a small amount of steel is used. Since the established guidelines call for the principal piping (drainage) to be of copper-nickel it was considered that for the relatively small additional piping, such as vents, the use of copper-nickel for all piping components would not adversely influence the overall results. Accordingly, the amounts of each size piping were estimated and a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.

(b) Steel - For this part of the cost estimate only the steel involved in the various shipyard supplied tanks is considered. Foundations are a separately treated item. For these tanks it was considered that one-quarter inch plate would be a good average thickness. Since the tanks would have to be structurally stiffened for proper support, a factor of 30% was added to the plate weight. The weight estimate was derived from the system guideline size requirements translated into configurations as shown on the equipment location and arrangement drawings.

For cost estimating of this nature, it is usual to apply a cost per pound figure. It was considered that a good current price of $0.55/lb. would cover material and labor for fabrication and placing on board. This does not include the cost of fixing the tanks permanently in place by welding. This is a separate consideration.

## WMS INSTALLATION COST ESTIMATES

Vessel_____

WMS No._____

| Installation Cost Element | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|
| Piping[1] | Pounds | $ 4.50/Lb. (Materials and Labor) | [2] | |
| Tank Steel[3] | Pounds | $ .55/Lb. (Materials and Labor) | [4] | |
| Foundations | Pounds | $ .92/Lb. (Materials and Labor) | [5] | |
| Electric Cables | Feet | $ 2.00/Ft. (Materials and Labor) | | |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | Man-Hours | $15.00/MH (Labor) | | |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | Feet | $ 1.00/Ft. (Labor) | | |
| Welding | Feet | $ 6.00/Ft. (Materials and Labor) | | |
| Removals: Cutting | Hours | $50.00/Hr. (Labor) [6] | | |
| Removals: Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | | |
| Total Installation Cost ($) | | | | |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

Figure 1

INSTALLATION COST ESTIMATE FORM

(c) Foundations - Supporting steel structure for all components of each WMS (tanks, pumps, MSD, incinerators, etc.) was estimated as approximately 10% of the weight which has to be carried. This is a usual rule of thumb for this type of installation. Fabrication and installation costs for material and labor were taken as $0.92/lb. based on consideration of today's average costs. The weights were estimated from the tank configurations and contents as well as the component weights given in Volume IV.

(d) Electrical Power Cable - The amount of footage was estimated from the ship's arrangement plans and the WMS equipment arrangement drawings prepared, with allowances for the devious routings which could be encountered. Since ship alteration work is usually more complex than new construction, allowance as made for less installation per unit time. Therefore a cost of approximately $2.00/ft. of cable was used to cover material and labor.

(e) Miscellaneous Installations - To cover the installation of various items such as pumps, motors, skid-mounted components, etc. where the activity centers principally around alignments and bolting in place, an estimate was made of the amount of time it would take to perform the tasks for each system installation, since the number and type of components varies. An estimated shipyard labor cost of approximately $15 per man-hour (MH) was considered representative.

(f) Access Cuts - In order to get material and components into the compartments where they would be fitted it could become necessary to temporarily cut the ship's hull, or deck plating or a bulkhead to provide passageway. The number of feet of cutting was estimated for each system installation based on the approximate size of the largest component anticipated. Estimated shipyard cost for such cutting is approximately $1.00/ft.

(g) Welding - This consideration includes securing tanks and non-bolted items and welding back any plating temporarily cut to provide access. An estimate of the number of feet of welding was made for each item in each system and a cost factor of $6.00/ft was considered satisfactory to cover material and labor.

(h) Removals - In cases where some existing equipment would have to be cut and removed from the vessel as no longer required, an estimate was made as to the approximate length of time it would take a team of two men to accomplish certain tasks. Estimated factors of $50/hour for cutting (based on an estimated cutting note of 50 ft/hour) and $15/man-hour (MH) for miscellaneous handling labor were considered representative of such costs.

(i) Other Considerations - The installation cost estimates do not include some shipyard costs which yards to include as a matter of quotation to perform a certain ship modification. Such intangibles would include: cleaning and gas-freeing tanks, temporary removals or modifications to ducts, piping, electric cables, machinery, ship's outfit or furnishings, etc. and re-installation to existing state after the basic modification has been completed; cleaning, preparing and repainting the compartments and parts of the steel work distrubed, use of special rigging and shipyard lifting gear; and other work items which are part of a hipyard's everyday business and which are normal for them to price out.

If a complete ship alteration price is desired, it would involve drawing up a complete set of specification and drawings in sufficient detail for a shipyard's estimating department to analyze at length. If possible, yard personnel would prefer to visit the vessel for a more accurate cost estimate to eliminate or minimize costs which it could possibly have to absorb.

One of the most difficult factors to consider and which is not obvious but which is very much a determinant is the shipyard's workload or backlog. If there is a convenient "hole" in the yard's work schedule, the price could be made attractive since it would provide needed economic continuity for its work force and facilities. Certainly if there is little or no other work in the offing, the yard will be inclined to "buy" the job by bidding lower than it normally would.

Thus it can be seen that there will be additional costs to those detailed herein, if one is interested in a "finished product" price than a comparative estimate.

## LIMITATIONS

The installation cost estimating procedures used are considered to be fairly general and applicable for study purposes of this type which places greater emphasis on relative cost among candidate systems rather than on the absolute cost for a given system. However, the installation cost estimates developed herein are based on specific vessel conditions, wastewater management system requirements and the governing installation guidelines and assumptions. Therefore, caution is advised in attempting to use these estimates directly for vessels and/or systems other than those specifically included in this study.

PERTINENT VESSEL INFORMATION

WHITE SAGE (133')

| Vessel Characteristics | Data |
|---|---|
| Class | WLM - 544<br>White Summac (133') Class |
| Type | Buoy Tender (Coastal) |
| Crew Size | 21 |
| Home Port | Woods Hole, Mass. |

SHIPCHECK OBSERVATIONS OF EXISTING VESSEL CONDITIONS

WHITE SAGE (133')

Crew 21 men

Waste Sources

Complete information on the sewage and gray water waste sources is contained in the tabulation sheets forming a part of these introductory remarks.

Existing Arrangement

The sanitary flushing system medium is salt water supplied by a pump/hydroneumatic tank arrangement.

The vessel's fresh water system is also supplied via a pump/hydropneumatic tank arrangement.

Compressed air is supplied via the diesel engine starting air compressor and tank arrangement.

Fire protection is via the fire and bilge pump supply to the fire main and local approved type portable and semi-portable extinguishers.

The following waste management system is fitted aboard the vessel:

(a) A 25 gallon Galley Retention Tank with built-in liquid level controlled pump is located in the aft starboard corner of the Engine Room.

The tank normally receives drains from the Galley and its deck drains and pumps them to the 220 gallon Collection Tank in the forward port corner of the Engine Room.

Galley wastes can gravitate directly overboard independent of any other waste sources. This is done when the tank's pump needs maintenance.

(b) Drains from the drinking fountain on the Main Deck, Frame 14, go directly overboard.

(c) A 220 gallon Collection Tank is located on the port side of the Engine Room, near the forward bulkhead.

All wastes (other than the aforementioned drinking fountain) go to this Collection Tank via separate mains, i.e. the black water mains are separte from the gray water mains.

Although not current practice aboard this vessel, the turbid drains can bypass the 220 gallon Collection Tank and gravitate directly overboard in the Engine Room.

A pump near the tank discharges the mixed wastes forward to Hold No. 2 via a pipe tunnel running fore and aft through the lower portion of the port side fuel oil storage tank which is immediately forward of the Engine Room. Although this pump can discharge overboard or to the pierside connections, it normally discharges to the 810 gallon Retention Tank in the port aft corner of Hold No. 2.

(d) The 810 gallon Retention Tank in Hold No. 2 receives wastes only from the 220 gallon Collection Tank. A pump located just forward of the hold's aft bulkhead and to stbd of the vessel's centerline transfers the waste material to the overboard shell connection on the port side and to the port and stbd pierside connections on deck.

The ships refrigerated stores are located in a self-contained unit having five (5) upper and lower compartments and straddling the vessel's centerline along the forward bulkhead of Hold No. 2.

The dry stores are located in a wire mesh enclosure in the center of the hold.

The cargo boom hydraulic tank is located in the port aft corner of the hold.

The remainder of the the hold is taken up by storage cabinets and racks.

Special Remarks

(1) The drawings used to study the "White Sage" are not in agreement with the actual vessel.

Dwg. 540 WAGL-0103-8 Booklet of General Drawings USCGC Whitebush, dated 5-30-74

is not applicable. The vessel itself is in possession of the correct drawing which is 544 WLM 0103 CGD1-1 Rev B, dated 12-15-75.

Dwg. 540 WAGL-4000-1 Whitebush Engine Room Rearrangement-Elevation & Plan, dated 3-18-74

does not reflect the Engine Room arrangement of the "White Sage"

Dwg. 540 WAGL-4808-2 Secondary Drainage System Alterations Fleet, dated 8-9-71

closely reflects the "White Sage" although the collection and retention tanks are located slightly off from the drawing dimensions. This did not impede its usage.

(2) It should be noted that the drawings indicate that some vessels of this class are fitted with a void space between the fuel oil storage tanks instead of a pipe tunnel through the port side of fuel oil tank. The void space would extend between the forward bulkhead of the Engine Room and the aft bulkhead of Hold No. 2. This void is significant in that it offers the solution to leading incinerator stacks in Hold No. 2 to the weather via the stack in the Engine Room. Under the guidelines for space utilization in this study, fuel oil storage tanks are not to be considered for modification. This deviation in class design will require special consideration and planning on how a stack can be run at the forward end of the vessel's house. The prime considerations involve cargo handling equipment, navigational aids, visibility from the bridge and smoke path from the top of the stack.

This discussion is given to highlight a certain aspect of the systems where incinerators can be located in Hold No. 2 and the viability of these systems as candidates depends on being able to satisfactorily provide a stack arrangement.

## VESSEL RESOURCES

VESSEL WHITE SAGE (WLM-544) - White Summac (133') Class

1. Fresh Water
   a. Source of supply (i.e., storage tank, evaporator) Supplied from off shore source to (4) storage tanks
   b. Capacity (# of gals, etc.) FORWARD PEAK TANK - 3216 gals. PORT WING TANK - 1675 gals.
      AFTER PEAK TANK - 3500 gals. STARBOARD WING TANK - 1675 gals.
   c. Usage rate (# of gpd, etc.) FRESH WATER - 135 gals. per day
      SALT WATER FOR FLUSHING - 16.5 per day
2. Fuel Oil
   a. Tank capacity (# of gals) PORT & STARBOARD TANKS - Each has capacity of 6432 gals. = Total capacity = 12,864 gals.
   b. Usage rate (gpd, etc.) Fuel Underway for 24 Hours Period = 720 gals per day. Average Underway Period = 285 gals.
      In Port - Winter - 30 gals per day In Port - Summer - None
3. Electric Power
   a. Capacity kw (2) - 60 KW Diesel Generators -
   b. Usage rate (when) Underway - Constant In Port - Use Shore Facilities
   c. Maximum kw used All electrical systems can generate off one (1) generator
   d. Average kwh per day 1000kwh per day -
4. Compressed Air
   a. Capacity 2 Air compressors - Service Air - 100psi.
      Starting Engine Air Pressure - 250psi Controlled Air - 125psi (Seperate Systems)
   b. Usage rate Starting Engine; Pneumatic Tools; Air Horn; Air Driven Pumps -
   c. No. of hours compressors run per day or percentage of time 50-60% AVERAGE - Under way.
5. Capacity of Ventilation Air in CFM
   a. Size of fan 2 Supply Vents in Main Engine Room - Total of 4000 CFM; Exhaust Fan in Engine Room - 1000 CFM
      Supply & Exhaust in No. 2 Hold - 2360 CFM; Supply - After Bulkhd. 19 = 2200 CFM Galley Hood - 100 CFM
   b. Location of incinerator for each system considered Present Stack: No. 2 Hold -
6. Ship has only single drainage system.

LOCATION OF BLACK WATER* WASTE SOURCES ABOARD A VESSEL

Vessel WHITE SAGE - (WLM-544) - White Summac (133') Class

| Bulkhead Identification Frame #/To # | Level Identification | Compartment Location | Compartment Name | Number of Water Closets | Number of Urinals | Estimate of Number of People Served | Comments |
|---|---|---|---|---|---|---|---|
| 11-19 | 01 | CL | C.O. SR, WR, WC | 1 | 0 | 1 | |
| 11-19 | 1 | P | Crew's WR and WC | 2 | 1 | 18 | |
| 11-19 | 1 | S | C.P.O. WC | 1 | 0 | 2 | |

* Sewage (output from commodes and urinals) and garbage grinder slurry.

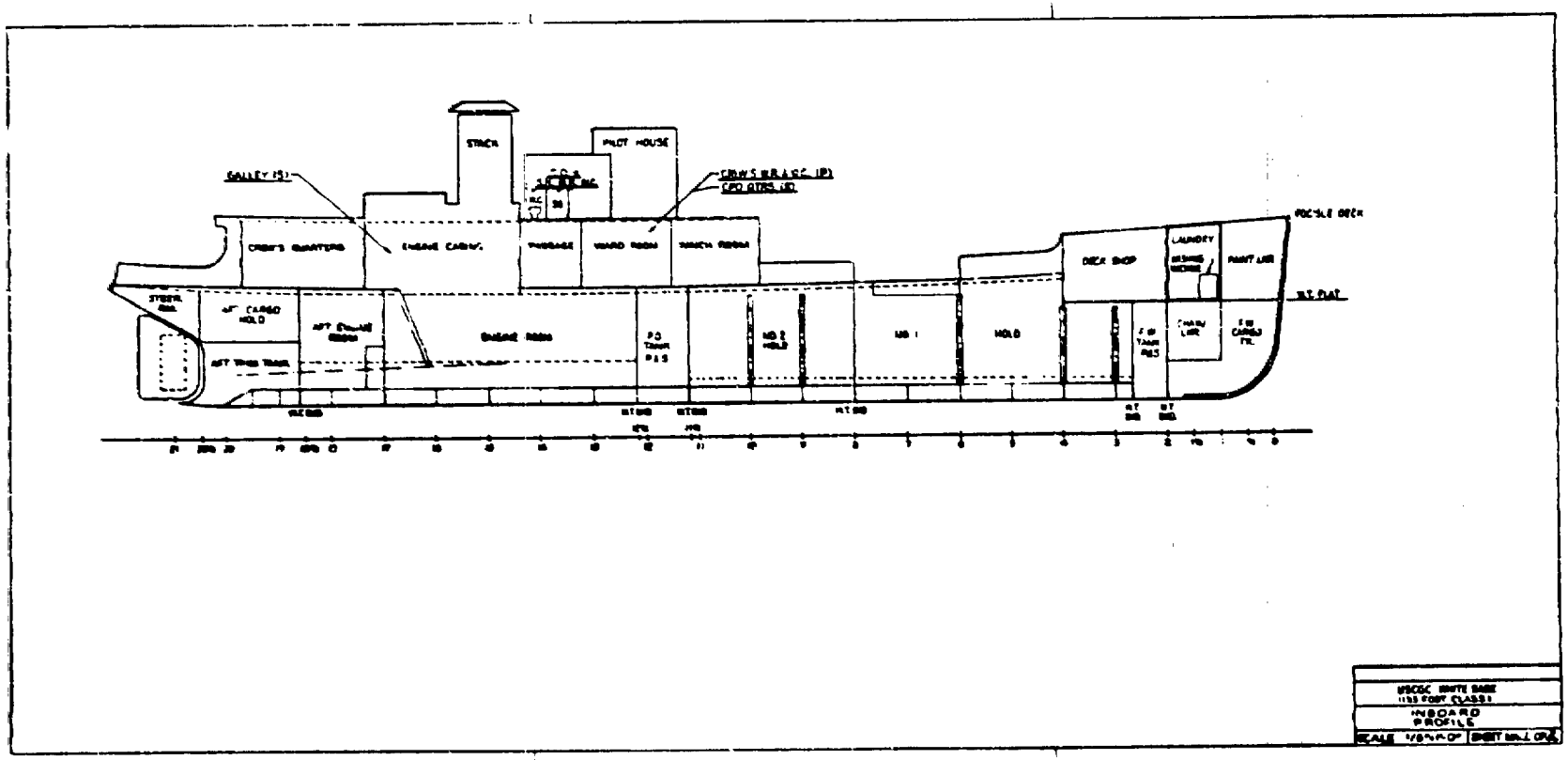
LOCATION OF GRAY WATER* WASTE SOURCES ABOARD A VESSEL

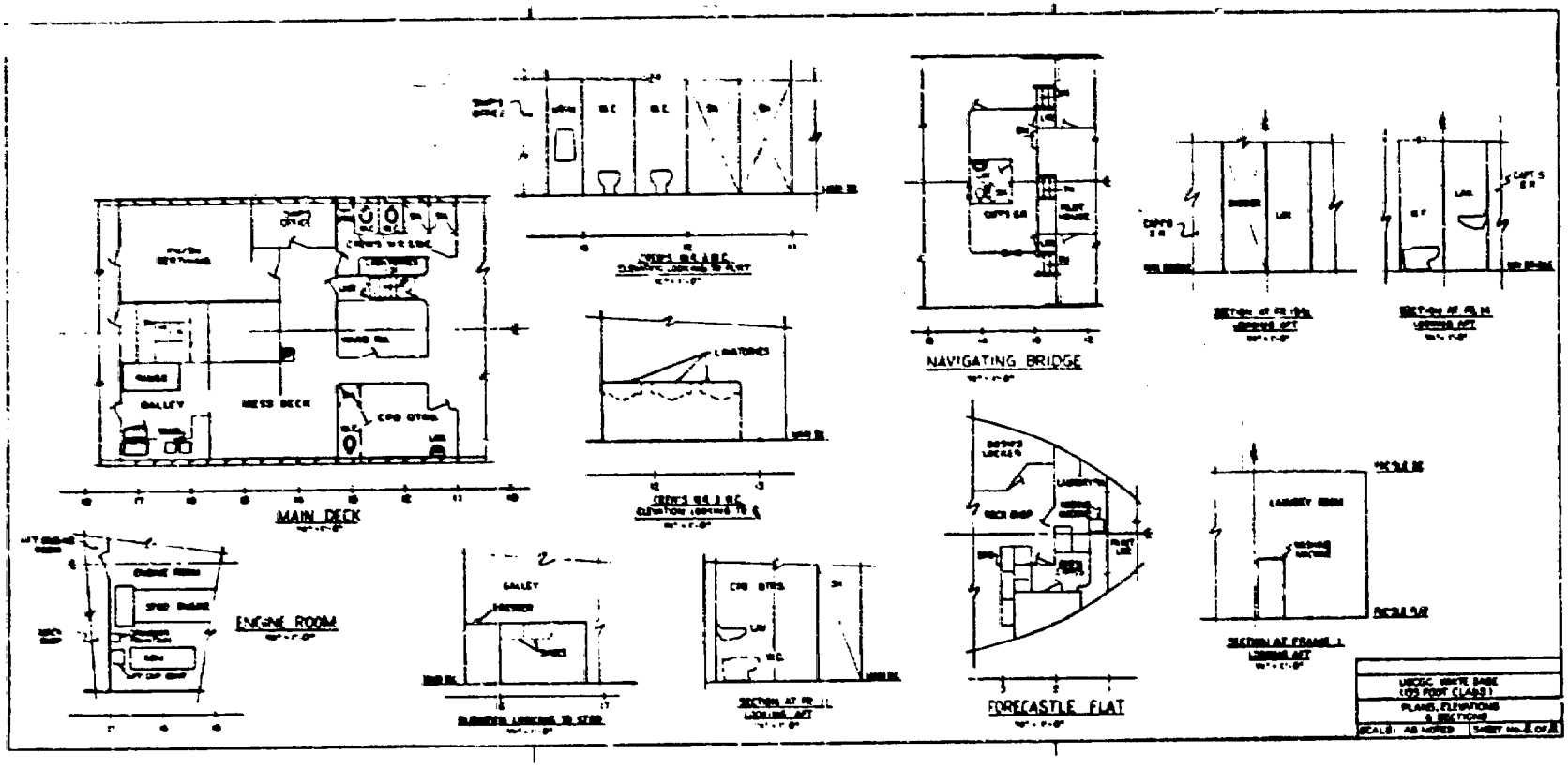
Vessel WHITE SAGE - (WLM-544) - White Summac (133') Class

| Bulhead Identification Frame #/To # | Level Identification | Compartment Location | Compartment Name | Waste Source | Comments |
|---|---|---|---|---|---|
| 11-19 | 01 | CL | C.O. WR | Shower (1) | |
| 11-19 | 01 | CL | C.O. WR | Lavatory (1) | |
| 11-19 | 1 | P | Crew's WR | Showers (2) | |
| 11-19 | 1 | P | Crew's WR | Lavatories (3) | |
| 11-19 | 1 | S | CPO WR | Shower (1) | |
| 11-19 | 1 | S | CPO WR | Lavatory (1) | |
| 11-19 | 1 | S | Galley | Sinks (2) | |
| 11-19 | 1 | S | Galley | Dishwasher (1) | |
| 11-19 | 1 | S | Galley | Drain from Refrig. to Deck to CHT. | |
| 11-19 | 1 | S | Galley | Range Hood to CHT. | |
| 17 | 1 | S | Engine Room | Drinking Fountain Drain to Bilge | |
| 14-15 | 1 | CL | Main Deck | Drinking Fountain Drain to Bilge | |
| 1- 4 | 1 | CL | Laundry | Washing Machine | |
| 11-19 | 2 | P | Hold | Drain from Air Cond. Chiller | |
| 8-11 | 2 | P | Hold | Drain from Refrig. | |
| 17 | 2 | S | Engine Room | Galley Ret. Tank - 25 Gal. | |
| 12-19 | 2 | P | Engine Room | Collection Tank 220 Gal. | |
| 8-11 | 2 | CL | Hold No. 2 | Rete[illegible]ion Tank [illegible]l. | |

* Galley and turbid wastewater.

## ARRANGEMENT OF BLACK AND GRAY WASTEWATER SOURCES




MAIN DECK
GALLEY
MESS DECK
CPO STOR.
ENGINE ROOM
NAVIGATING BRIDGE
FORECASTLE FLAT
LAUNDRY ROOM
USCGC WHITE BIRCH
(123 FOOT CLASS)
PLANS, ELEVATIONS
& SECTIONS

## WMS EQUIPMENT REQUIREMENTS

Vessel WHITE SAGE (133')

| WMS NUMBER | WMS ACCEPTABILITY: For Installation (Yes/No) | Holding Time (%) Black | Holding Time (%) Gray | Safety (1) (Yes/No) | NUMBER OF FIXTURES: Commodes (2) | Urinals (3) | JERED: NUMBER OF VCT's (Sized By Gallons) Small Boat 30 | 60 | Large Boat 120 | 200 | 250 | Jered | Thiokol | NUMBER OF INCINERATORS: Number of M/T Pumps | GATX: NUMBER OF EVAPORATORS (Sized By Gallons) 20 | 40 | 60 | 80 | Number of Vapor Treatment Sections | Number of Treatment Subsystems | GRUMMAN: Number of Thiokol Incinerators | CHRYSLER: COLLECTION AND RECIRCUL. SUBSYSTEM: Number of Separator Tanks Model A | A/B | D | Number of P&FM Packages Model A | B | INCINERATOR SUBSYSTEM: Number of Sludge Surge Tanks Model B | C | Number of Incinerators Model A | C | TANKS(4) BLACK (Gallons Each Tank) | GRAY (Gallons Each Tank) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | | | | | | | | | | | | | | 722B | 2063B |
| 2 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | 135C | 2063B |
| 3 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | 1 | | | 2063B |
| 4 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 110A,60C | 2063B |
| 5 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 432A, 232C | |
| 6 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 722B | 323A,172C |
| 7 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | 110A | 2063B |
| 8 | Yes | 100 | 100 | Yes | 4S | 1S | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | 432A | |
| 9 | Yes | 100 | 100 | Yes | 4J | 1S/2J | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 200B | 2063B |
| 10 | Yes | 100 | 100 | Yes | 4J | 1S/2J | | | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | 2063B |
| 11 | Yes | 100 | 100 | Yes | 4J | 1S/2J | 1 | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | 2063B |
| 12 | Yes | 100 | 100 | Yes | 4J | 1S/2J | 1 | | | | | | | | | | | | 1 | | | | | | | | | | | | | 200B | 172C,323A |
| 13 | Yes | 100 | 100 | Yes | 4J | 1S/2J | 1 | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | 323A |
| 14 | Yes | 100 | 100 | Yes | 4G | 1S/1G | | | | | | | | 3 | | | | | | | | | | | | | | | | | | 232B | 2063B |
| 15 | Yes | 100 | 100 | Yes | 4G | 1S/1G | | | | | | | 1 | 3 | | | | | | | | | | | | | | | | | | | 2063B |
| 16 | Yes | 100 | 100 | Yes | 4G | 1S/1G | | | | | | | | 3 | | | 1 | 1 | | | | | | | | | | | | | | | 2063B |
| 17 | Yes | 100 | 100 | Yes | 4G | 1S/1G | | | | | | | | 3 | | | | | 1 | | | | | | | | | | | | | 232B | 323A,172C |
| 18 | Yes | 100 | 100 | Yes | 4G | 1S/1G | | | | | | | | 3 | | | | | 1 | 1 | | | | | | | | | | | | 43D | 323A |

WMS = Wastewater Management System
P&FM = Pressurization and Fluid Maintenance
(1) Does WMS meet all applicable safety standards?
(2) Letter following entered number means: S = Standard, J = JERED, G = GATX
(3) Letters following entered numbers mean: S = Standard urinal only, S/J = Standard urinals with indicated number of jered urinal discharge valves, S/G = Standard urinals with indicated number of GATX flushometers.
(4) Letter following entered gallonage denotes tank usage: A = Influent Surge, B = Wastewater holding, C = Sludge holding, D = Intermediate tank not supplied with MSD.

| WMS No. | 1, 5, 14 | 2, 9, 12 | 4 | 6 | 17 |
|---|---|---|---|---|---|
| Tank Height | 5'-6" | 3'-0" | 2'-0" | 6'-0" | 5'-0" |

NOTE: WMS No. 18 = Intermediate tank used as influent surge tank.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 1 Full Volume Flush Gravity Collection/Holding Tank for Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Sewage Holding Tank | 722 gal. (97 cu. ft.) | 6' x 3' x 5' - 6" |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Sewage Holding Tank Discharge Pumps | Two (2) | |
| Galley/Turbid Holding Tank Discharge Pumps | Two (2) | |

Discussion

The system is considered to be a viable candidate.

The components would be located as follows:

(a) Sewage Holding Tank in the Engine Room, Port Side, Frame 14, just aft of location of existing collecting tank.

(b) Sewage Holding Tank Discharge Pumps (overboard/pierside) just forward of the tank.

(c) Galley/Turbid Holding Tank in Hold No. 2, Starboard side, in the location of the existing retention tank.

(d) Galley/Turbid Holding Tank Discharge Pumps (overboard/pierside) just forward of the tank.

(e) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Staboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

Vessel: WHITE SAGE (133')

System No. 1 (Cont'd)

Drainage would be as follows:

(a) Sewage would drain by gravity to the Sewage Holding Tank. The tank discharge pumps' discharge line would be led to Hold No. 2 via the existing pipe tunnel passing through the lower inboard side of the Port Fuel Oil Tank. From there it would run to the existing overboard shell connection and to the existing weather deck discharge connections to pierside, port and starboard.

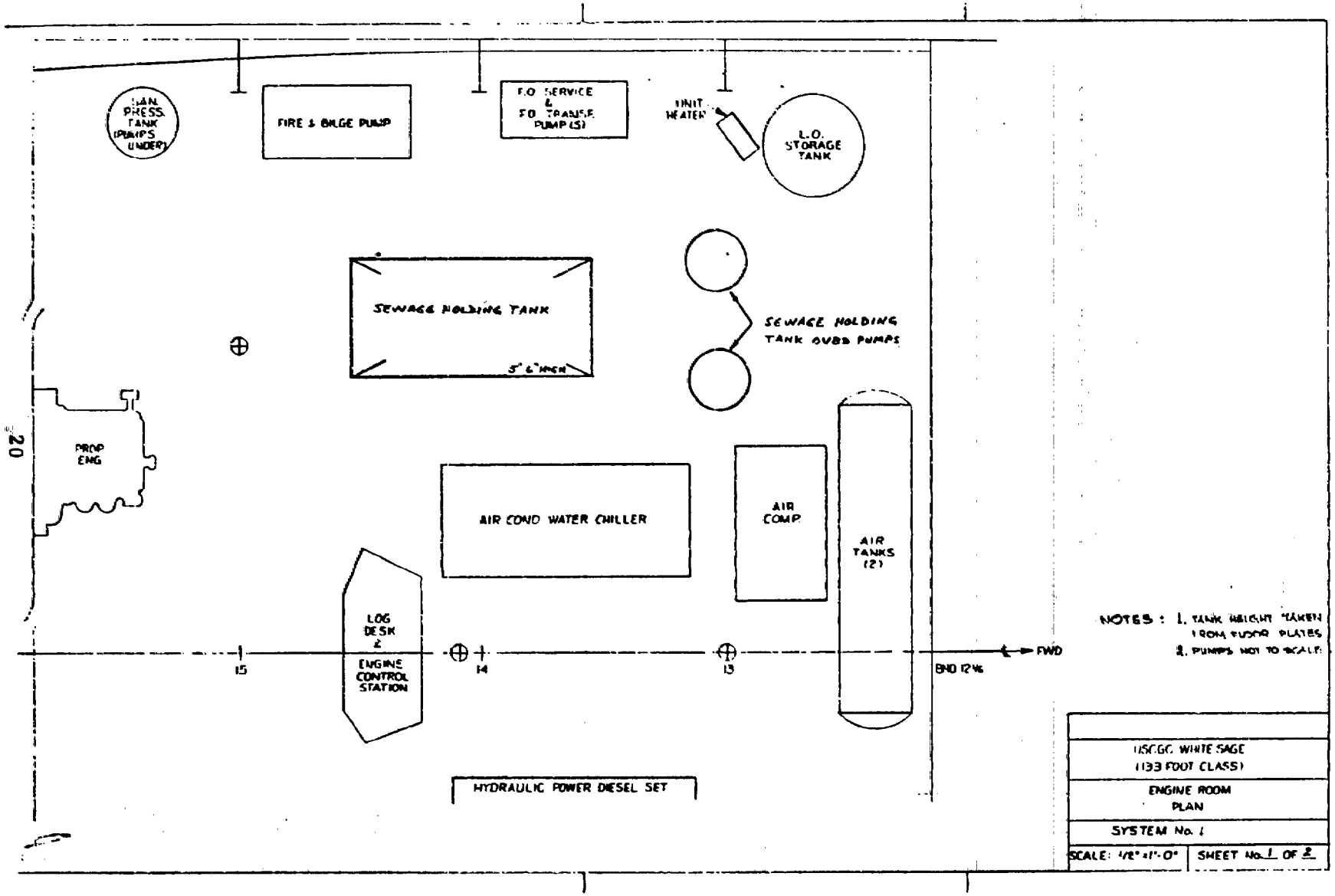
(b) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank semilar to the existing one, but located through the upper part of the tank.

(c) Drain from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(d) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pumps would be capable of discharging the tank contents overboard and to pierside.

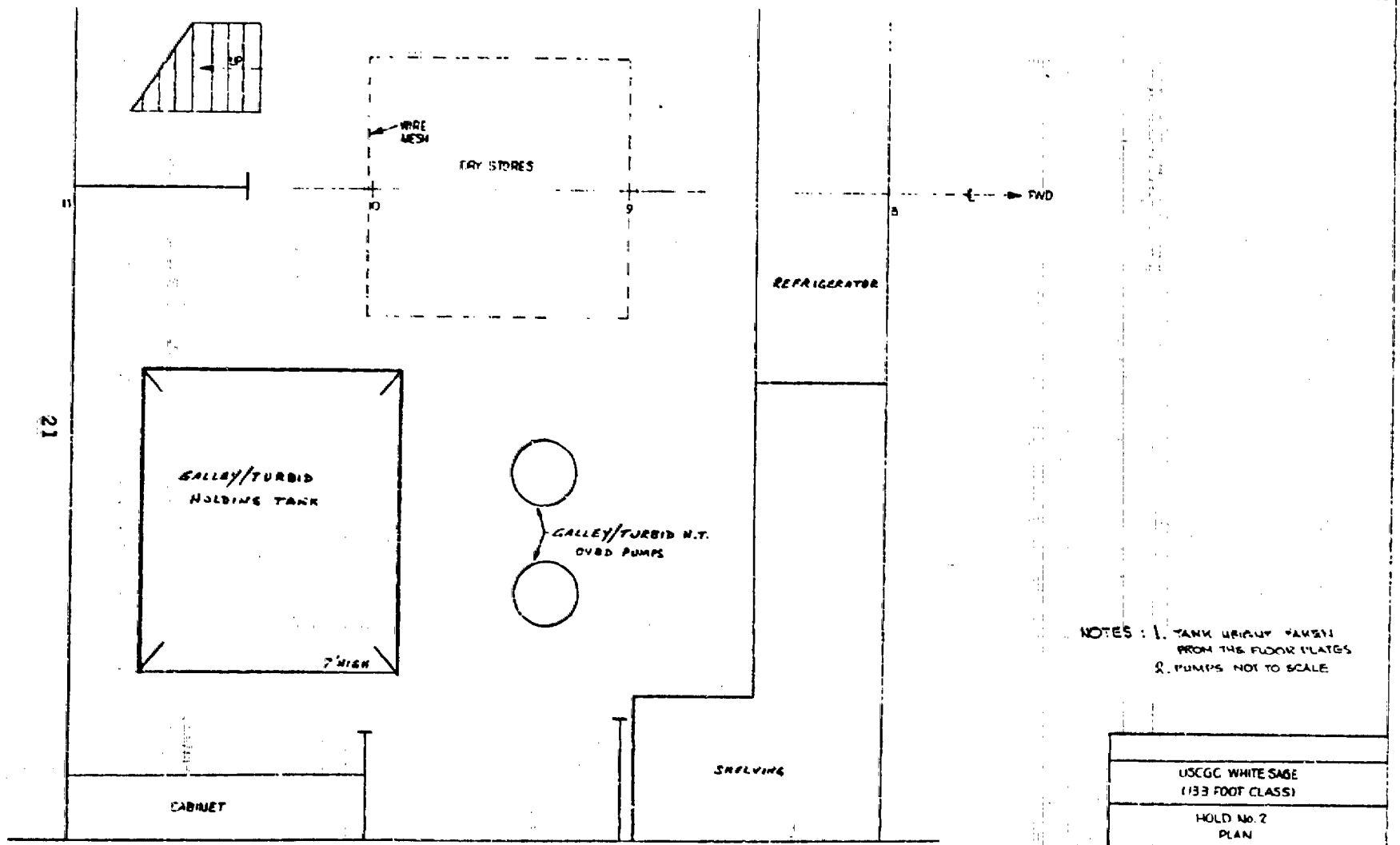
To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 1 |
| SCALE: 1/2" = 1'-0" \| SHEET No. 1 OF 2 |




NOTES : 1. TANK WEIGHT TAKEN FROM THE FLOOR PLATES
2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 1 |
| SCALE: 1/2"=1'-0" \| SHEET No. 2 OF 2 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 1

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping (1) | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,105 (2) | 4,568 |
| Tank Steel (3) | | Pounds | $ .55/Lb. (Materials and Labor) | 5,340 (4) | 2,937 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,970 (5) | 2,733 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 250 | 500 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 125 | 750 |
| Removals | Cutting | Hours | $50.00/Hr. (6) (Labor) | 15 | 750 |
| Removals | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 13,188 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

**WMS No. 2** Full Volume Flush Oil Recirculation and Gravity Collection/ Chrysler System with Sludge Holding Tank for Sewage/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Sewage Holding Tank | 135 gal. (18 cu. ft.) | 2' x 3' x 3' |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu. ft.) | 7' x 6' x 7' |
| Chrysler Model and Quantity | One (1) Model A Separation Tank and One (1) Model A Pump and Fluid Maintenance Package | |
| Sewage Holding Tank Discharge Pumps | Two (2) | |
| Galley/Turbid Holding Tank Discharge Pumps | Two (2) | |

Discussion

The system is considered to be a viable candidate.

The components would be located as follows:

(a) Sewage Holding Tank in the Engine Room, Port side, Frame 13, in place of the existing collecting tank.

(b) Sewage Holding Tank Discharge Pumps (overboard/pierside) just forward and outboard of the tank.

(c) Chrysler Separation Tank and Pump and Fluid Maintenance Package in the Engine Room, just aft of the Sewage Holding Tank.

(d) Galley/Turbid Holding Tank in Hold No. 2, Starboard side, in the location of the existing retention tank (Same as in System No. 1)

(e) Galley/Turbid Holding Tank Discharge Pumps (overboard/ pierside) just forward of the tank (Same as in System No. 1).

(f) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

Drainage would be as follows:

(a) Sewage would drain by gravity to the Chrysler Separation Tank.

(b) The effluent from the Separation Tank would be pumped to the Sewage Holding Tank.

(c) The Sewage Holding Tank Discharge Pump piping would be led to Hold No. 2 via the existing pipe tunnel passing through the lower inboard side of the Port Fuel Oil Tank. From there it would run to the existing overboard shell connection and to the existing weather deck discharge connection to pierside, port and starboard.

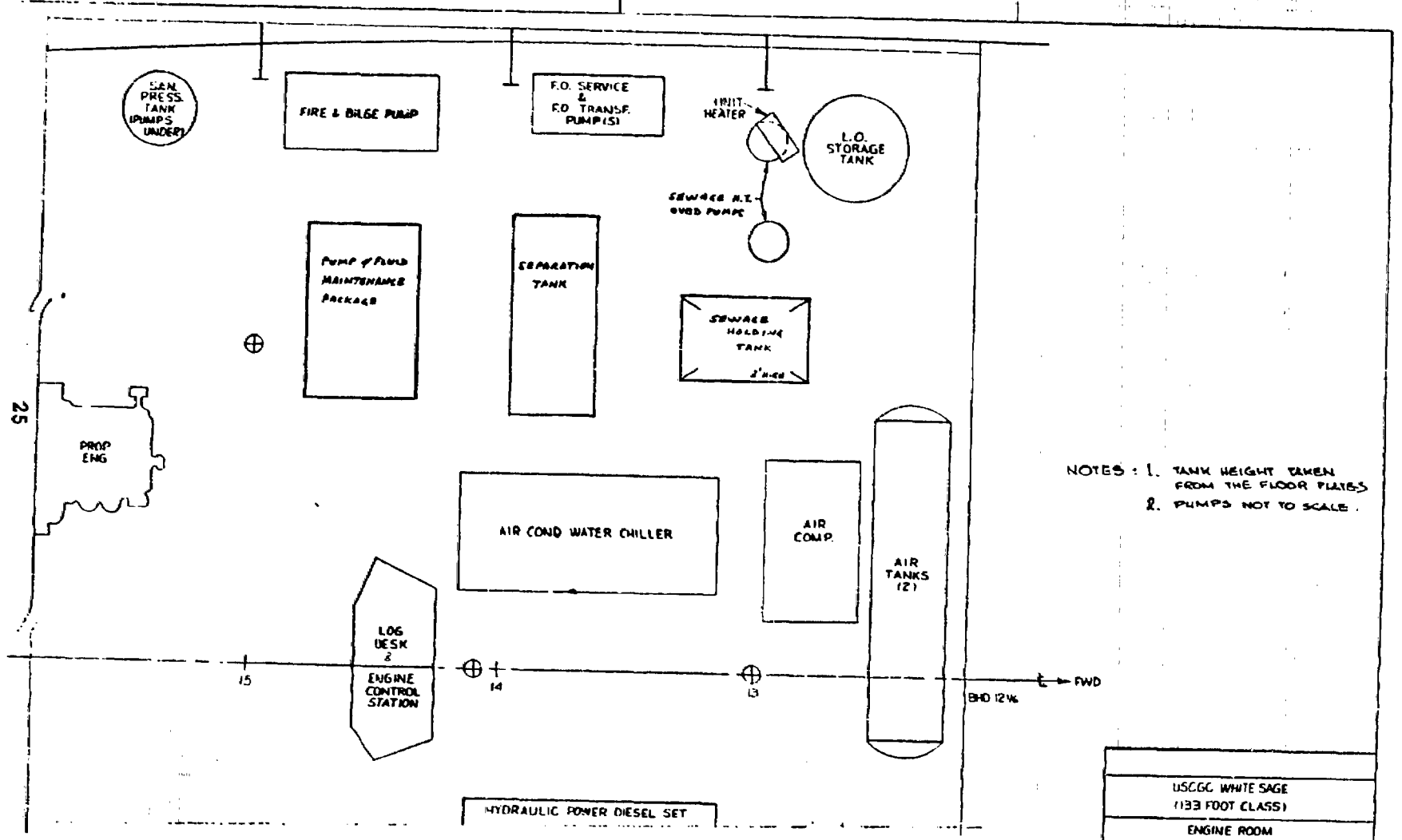
(d) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

(e) Drains from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(f) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pumps would be capable of discharging the tank contents overboard and to pierside.

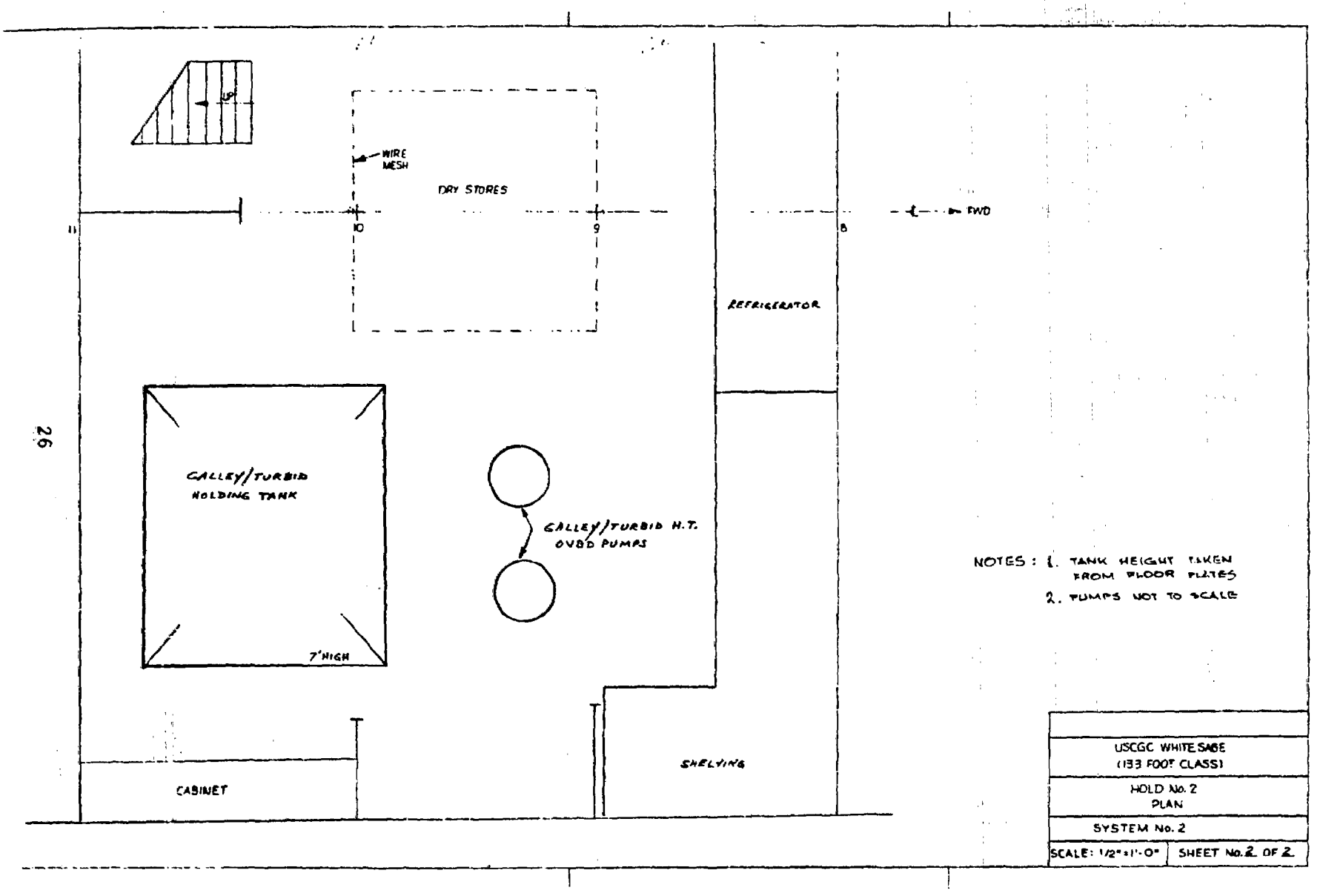
To accommodate the equipment in Hold No. 2, there may be minor modification required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM THE FLOOR PLATES
2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 2 |
| SCALE: 1/8" = 1'-0" \| SHEET No. 1 OF 2 |


UP
WIRE MESH
DRY STORES
11
10
9
8
FWD
REFRIGERATOR
GALLEY/TURBID HOLDING TANK
7'HIGH
GALLEY/TURBID H.T. OVBD PUMPS
CABINET
SHELVING
NOTES: 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE (133 FOOT CLASS)
HOLD No. 2 PLAN
SYSTEM No. 2
SCALE: 1/2"=1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 2

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,220 [2] | 5,490 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 4,100 [4] | 2,255 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 3,160 [5] | 2,908 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 300 | 600 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 140 | 840 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 13,793 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 3 Full Volume Flush Oil Recirculation and Gravity Collection/ Chrysler System with Incinerator for Sewage/Holding Tank for Gray Water

| | Required | Approximate Dimensions(L x W x H) |
|---|---|---|
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Sludge Ejection Tank | 50 gal. (6.7 cu.ft.) | 24" dia. x 60" L |
| Chrysler Model and Quantity | One (1) Model A Separation Tank and One (1) Model A Pump and Fluid Maintenance Package | |
| Incinerator Model and Quantity | One (1) - A | |
| Sludge Ejection Tank Transfer Pump | One (1) | |
| Sludge Ejection Tank Discharge Pump | One (1) | |
| Galley/Turbid Holding Tank Discharge Pumps | Two (2) | |

Discussion

The system is considered to be a viable candidate.

The components would be located as follows:

(a) Chrysler Pump and Fluid Maintenance Package, and Separation Tank followed by the Sludge Ejection Tank would be located in that order (fwd to aft) on the port side of the Engine Room, from the location of the existing collecting tank aft to the stanchion (Frames 13 to 15).

(b) The incinerator would be located in the Engine Room, port side, between Frames 14 and 15 just inboard of the ejection tank. Its stack would run inboard and up to the weather alongside the diesel engine exhaust pipes in the ship's stack.

Vessel: WHITE SAGE (133')

System No. 3 (Cont'd)

(c) The Sludge Ejection Tank Pumps would be located in the Engine Room, just forward of the incinerator.

(d) The incinerator fuel tank could be located on the Engine Room forward bulkhead, port side.

(e) Galley/Turbid Holding Tank in Hold No. 2, Starboard side, in the location of the existing retention tank (Same as System Nos. 1 and 2).

(f) Galley/Turbid Holding Tank Discharge Pumps (overboard/pierside) just forward of the tank (Same as System Nos. 1 and 2).

(g) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Starboard corner would be retained. The tank has a built-in liquid level controlled discharge pump.

Drainage would be as follows:

(a) Sewage would drain by gravity to the Chrysler Separation Tank and pass on to the incinerator via the Sludge Ejection Tank and the Transfer Pump.

(b) The Sludge Ejection Tank would be pumped overboard and to pierside via the tank's discharge pump. The discharge piping would be led to Hold No. 2 via the existing pipe tunnel through the Port Fuel Oil Tank and then to the ship's existing overboard and pierside connections.

(c) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

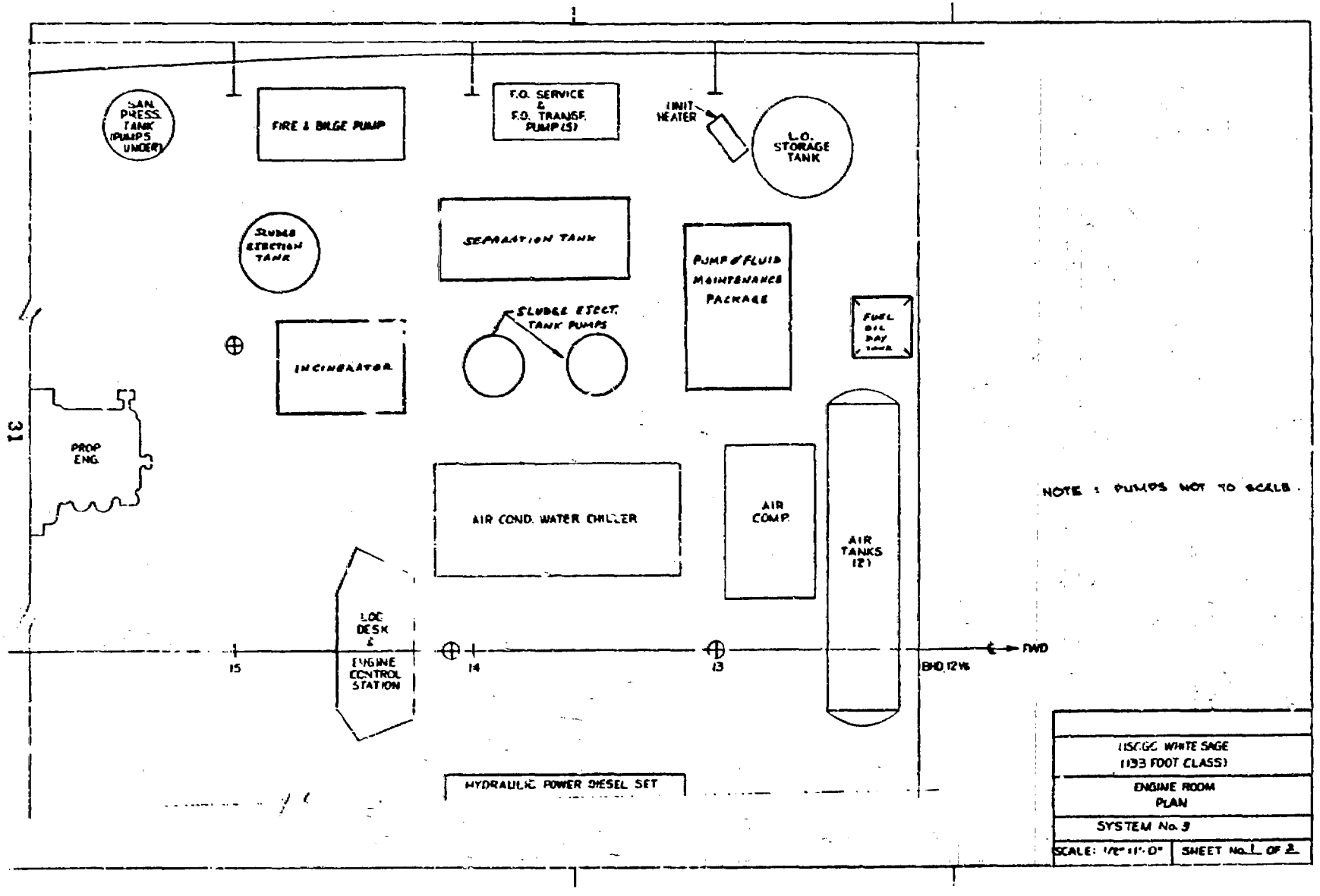
(d) Drain from the drinking fountain on the Main Deck, Frame 14 to starboard of the ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(e) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pumps would be capable of discharging the tank contents overboard and to pierside.

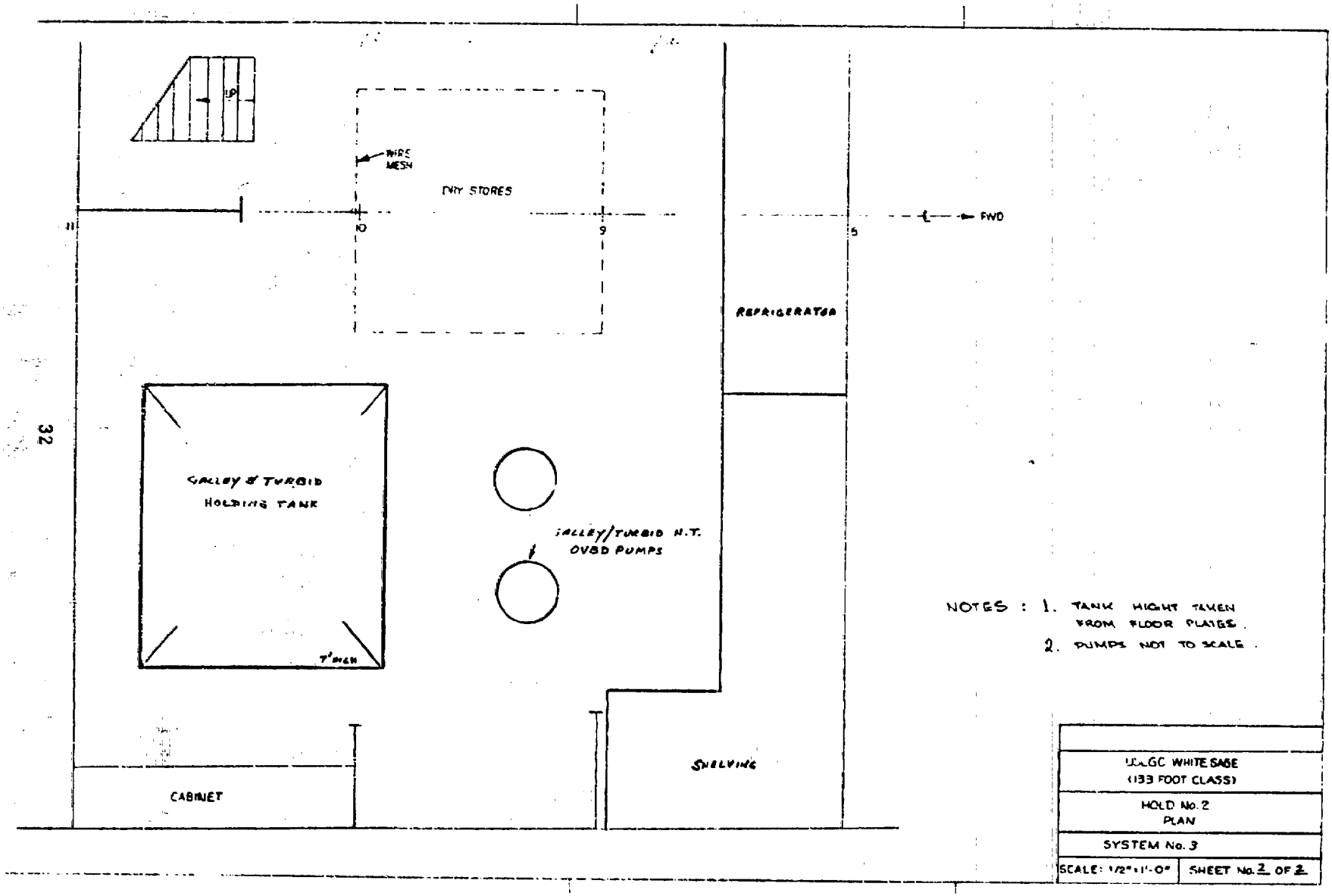
To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

Due to the incinerator installation additional fire protection will have to be provided and the ventilation system will have to be modified.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 3 |
| SCALE: 1/2" = 1'-0" \| SHEET No. 1 OF 2 |




NOTES : 1. TANK HIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.

| |
|---|
| U.S.C.G. WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 3 |
| SCALE: 1/2"=1'-0" \| SHEET No. 2 OF 2 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 3

| Installation Cost Element | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|
| Piping[1] | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,930 [2] | 8,685 |
| Tank Steel[3] | Pounds | $ .55/Lb. (Materials and Labor) | 4,360 [4] | 2,398 |
| Foundations | Pounds | $ .92/Lb. (Materials and Labor) | 2,620 [5] | 2,411 |
| Electric Cables | Feet | $ 2.00/Ft. (Materials and Labor) | 350 | 700 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | Feet | $ 6.00/Ft. (Materials and Labor) | 150 | 900 |
| Removals: Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| Removals: Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | 16,794 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 4 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Holding Tank for Black Water/ Holding Tank for Gray Water

| | Required | Approximate Dimensions(L x W x H) |
|---|---|---|
| Sewage Influent Surge Tank | 110 gal. (15 cu. ft.) | 2' x 2' x 4' |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Sludge Holding Tank | 60 gal. (8 cu. ft.) | 2' x 2' x 2' |
| Grumman Unit without Incinerator | One (1) | |
| Surge Tank Pumps | One (1) | |
| Surge Tank Overboard Pump | Two (2) | |
| Sludge Transfer Pump | One (1) | |
| Galley/Turbid Holding Tank Discharge Pump | Two (2) | |

Discussion

The system is considered to be a viable candidate.

The components would be located as follows:

(a) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

(b) Due to the lack of adequate space in the Engine Room and for a better piping arrangement, the Sewage Influent Surge Tank, Sludge Holding Tank, Grumman Unit and Galley/Turbid Holding Tank would all be located on the starboard side of Hold No. 2. The G/T Holding Tank would be located where the retention tank is fitted (Frames 10 - 11). The Grumman Unit would be located forward of the G/T Holding Tank, with the Sludge Holding Tank adjacent and outboard (Frames 8-9). The Influent Surge Tank would be located just forward of Bhd 11 and to Starboard of the ship's centerline (Frames 10 - 11) near the G/T Holding Tank.

(c) The independent pumps associated with the tanks would be distributed in the area between Frames 9 - 10 1/2 Starboard of the ship's centerline and near the Sludge Holding Tank.

Drainage would be as follows:

(a) All drainage piping aft of Bhd No. 12, sewage as well as galley/turbid, would be led to Hold No. 2 via separate mains through a new pipe tunnel passing through the upper part of the Port Fuel Oil Tank (similar to the existing one which passes through the lower part of the tank).

(b) Sewage would gravitate to the Influent Surge Tank, from which it would be pumped by the Surge Tank Pump to the Grumman Feed Tank. The Surge Tank would be pumped overboard and to pierside via the tank's overboard pumps.

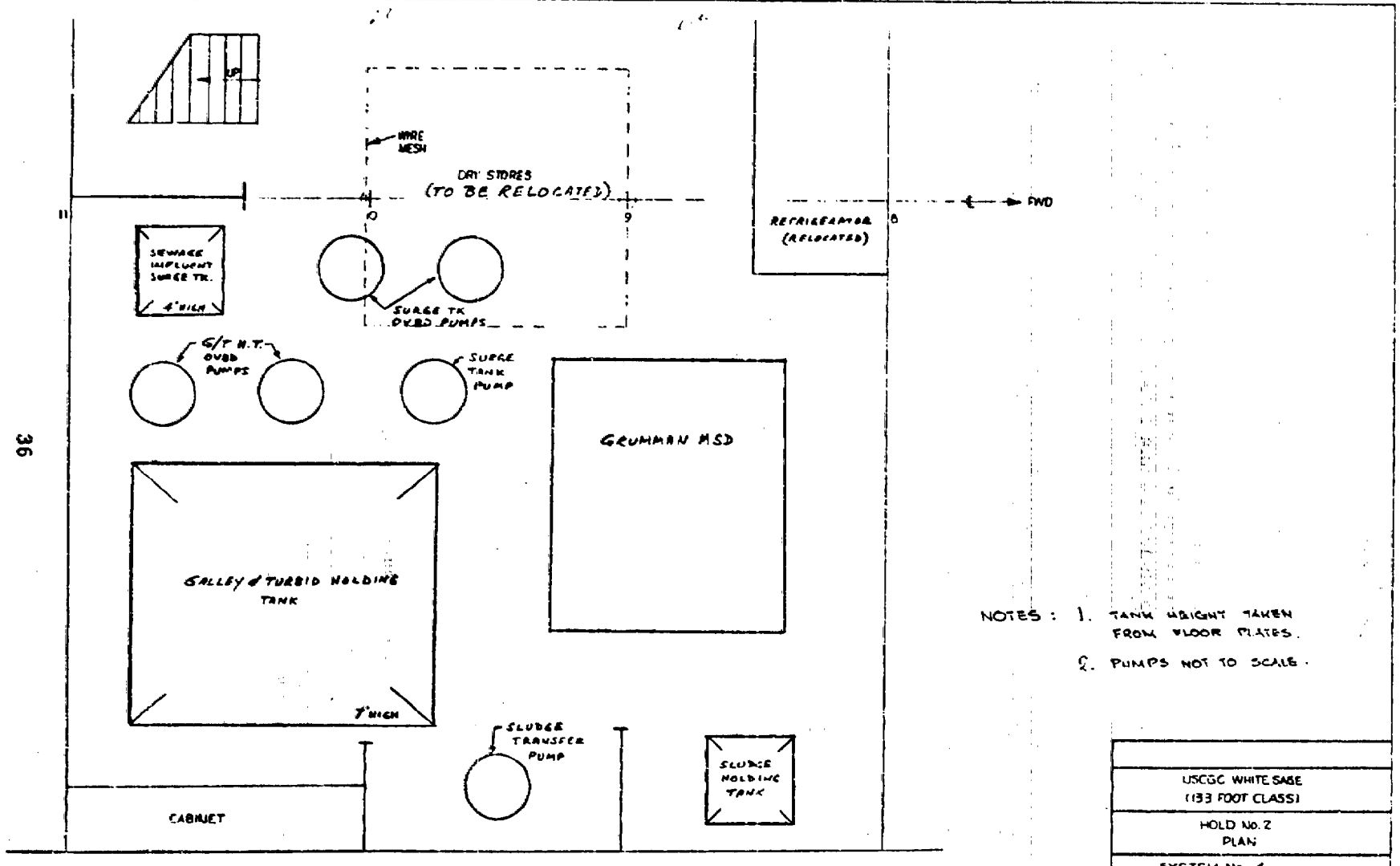
(c) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via the new pipe tunnel through the Port Fuel Oil Tank mentioned above.

(d) Drains from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(e) Remaining Galley/Turbid drains would gravitate overboard and to their Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pumps would be capable of discharging the tank contents overboard and to pierside.

To accommodate equipment locations the existing shelving arrangement along the starboard shell would have to be modified, the ship's dry stores enclosure would have to be relocated from the ship's centerline to some place on the Port side, and the ship's stores refrigerator would have to be moved slightly to Port to clear the Grumman unit. The refrigerator has its own two air-cooled compressors mounted on top of the refrigerator.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.

2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 4 |
| SCALE: 1/2"=1'-0" \| SHEET No. 1 OF 1 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 4

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.30/Lb. (Materials and Labor) | 1,830 [2] | 8,235 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 4,395 [4] | 2,418 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,705 [5] | 2,489 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 525 | 1,050 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 50 | 750 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 35 | 35 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 150 | 900 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 17,002 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

WMS No. 5 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Holding Tank for Combined Black and Gray Waters

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Influent Surge Tank | 432 gal. (58 cu.ft.) | 3' x 3' x 6' - 5" |
| Sludge Holding Tank | 232 gal. (31 cu.ft.) | 3' x 2' x 5' - 6" |
| Grumman Unit without Incinerator | One (1) | |
| Surge Tank Pump | One (1) | |
| Surge Tank Overboard Pump | Two (2) | |
| Sludge Transfer Pump | One (1) | |

Discussion

The system is considered to be a viable candidate.

The components would be located as follows:

(a) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

(b) Due to the lack of adequate space in the Engine Room and for a better piping arrangement, the Sewage Influent Surge Tank, Sludge Holding Tank, and the Grumman Unit would all be located on the starboard side of Hold No. 2. The Grumman treatment sub-system would be located where the retention tank is presently fitted. The Sludge Holding Tank would be located just outboard of the Grumman unit. The influent surge tank would be located just forward of Bhd 11, to starboard of the ship's centerline.

(c) The independent pumps would be functionally located arround the Grumman unit and Surge Tank.

Vessel: WHITE SAGE (133')

System No. 5 (Cont'd)

Drainage would be as follows:

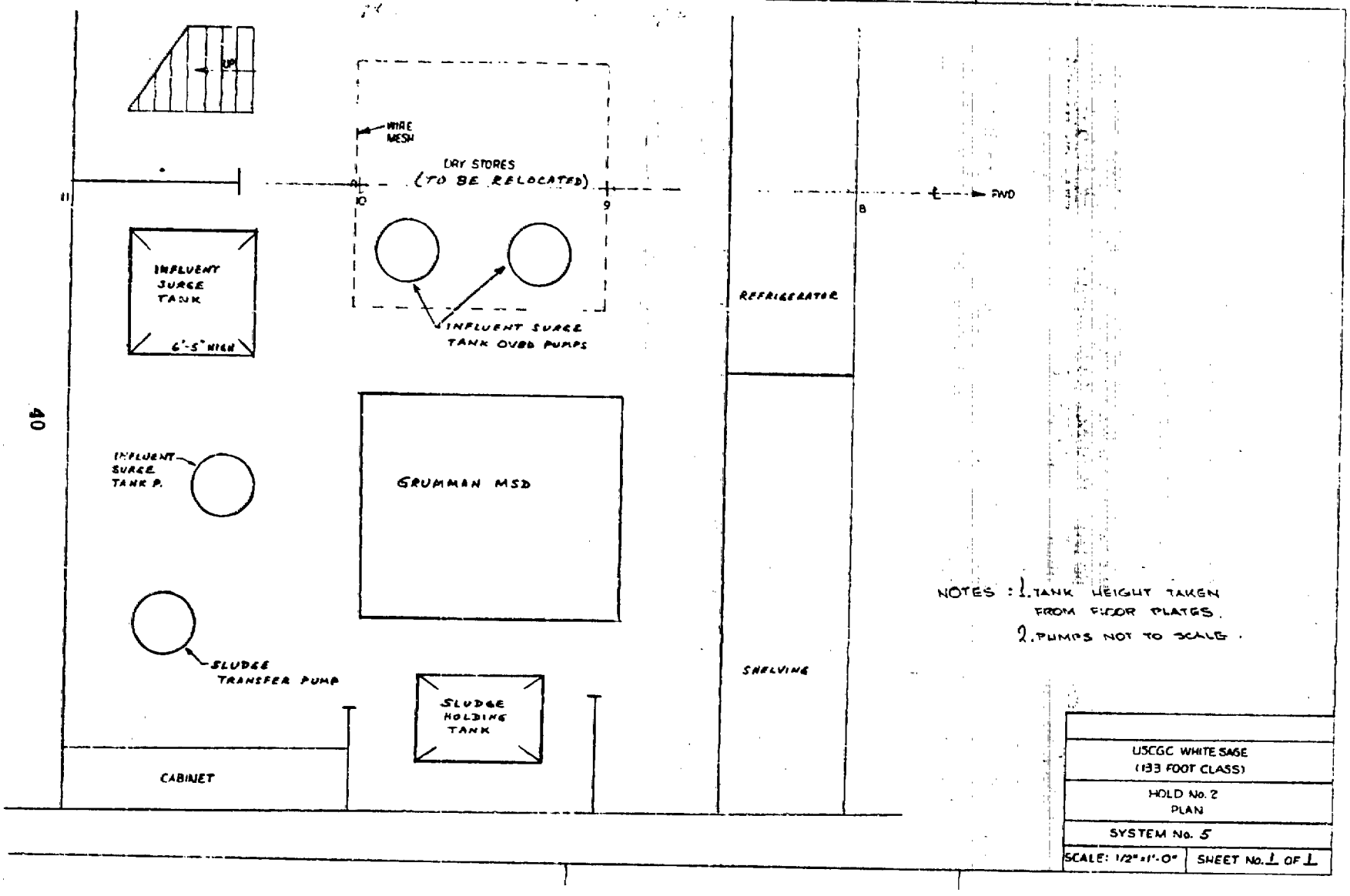
(a) All drainage piping aft of Bhd No. 12, sewage as well as Galley/Turbid, would be led to Hold No. 2 via separate mains through a new pipe tunnel passing through the upper part of the Port Fuel Oil Tank (similar to the existing one which passes through the lower part of the tank).

(b) Sewage and Galley/Turbid drains would gravitate to the Influent Surge Tank, from which they would be pumped by the Surge Tank Pump to the Grumman Feed Tank. The Surge Tank would be pumped overboard and to pierside via the tank's overboard pumps.

(c) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Influent Surge Tank in Hold No. 2 via the new pipe tunnel through the Port Fuel Oil Tank mentioned above.

To accommodate the equipment in Hold No. 2, minor modifications will be required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10) will have to be moved further to Port.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 5 |
| SCALE: 1/2"=1'-0" \| SHEET No. 1 OF 1 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 5

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,635[2] | 7,358 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 2,170[4] | 1,194 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 1,120[5] | 1,031 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 450 | 900 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 35 | 35 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 120 | 720 |
| Removals | Cutting | Hours | $50.00/Hr.[6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 12,888 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 6 Full Volume Flush Gravity Collection/Holding Tank for Black Water/Grumman Flow Through System with Sludge Holding Tank for Gray Water

| | Required | Approximate Dimensions(L x W x H) |
|---|---|---|
| G/T Influent Surge Tank | 323 gal. (43 cu.ft.) | 3' x 3' x 5' |
| Sewage Holding Tank | 722 gal. (97 cu.ft.) | 4' x 4' x 6' |
| Sludge Holding Tank | 172 gal. (23 cu.ft.) | 2'-6" x 2'-6" x 4' |
| Optional Combined Sewage/ Sludge Holding Tank | 894 gal. (120 cu.ft.) | 5' x 5' x 5' |
| Grumman Unit without Incinerator | One (1) | |
| G/T Influent Surge Tank Pump | One (1) | |
| G/T Influent Surge Tank Transfer pump | One (1) | |
| Sewage Holding Tank Overboard Pump | Two (2) | |
| Sludge Holding Tank Transfer Pump | | |

Discussion

The system is considered to be a viable candidate.

The components would be located as follows:

(a) The existing 25 gallon Galley Collecting Tank located on the operating level of the Engine Room, in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

(b) Due to the lack of adequate space in the Engine Room and for a better piping arrangement the remaining components would all be located on the starboard side of Hold No. 2. The G/T Influent Surge Tank would be fitted near the ship's centerline, just forward of Bhd No. 11. The Sewage Holding Tank would be located where the existing retention

tank is fitted. The Grumann treatment subsystem would be fitted forward (Frames 9-10) with the Sludge Holding Tank forward and outboard.

The Optional Combined Sewage/Sludge Holding Tank can be located in place of the Sewage Holding Tank.

(c) The independent pumps associated with the tanks would be distributed functionally near the equipment served.

Drainage would be as follows:

(a) All drainage piping aft of Bhd No. 12, sewage as well as galley/turbid, would be led to Hold No. 2 via separate mains through a new pipe tunnel passing through the upper part of the Port Fuel Oil Tank (similar to the existing one which passes through the lower port of the tank).

(b) Sewage would gravitate to the Sewage Holding Tank from which it would be pumped overboard or to pierside by the tank's overboard discharge pumps.

(c) The Sludge Holding Tank Transfer Pump would transfer effluent from the tank to the Sewage Holding Tank for discharge overboard and to pierside via the Sewage Holding Tank Overboard Pumps.

(d) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Influent Surge Tank in Hold No. 2 via the new pipe tunnel through the Port Fuel Oil Tank mentioned above.

(e) Drain from the drinking fountain on the Main Deck, Frame 14 to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

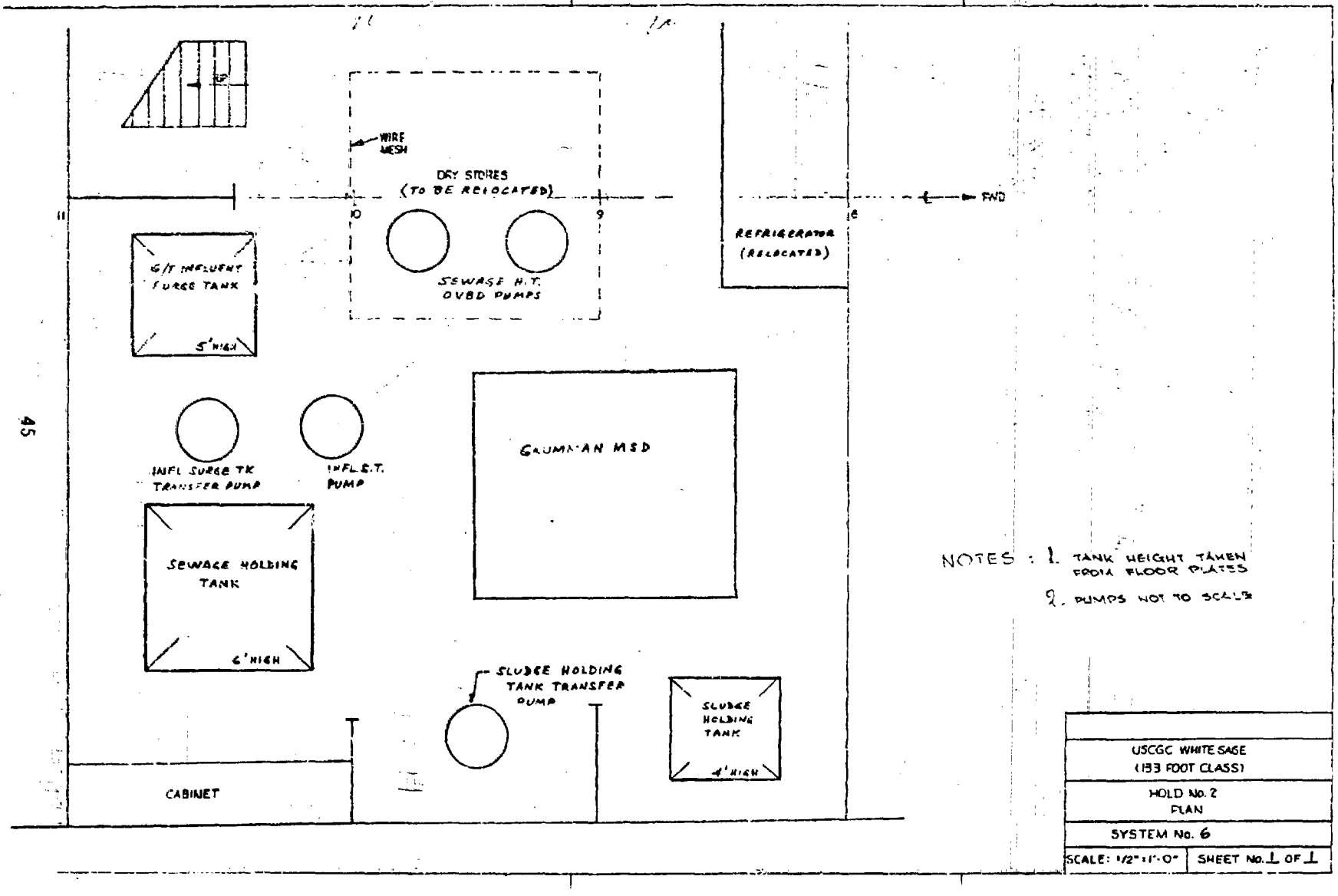
(f) Remaining Galley/Turbid drains would gravitate overboard and to the G/T Influent Surge Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank transfer pump would discharge the tank contents to the Sewage Holding Tank for discharge overboard and to pierside.

Vessel: WHITE SAGE (133')

System No. 6 (Cont'd)

To accommodate equipment locations the existing shelving arrangement along the starboard shell would have to be modified, the ship's dry stores enclosure would have to be relocated from the ship's centerline to some place on the Port side, and the ship's stores refrigerator along the forward bulkhead would have to be moved to Port to clear the Grumman unit. The refrigerator has its own two air-cooled compressors mounted on top of the refrigerator.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES

2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 6 |
| SCALE: 1/2"=1'-0" \| SHEET No. 1 OF 1 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 6

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,830[2] | 8,235 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 3,445[4] | 1,895 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 1,760[5] | 1,620 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 450 | 900 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 50 | 750 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 35 | 35 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 150 | 900 |
| Removals | Cutting | Hours | $50.00/Hr.[6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 15,460 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fitdngs, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 60 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

WMS No. 7 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Incinerator for Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions(L x W x H) |
|---|---|---|
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Sewage Influent Surge Tank | 110 gal. (15 cu. ft.) | 2' x 2' x 4' |
| Fuel Oil Day Tank | 25 gal. (3.3 cu. ft.) | 1'-6" x 1'-6" x 1'-6" |
| Grumman Unit with Incinerator | One (1) with One (1) Thiokol Incinerator | |
| Influent Surge Tank Pump | One (1) | |
| Influent Surge Tank Overboard Pump | Two (2) | |
| Galley/Turbid Holding Tank Overboard Pump | Two (2) | |

Discussion

The system is a viable candidate with certain considerations.

The components would be located as follows:

(a) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

(b) The Sewage Influent Surge Tank, Surge Tank Pump, and the tank's overboard pumps would be located in the Engine Room, Port side in place of the existing collecting tank.

(c) The Galley/Turbid Holding Tank would be fitted in Hold No. 2 where the existing retention tank is located. The Grumman MSD with the incinerator would be located just forward of the G/T Holding Tank; the Fuel Oil Day Tank would be located in the Starboard aft corner of the hold near the G/T Holding Tank.

(d) The G/T Holding Tank pumps for overboard/pierside discharge would be located inboard of the tank.

(e) In view of the arrangement of the vessel as described in the discussion of existing conditions at the beginning of this section, the incinerator stack run to the weather seems to be severely limited. The only apparent solution is to run it up through the Main Deck alongside the port or starboard sheer leg of the cargo boom tripod support structure. The structure legs begin near the overhead in Hold No. 2. Care would have to be exercised due to tight house access arrangements on the Main Deck and the navigational and operations clearance needed.

Drainage would be as follows:

(a) Sewage would gravitate to the Sewage Influent Surge tank in the Engine Room from which it would be pumped to the Grumman feed tank by the surge tank pump. The surge tank would be pumped overboard or to pierside by the tank's overboard pumps. The Surge tank pump and the tank overboard/ pierside discharge pump would discharge via the existing pipe tunnel through the lower part of the Port Fuel Oil Tank.

(b) Galley and Turbid drainage piping aft of Bhd No. 12 would be led to the G/T Holding Tank in Hold No. 2 through a new pipe tunnel passing through the upper part of the Port Fuel Oil Tank (similar to the existing one which passes through the lower part of the tank).

(c) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via the aforementioned new pipe tunnel through the Port Fuel Oil Tank.

(d) Drains from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(e) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 directly. The tank discharge pumps would be capable of discharging the tank contents overboard and to pierside.

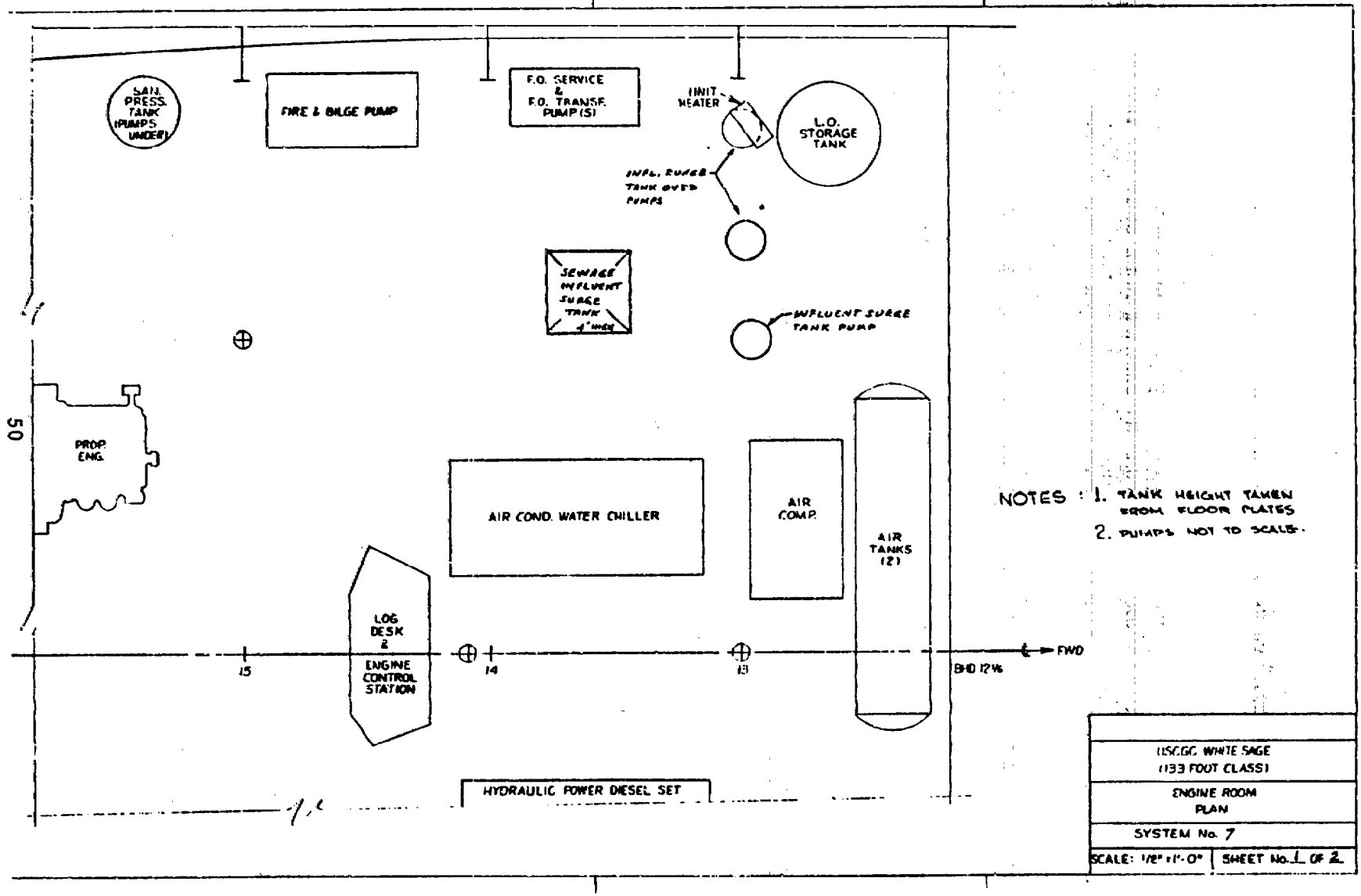
Vessel: WHITE SAGE (133')

System No. 7 (Cont'd)

To accommodate the equipment in Hold No. 2, minor modifications would be required to the shelving on the starboard side (along the shell of the vessel); the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10) would have to be moved to port of the ship's centerline; the ship's stores refrigerator along the forward bulkhead would have to be moved to port to clear the Grumman unit. The refrigerator has its own two air-cooled compressors mounted on top of the refrigerator.

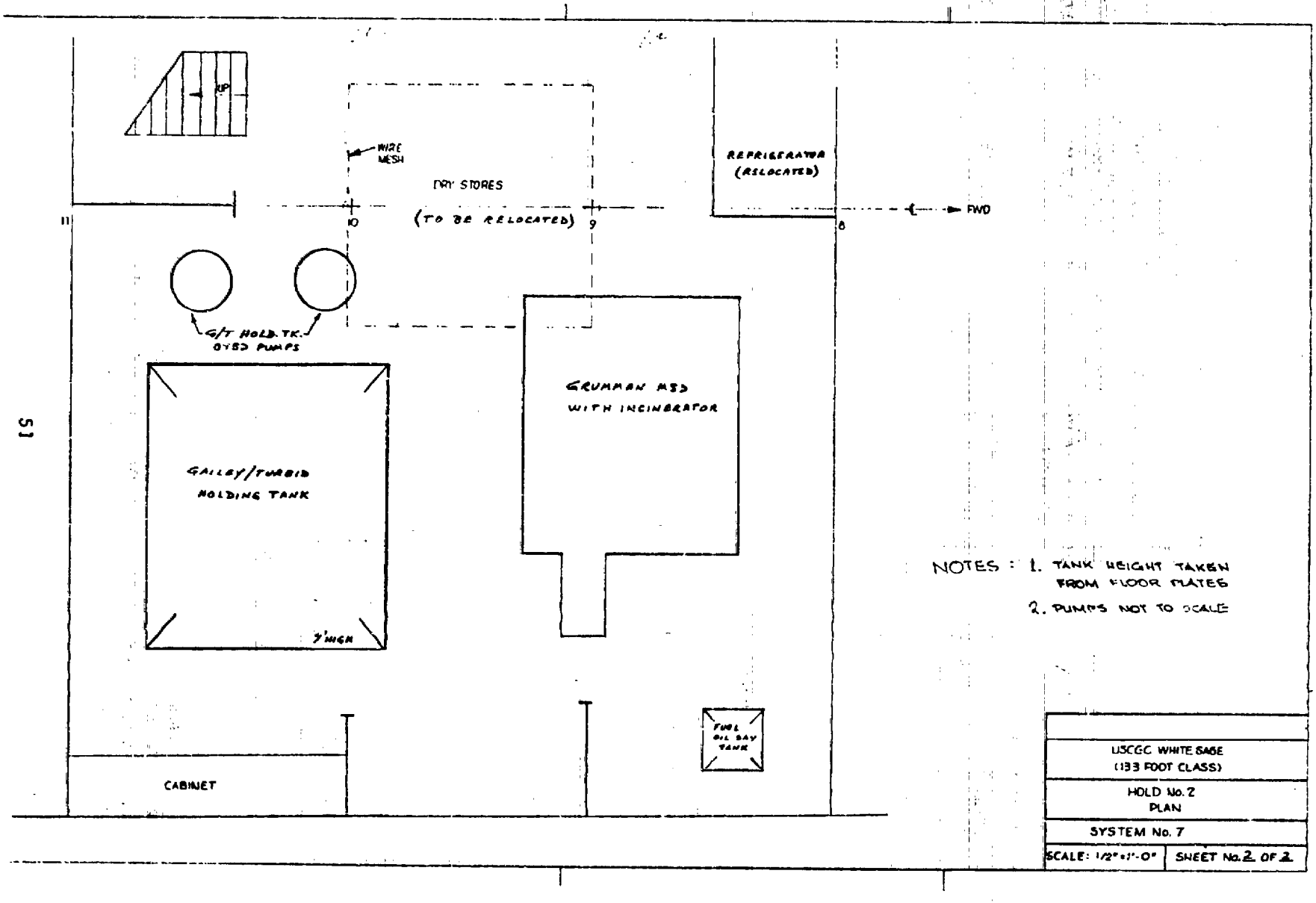
Due to the incinerator installation additional fire protection will have to be provided and the ventilation system for Hold No. 2 will have to be modified.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 7 |
| SCALE: 1/2" = 1'-0" \| SHEET No. 1 OF 2 |


UP
WIRE MESH
DRY STORES
(TO BE RELOCATED)
REFRIGERATOR
(RELOCATED)
FWD
11
10
9
8
G/T HOLD. TK.
OTBD PUMPS
GRUMMAN MS3
WITH INCINERATOR
GALLEY/FWDED
HOLDING TANK
5'HIGH
FUEL OIL DAY TANK
CABINET
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No. 2
PLAN
SYSTEM No. 7
SCALE: 1/2"=1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 7

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 3,775 [2] | 16,988 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 2,525 [4] | 1,389 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 1,505 [5] | 1,385 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 375 | 750 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 40 | 600 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 35 | 35 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 135 | 810 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 23,082 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 8 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Incinerator for Combined Black and Gray Waters

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Influent Surge Tank | 432 gal. (58 cu. ft.) | 3'-9" x 4' x 4' |
| Fuel Oil Day Tank | 25 gal. (3.3 cu. ft.) | 1'-6" x 1'-6" x 1'-6" |
| Grumman Units with Incinerators | One (1) with One (1) Thiokol Incinerator | |
| Influent Surge Tank Pump | One (1) | |
| Influent Surge Tank Overboard Pumps | Two (2) | |

Discussion

The system is a viable candidate with certain considerations.

The system is very similar to System No. 7 except that the Galley/Turbid Holding Tank and its overboard/pierside discharge pumps have been deleted.

The components would be located as follows:

(a) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

(b) The Influent Surge Tank, Surge Tank Pump, and the tank's overboard pumps would be located in the Engine Room, Port side in place of the existing collecting tank.

(c) The Grumman MSD with the incinerator would be located in Hold No. 2 in place of the existing retention tank.

(d) In view of the arrangement of the vessel as described in the discussion of existing conditions at the beginning of this section, the incinerator stack run to the weather seems to be severly limited. The only apparent solution is to run it up through the Main Deck alongside the port or starboard sheer leg of the cargo boom tripod support structure. The structure legs begin near the overhead in Hold No. 2. Care would have to be exercised due to tight house access arrangements on the Main Deck and the navigational and operational clearances needed.

Drainage would be as follows:

(a) Sewage and Galley/Turbid water would go to the Influent Surge Tank from which it would be pumped by the surge tank pump to the Grumman feed tank via the existing pipe tunnel through the Port Fuel Oil Tank. The Influent Surge Tank overboard pump would discharge overboard/ pierside via the same pipe tunnel to the existing connections.

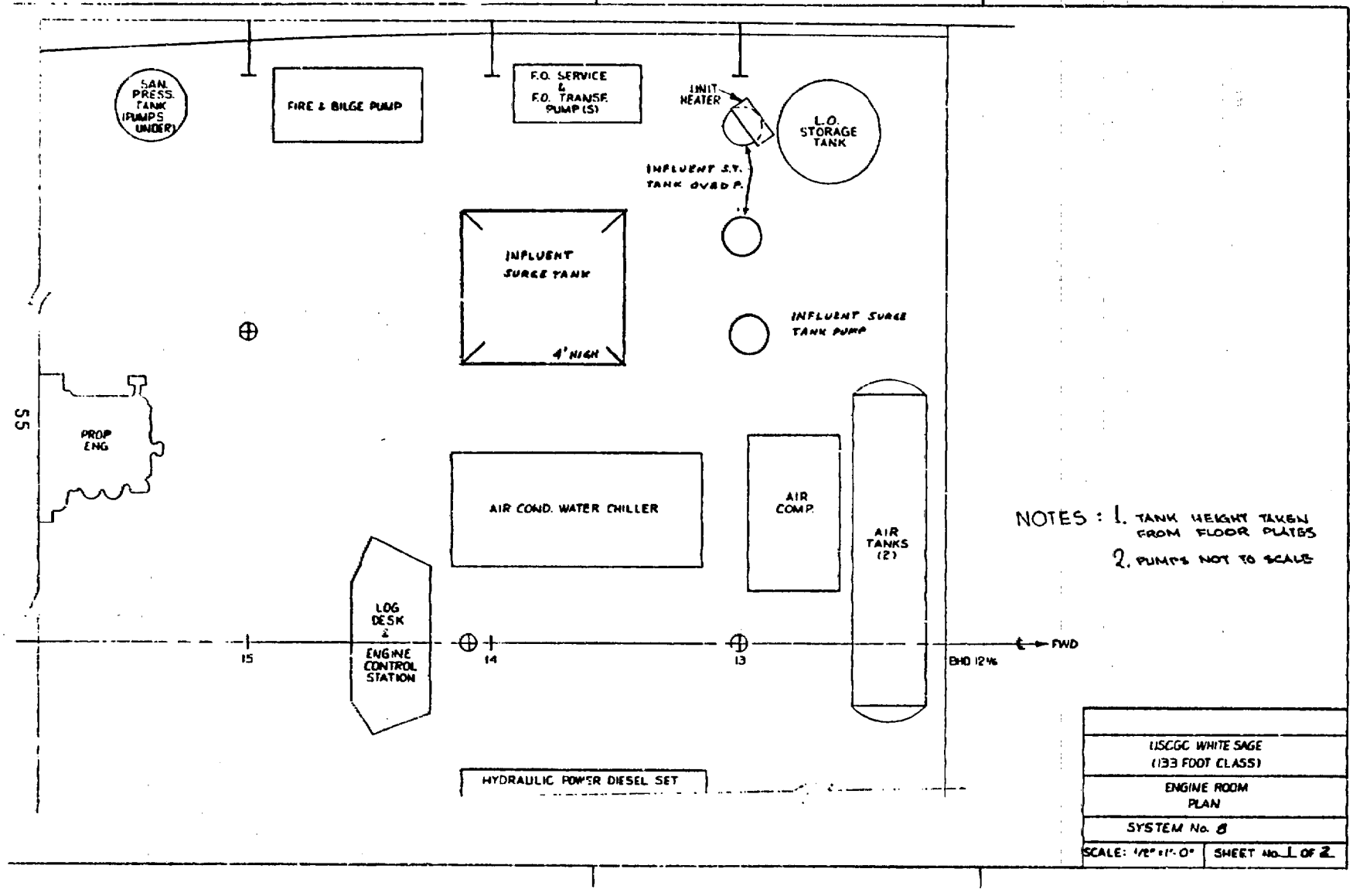
(b) The effluent from the existing 25 gallon Galley Sink/deck drain collecting tank would be pumped to the influent surge tank.

(c) Drains from the drinking fountain on the Main Deck, Frame 14, would have to be re-routed to drain into the 25 gallon collecting tank.

To accommodate the equipment in Hold No. 2, shelving may have to be modified and the wire mesh enclosure for ship's dry stores may have to be moved to port.

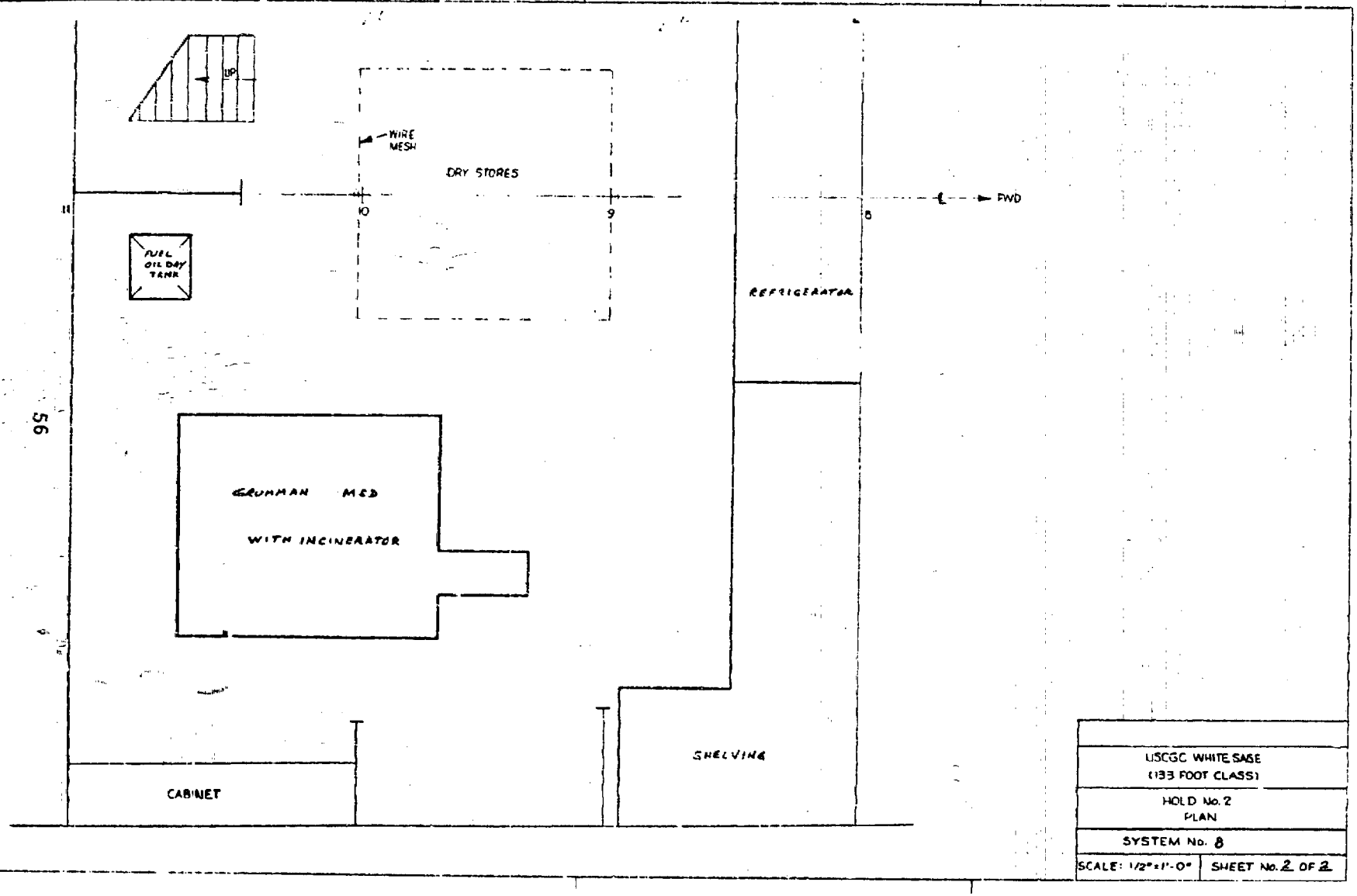
Due to the incinerator installation additional fire protection will have to be provided and the ventilation system for Hold No. 2 will have to be modified.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 8 |
| SCALE: 1/8" = 1'-0" \| SHEET No. 1 OF 2 |




| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 8 |
| SCALE: 1/2"=1'-0" \| SHEET No. 2 OF 2 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 8

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,875 [2] | 8,438 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 1,415 [4] | 779 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 1,005 [5] | 925 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 225 | 450 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 135 | 810 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 13,102 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

WMS No. 9 JERED Reduced Volume Flush Vacuum Collection/Holding Tank for Concentrated Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Vacuum Collection Tank | 30 gal. (4.4 cu.ft.) | 16" dia. x 38" H |
| Sanitary Holding Tank | 200 gal. (27 cu.ft.) | 3' x 3' x 3' |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Sanitary Holding Tank Overboard Pumps | Two (2) | |
| Galley/Turbid Holding Tank Overboard Pumps | Two (2) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system would be required.

The components would be located as follows:

(a) The Vacuum Collection Tank and its pumps would be located in the Engine Room, port side, where the existing collection tank is fitted.

(b) The Sanitary Holding Tank and its overboard pumps would be located just aft of the vacuum collection tank.

(c) The Galley/Turbid Holding Tank and its overboard discharge pumps would be located in Hold No. 2 in place of the existing retention tank.

(d) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

Vessel: WHITE SAGE (133')

System No. 9 (Cont'd)

Drainage would be as follows:

(a) Sewage would be collected in the Vacuum Collection Tank and transfered to the Sanitary Holding Tank. The holding tank discharge pump's discharge line would be led to Hold No. 2 via the existing pipe tunnel passing through the lower inboard side of the Port Fuel Oil Tank. From there it would run to the existing overboard shell connection and to the existing weather deck discharge connections to pierside, port and starboard.

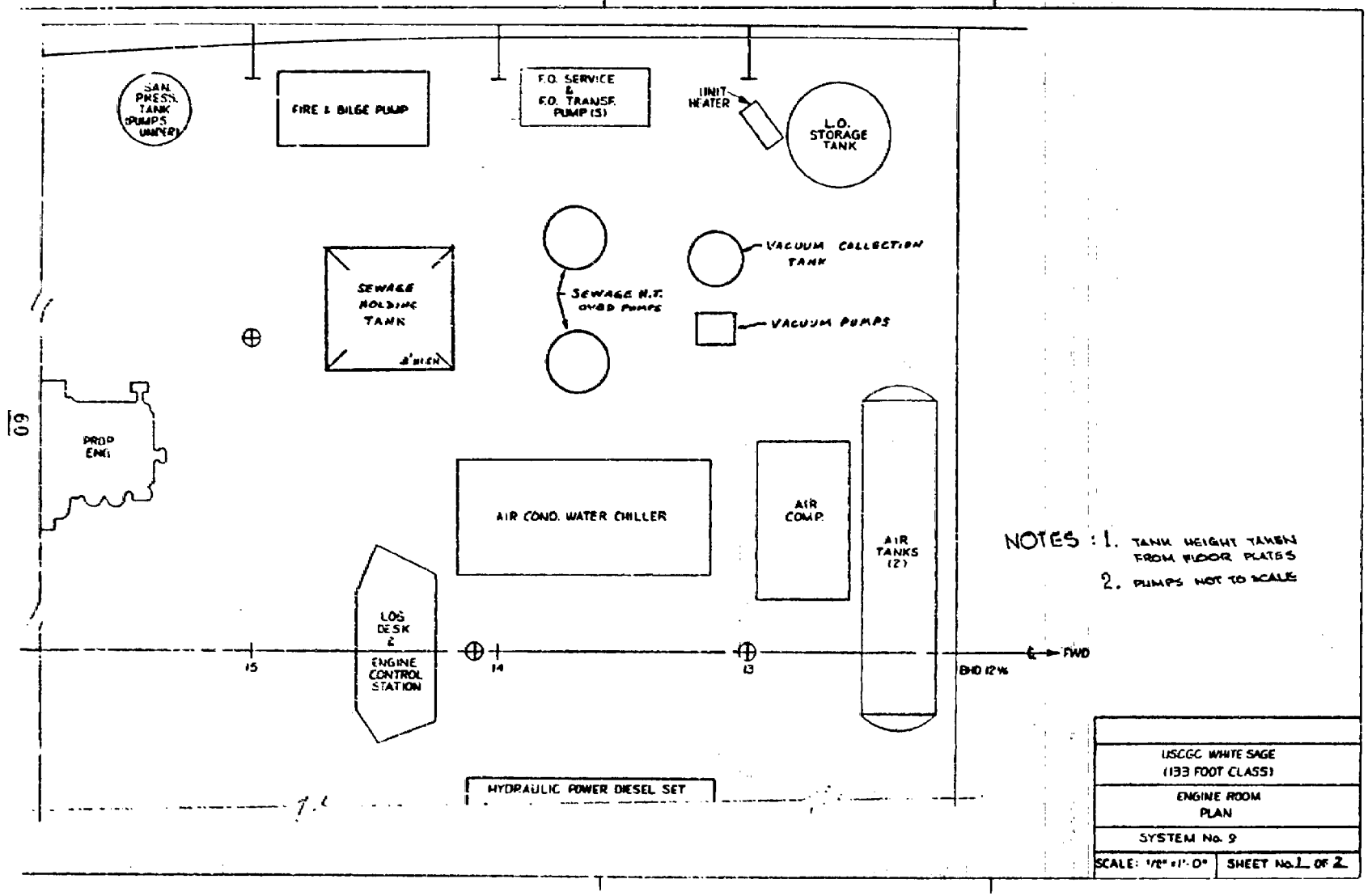
(b) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

(c) Drain from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(d) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pump would be capable of discharging the tank contents overboard and to pierside.

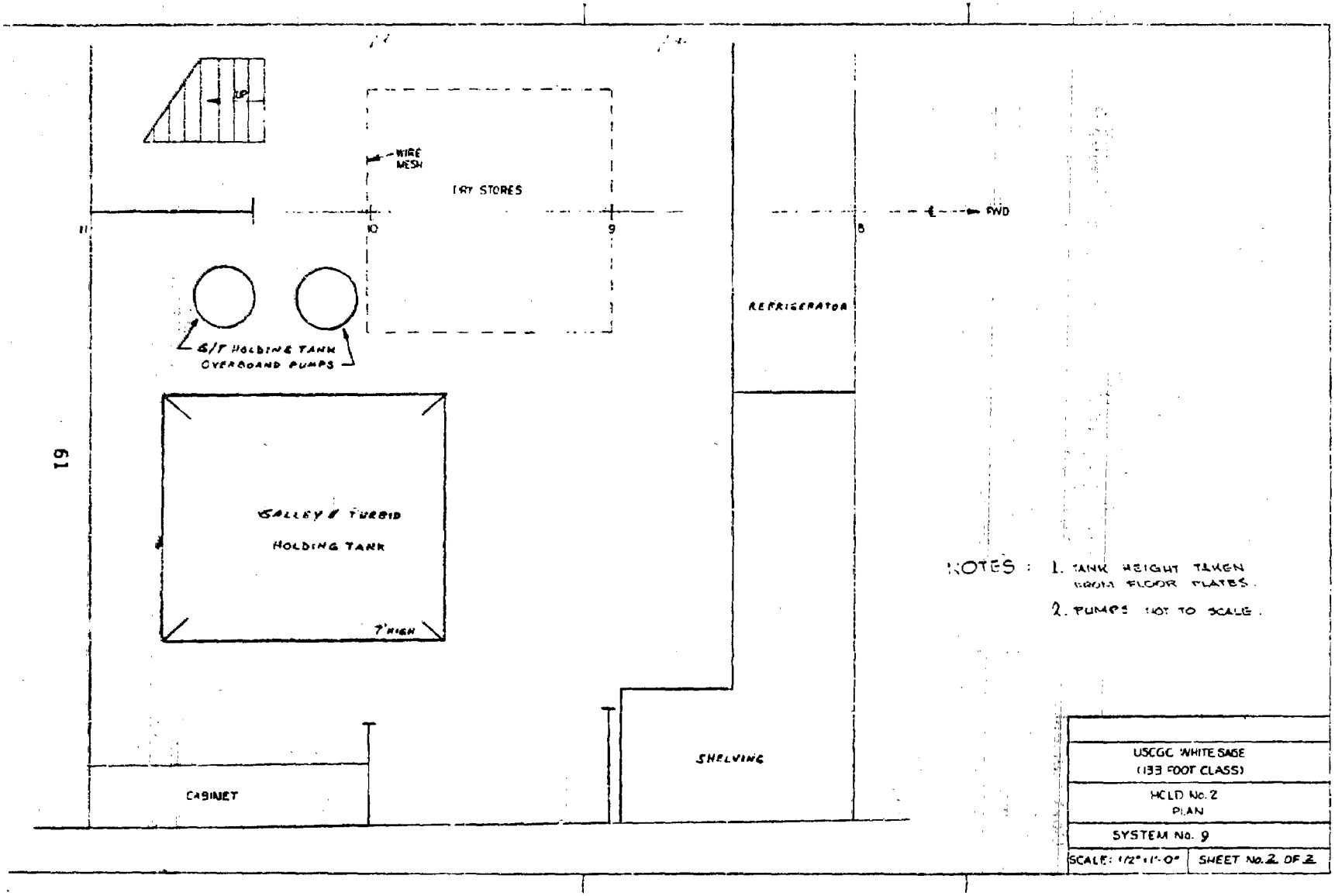
To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 9 |
| SCALE: 1/8" = 1'-0" \| SHEET No. 1 OF 2 |


WIRE MESH
DRY STORES
FWD
11
10
9
8
REFRIGERATOR
G/F HOLDING TANK OVERBOARD PUMPS
GALLEY & TURBID HOLDING TANK
7' HIGH
SHELVING
CABINET
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No. 2
PLAN
SYSTEM No. 9
SCALE: 1/2"=1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 9

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,120 [2] | 5,040 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 4,260 [4] | 2,343 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,425 [5] | 2,231 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 300 | 600 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 135 | 810 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 12,724 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 10 JERED Reduced Volume Flush Vacuum Collection/Incinerator for Concentrated Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Vacuum Collection Tank | 120 gal. (18 cu. ft.) | 2' dia. x 5'-9" L |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu. ft.) | 7' x 6' x 7' |
| Incinerator Feed Tank (Sludge) | 50 gal. (6.5 cu. ft.) | 2'-6" x 1' x 2'-7" |
| Fuel Oil Day Tank | 22 gal. (3.0 cu.ft.) | 1'-6" x 1'-6" x 1'-6" |
| Incinerator | One (1) Thiokol | |
| Vacuum Collection Tank Overboard Pump | One (1) | |
| G/T Holding Tank Overboard Pump | Two (2) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system will be required.

The components would be located as follows:

(a) The Vacuum Collection Tank and its pumps would be located in the Engine Room, port side, where the existing collection tank is fitted.

(b) The incinerator and blower would be fitted aft of the VCT.

The fuel oil day tank would be located on the Engine Room forward bulkhead near the VCT.

The incinerator stack would go up the ship's stack alongside the diesel engine exhausts.

(c) The Galley/Turbid Holding Tank would be located in Hold No. 2 in place of the existing retention tank. Its overboard pumps would be located inboard of the tank.

(d) The existing 25 gallon Galley Retention Tank (with internal sump pump) located in the starboard aft corner of the Engine Room would be retained.

Drainage would be as follows:

(a) Sewage would be collected in the Vacuum Collection Tank (VCT) and transfered to the incinerator via the feed (Sludge) tank.

(b) The VCT would be pumped overboard and pierside by its overboard pump via the existing pipe tunnel through the lower part of the Port Fuel Oil Tank to the existing connections in Hold No. 2.

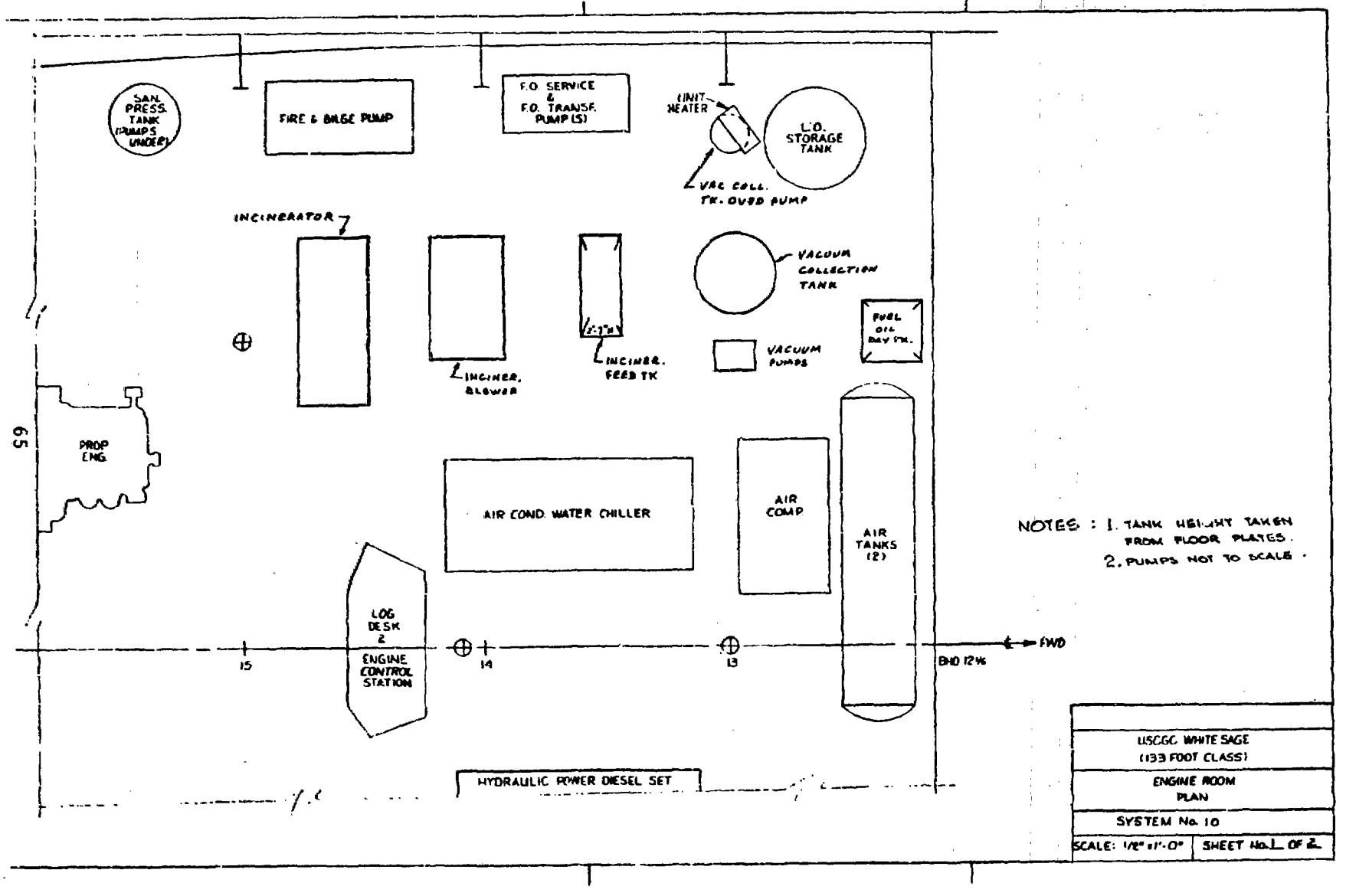
(c) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

(d) Drain from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(e) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pump would be capable of discharging the tank contents overboard and to pierside.

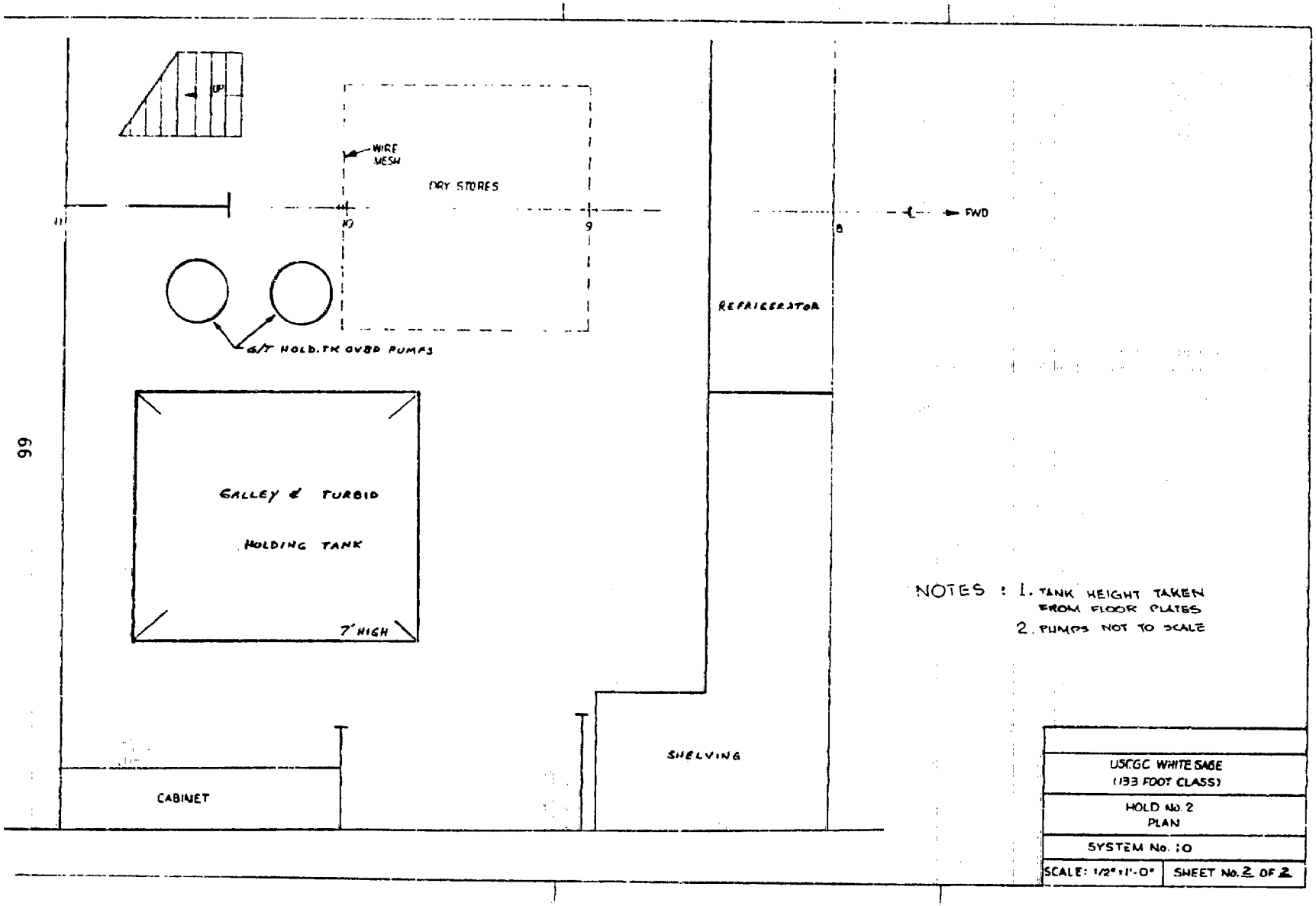
To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclsoure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 10 |
| SCALE: 1/2" = 1'-0" \| SHEET No. 1 OF 2 |


UP
WIRE MESH
DRY STORES
11
10
9
8
FWD
REFRIGERATOR
G/T HOLD. TK OVBD PUMPS
GALLEY & TURBID
HOLDING TANK
7' HIGH
SHELVING
CABINET
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No. 2
PLAN
SYSTEM No. : O
SCALE: 1/2" = 1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 10

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 2,025 [2] | 9,113 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 3,780 [4] | 2,079 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,457 [5] | 2,277 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 250 | 500 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 130 | 780 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 16,299 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

**WMS No. 11** JERED Reduced Volume Flush Vacuum Collection/GATX Evaporator for Concentrated Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) | 16" dia. x 38" L |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Evaporator (GATX) | One (1) - 80 gal. | |
| Catalytic Oxidizer | One (1) | |
| Galley/Turbid Holding Tank Overboard Pumps | Two (2) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system would be required.

The equipment would be located as follows:

(a) The Vacuum Collection Tank and its pumps would be located in the Engine Room, port side, where the existing collection tank is fitted.

(b) The GATX Evaporator would be located just aft of the VCT.

(c) The existing 25 gallon Galley Collecting Tank located in the starboard aft corner of the Engine Room would be retained. The tank has a built-in liquid level controlled discharge pump.

(d) The Galley/Turbid Holding Tank would be located in Hold No. 2 in place of the existing retention tank. Its overboard pumps would be located inboard of the tank.

Vessel: WHITE SAGE (133')

System No. 11 (Cont'd)

Drainage would be as follows:

(a) Sewage would be collected in the Vacuum Collection Tank (VCT) and transfered to the evaporator.

(b) The pumps forming a part of the VCT assembly would discharge the sewage overboard or pierside via the existing pipe tunnel passing through the lower part of the Port Fuel Oil Tank to the existing connections in Hold No. 2.

(c) Sludge from the evaporator would be pumped overboard/ pierside by its own pump via the same route as for the VCT.

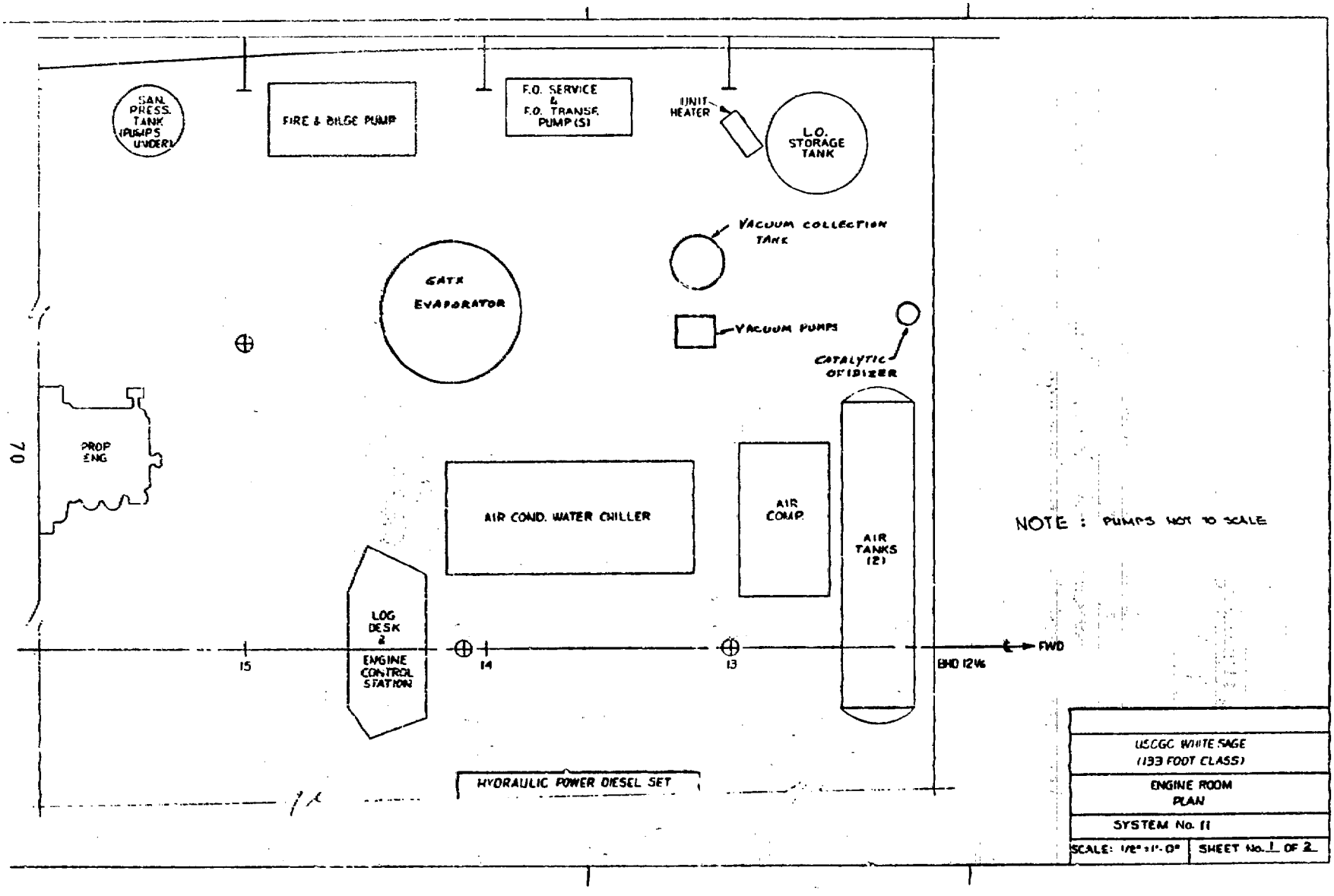
(d) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

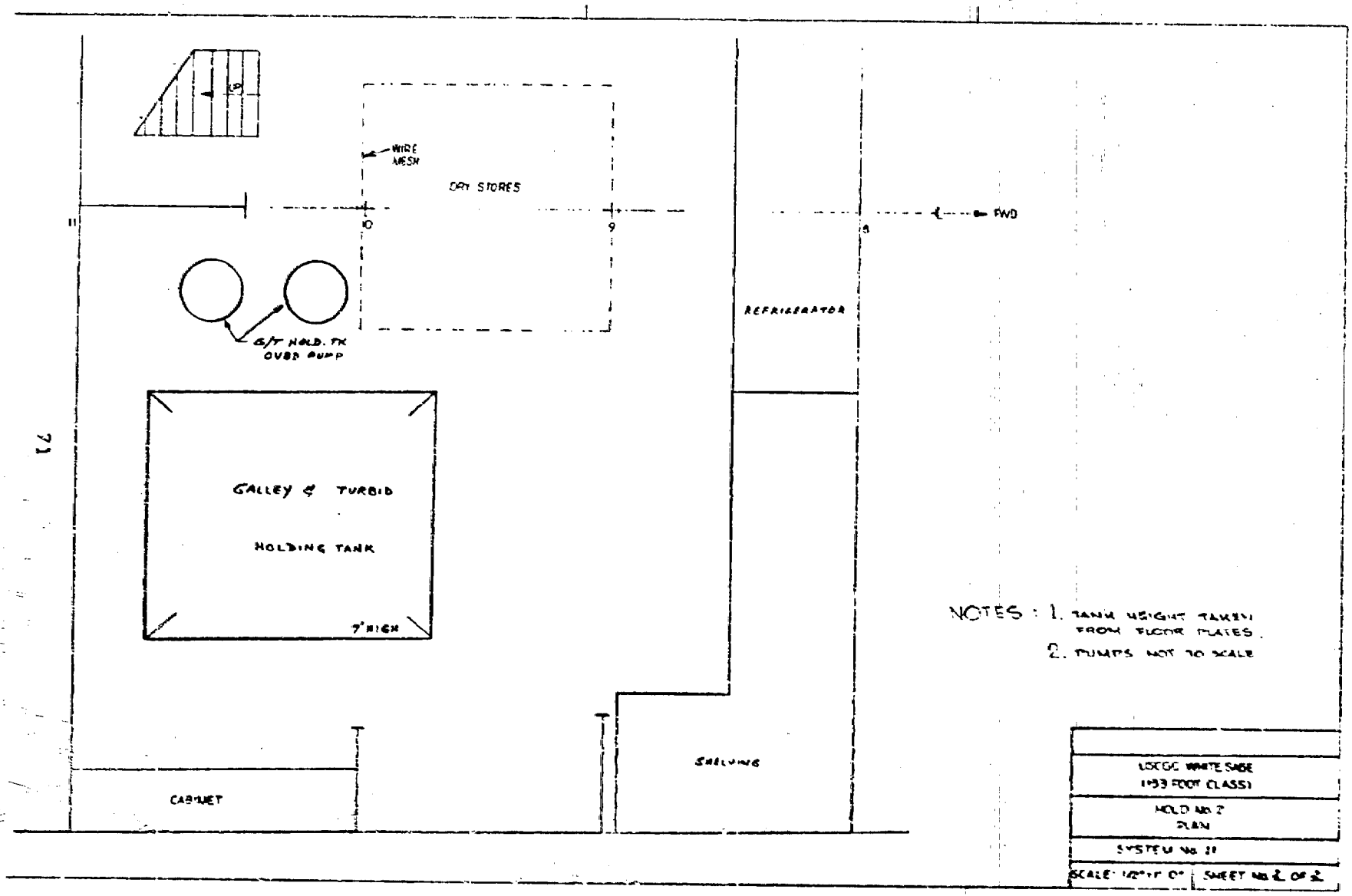
(e) Drain from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(f) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pumps would be capable of discharging the tank contents overboard and to pierside.

To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




WIRE MESH
DRY STORES
10
9
8
FWD
G/T HOLD. TK
OVBD PUMP
REFRIGERATOR
GALLEY & TURBID
HOLDING TANK
7' HIGH
CABINET
SHELVING
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE
(153 FOOT CLASS)
HOLD NO 2
PLAN
SYSTEM No II
SCALE: 1/2" = 1'-0"
SHEET No 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 11

| Installation Cost Element | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|
| Piping[1] | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,280 [2] | 5,760 |
| Tank Steel[3] | Pounds | $ .55/Lb. (Materials and Labor) | 3,540 [4] | 1,947 |
| Foundations | Pounds | $ .92/Lb. (Materials and Labor) | 2,340 [5] | 2,153 |
| Electric Cables | Foot | $ 2.00/Ft. (Materials and Labor) | 200 | 400 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | Man-Hours | $15.00/MH (Labor) | 20 | 300 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | Foot | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | Foot | $ 6.00/Ft. (Materials and Labor) | 80 | 480 |
| Removals: Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| Removals: Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | 12,215 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 80% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 50% added to allow for required structural stiffening by proper support.
(5) Estimated on the basis of 1.5' of the weight which has to be supported.
(6) Based on an assumed cutting rate of 30 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

WMS No. 12 JERED Reduced Volume Flush Vacuum Collection/Holding Tank for Concentrated Black Water/Grumman Flow Through System with Sludge Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Galley/Turbid Influent Surge Tank | 322 gal. (43 cu. ft.) | 3'-6" dia. x 5' H |
| Sludge Holding Tank | 172 gal. (23 cu. ft.) | 2'-6" x 2'-6" x 4' |
| Sewage Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) | 16" dia. x 39" L |
| Sewage Holding Tank | 200 gal. (27 cu. ft.) | 3' x 3' x 3' |
| Grumman Unit without Incinerator | One (1) | |
| Sewage Holding Tank Overboard Pumps | Two (2) | |
| Sludge Holding Tank Transfer Pump | One (1) | |
| Influent Surge Tank Transfer Pump | One (1) | |
| Influent Surge Tank Pump | One (1) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system will be required.

The components would be located as follows:

(a) The Galley/Turbid Influent Surge Tank and its pumps would be located in the Engine Room, port side, in place of the existing collection tank.

(b) The Vacuum Collection Tank and pumps would be located aft of the G/T Holding Tank.

(c) The Sewage Holding Tank would be located aft of the VCT. The tank overboard pumps would be located forward and inboard of the Sewage Holding Tank.

(d) The existing 25 gallon Galley Retention Tank located in the starboard aft corner of the Engine Room would be retained. The tank has a built-in liquid level controlled discharge pump.

(e) The Grumman MSD, Sludge Holding Tank and its transfer pump would be located in Hold No. 2 in place of the existing retention tank.

Drainage would be as follows:

(a) Sewage would be collected in the Vacuum Collection Tank and transfered to the Sewage Holding Tank which would be pumped overboard or to pierside by the overboard pumps via the existing pipe tunnel through the Port Fuel Oil Tank to Hold No. 2 and then overboard using the existing connections.

(b) The 25 gallon Galley Retention Tank would discharge to the G/T Influent Surge Tank. The remaining G/T drains would gravitate to the tank. All gray water would also be capable of being discharged or gravitated overboard.

(c) Drains from the drinking fountain on the Main Deck, Frame 14, would have to be re-routed to the 25 gallon retention tank.

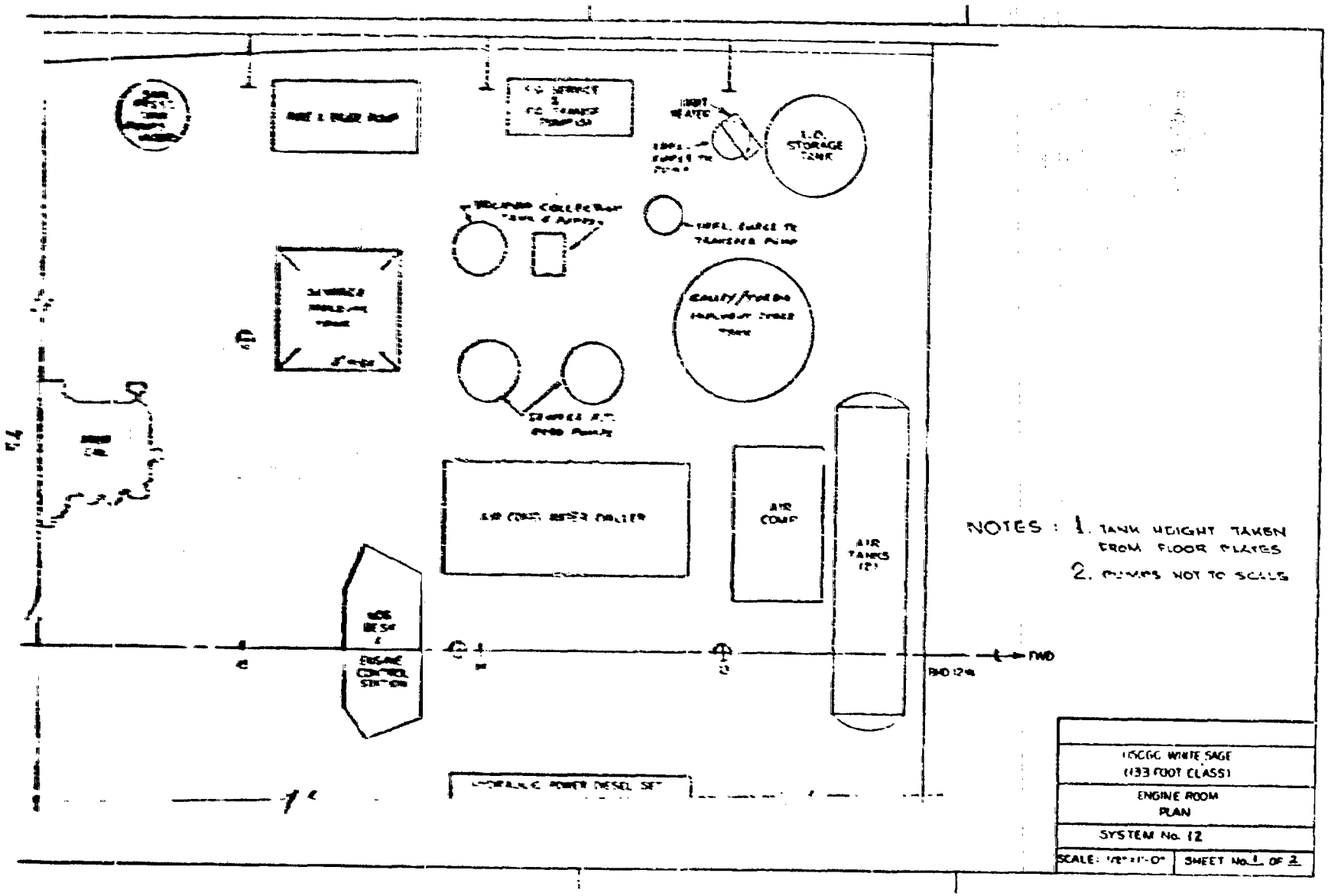
(d) The Surge Tank Transfer Pump would pump from the tank to the Sewage Holding Tank for discharge overboard or to pierside.

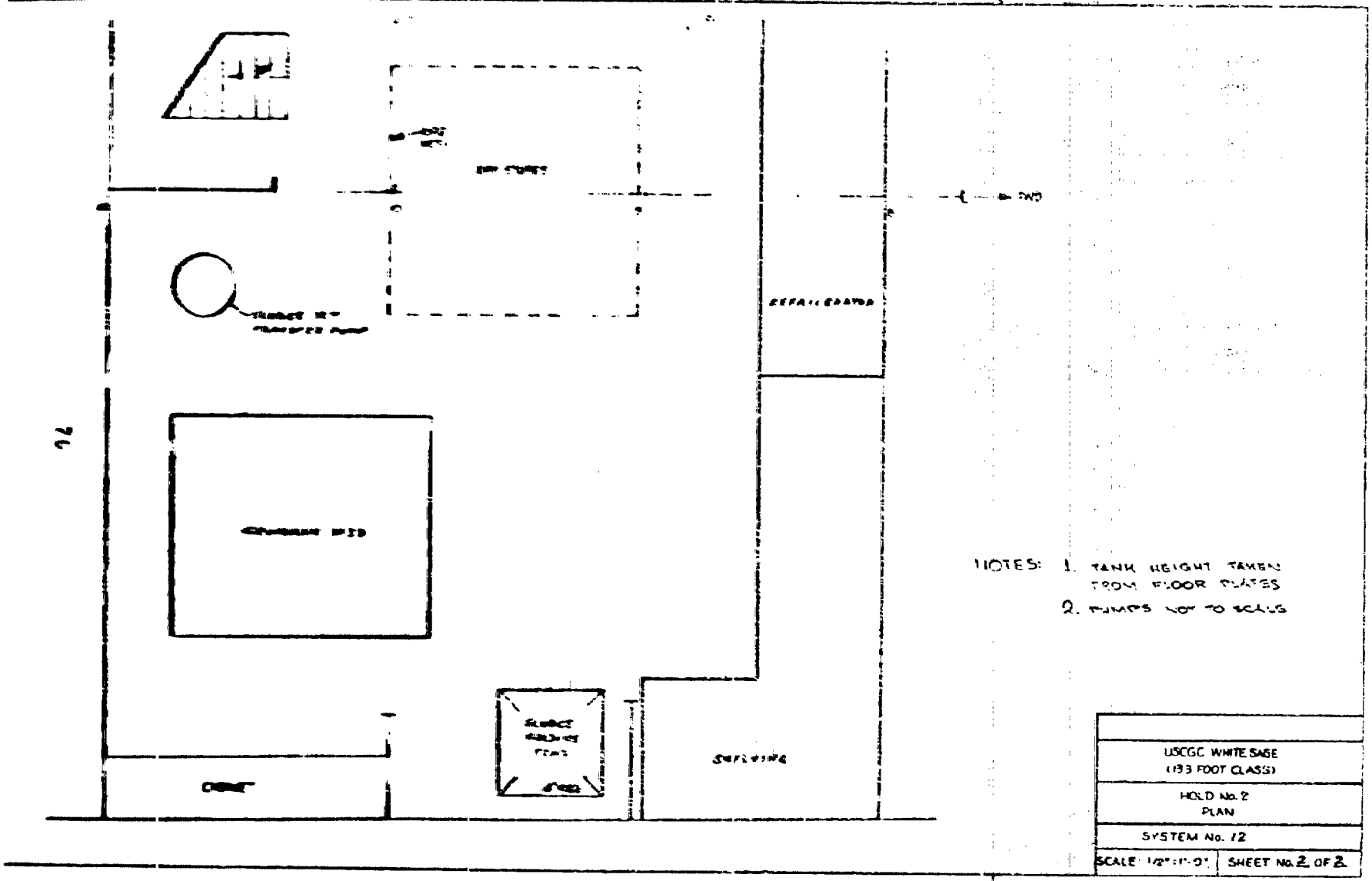
(e) The Surge Tank Pump would discharge to the Grumman Feed Tank in Hold No. 2 via the aforementioned existing pipe tunnel.

(f) The Sludge Holding Tank would be pumped back to the Sewage Holding Tank for off-loading via the aforementioned existing pipe tunnel.

To accommodate the equipment in Hold No. 2 the shelving along the starboard side would require modification as well as the wire mesh dry stores enclosure on the ship's centerline.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES: 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No. 2
PLAN
SYSTEM No. 12
SCALE 1/2"=1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 12

| Installation Cost Element | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|
| Piping[1] | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,150[2] | 5,175 |
| Tank Steel[3] | Pounds | $ .55/Lb. (Materials and Labor) | 2,410[4] | 1,326 |
| Foundations | Pounds | $ .92/Lb. (Materials and Labor) | 1,235[5] | 1,137 |
| Electric Cables | Feet | $ 2.00/Ft. (Materials and Labor) | 325 | 650 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | Man-Hours | $15.00/MH (Labor) | 40 | 600 |
| Access Cuts (in hull), deck plating or bulkhead to provide passageway) | Feet | $ 1.00/Ft. (Labor) | 40 | 40 |
| Welding | Feet | $ 6.00/Ft. (Materials and Labor) | 90 | 540 |
| Removals: Cutting | Hours | $50.00/Hr.[6] (Labor) | 15 | 750 |
| Removals: Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | 10,001 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 5% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 50% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 30 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel; WHITE SAGE (133')

WMS No. 13 JERED Reduced Volume Flush Vacuum Collection/Grumman Flow Through System for Gray Water/Incinerator for both Concentrated Black Water and Gray Water Sludge

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Galley/Turbid Surge Tank | 323 gal. (43 cu.ft.) | 3'-6" dia. x 5' H |
| Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) | 16" dia. x 38" H |
| Fuel Oil Day Tank | 40 gal. (5.3 cu. ft.) | 2' x 2' x 1'-6" |
| Grumman Unit with Incinerator | One (1) with One (1) Thiokol Incinerator | |
| Galley/Turbid Surge Tank Overboard Pump | One (1) | |
| G/T Surge Tank Pump | One (1) | |

Discussion

The system is a viable candidate with certain considerations.

A fresh water sanitary flushing system would be required.

The components would be located as follows:

(a) The Galley/Turbid Surge Tank would be located in the Engine Room, Port side, in place of the existing collection tank. The tank overboard pumps would be fitted outboard of the tank.

(b) The Vacuum Collection Tank and its pumps would be located just aft of the G/T Surge Tank.

(c) The existing 25 gallon Galley Retention Tank located in the aft Starboard corner of the Engine Room would be retained. The tank has a built in liquid level controlled discharge pump.

Vessel: WHITE SAGE (133')

System No. 13 (Cont'd)

(c) The Grumman MSD with the incinerator would be located on the Starboard side of Hold No. 2 in place of the existing retention tank.

(e) In view of the arrangement of the vessel as described in the discussion of existing conditions at the beginning of this section, the incinerator stack run to the weather seems to be severely limited. The only apparent solution is to run it up through the Main Deck alongside the port or starboard sheer leg of the cargo boom tripod support structure. The structure legs begin near the overhead in Hold No. 2. Care would have to be exercised due to tight house access arrangements on the Main Deck and the navigational and operational clearances needed.

Drainage would be as follows:

(a) Sewage would be collected in the Vacuum Collecting Tank for transfer to the Grumman Sludge Feed Tank or to overboard and pierside. Piping from the VCT pumps would pass into Hold No. 2 via the existing pipe tunnel through the lower part of the Port Fuel Oil Tank. The existing overboard and pierside connections would be re-used.

(b) The existing 25 gallon Galley Retention Tank would discharge into the G/T Influent Surge Tank. Remaining G/T drains would gravitate to the surge tank.

(c) Drain from the drinking fountain on the Main Deck, Frame 14, would have to be re-routed to the 25 gallon retention tank.

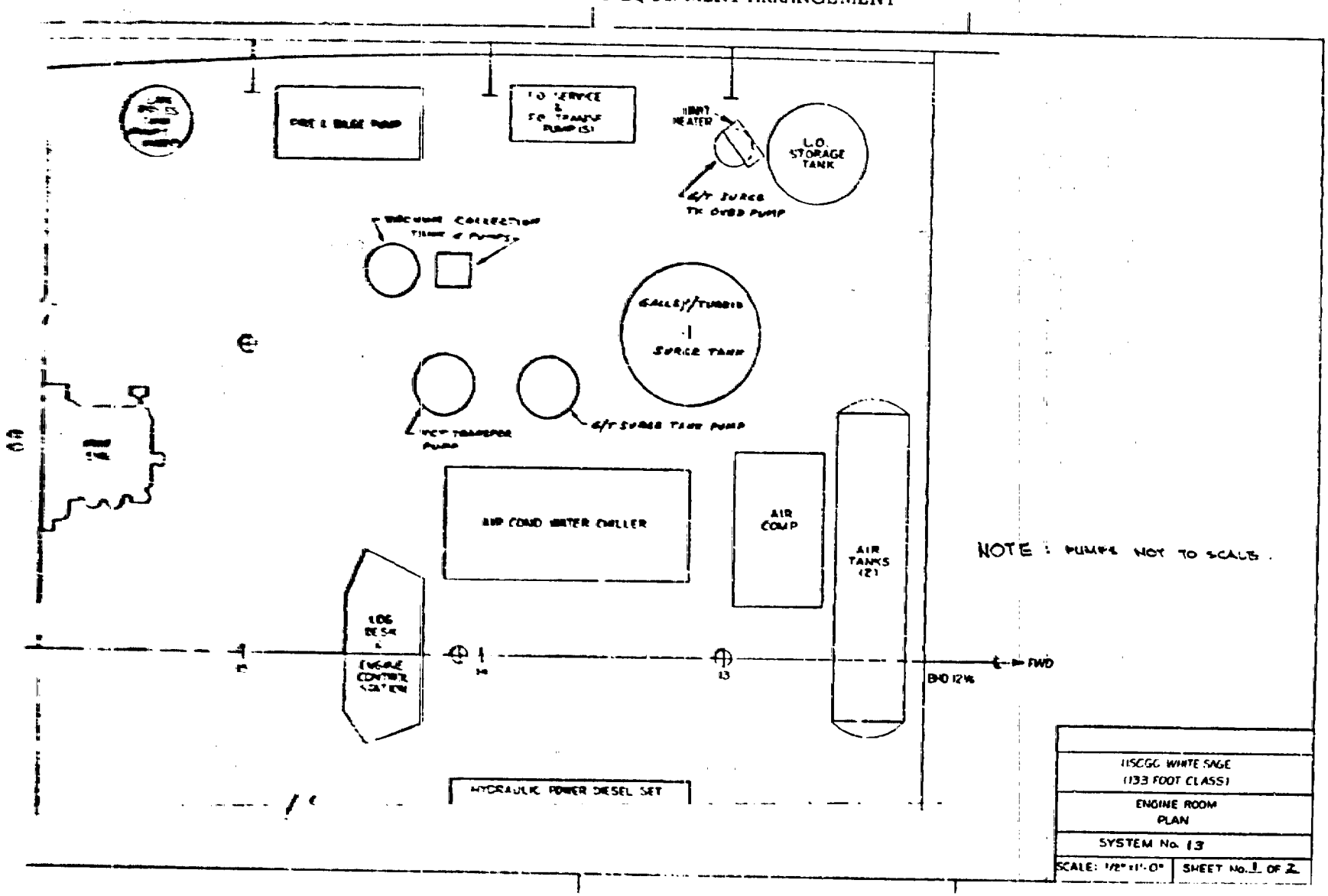
(d) The G/T Surge Tank Pump would discharge to the Grumman feed tank via the aforementioned pipe tunnel to Hold No. 2.

The G/T Surge Tank Overboard Pump would discharge via the same pipe tunnel to Hold No. 2 and then to the existing overboard and pierside connections.

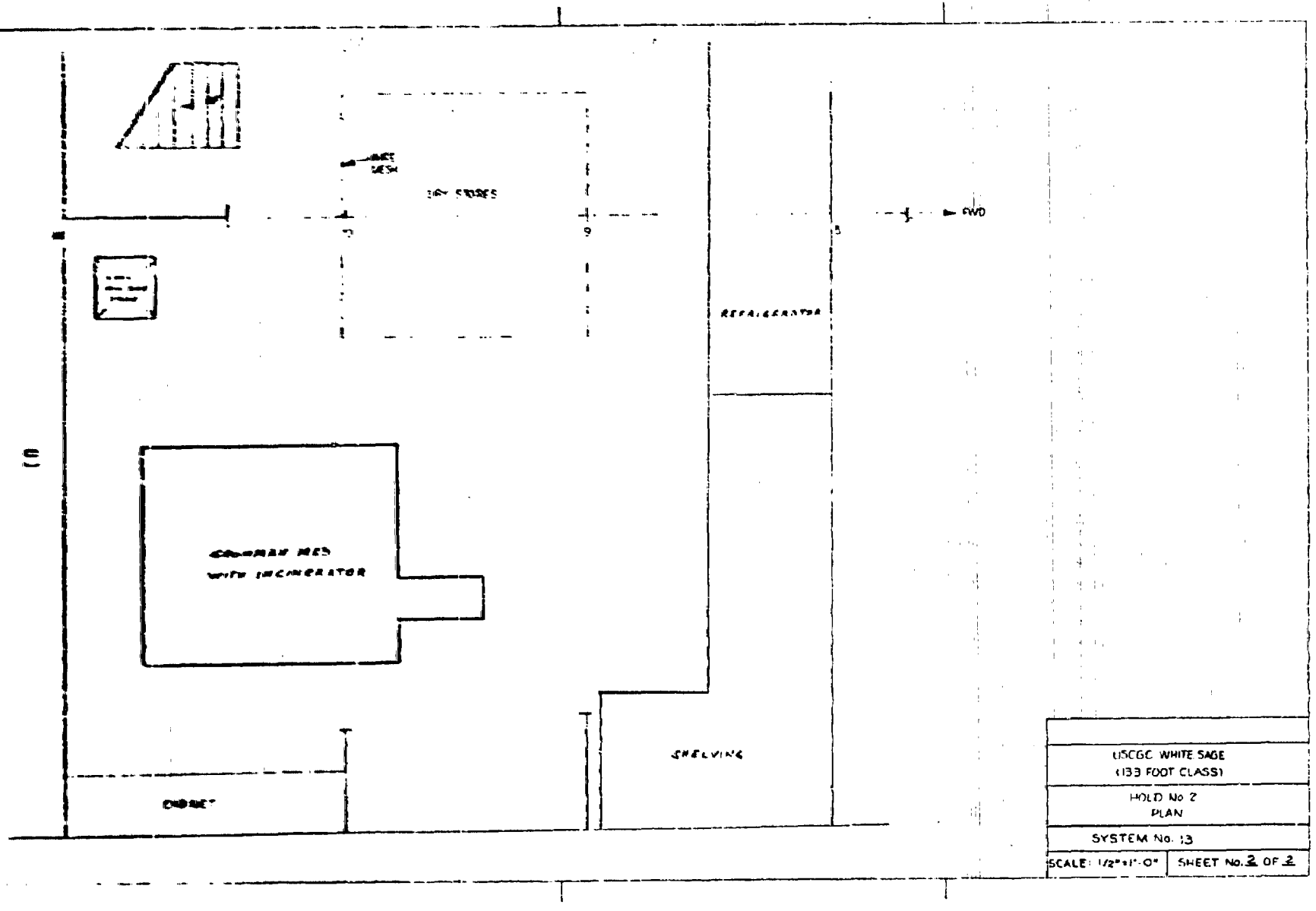
To accommodate the equipment in Hold No. 2, the shelving along the starboard shell will have to be modified and the ship's stores wire mesh enclosure on the centerline moved to port.

Due to the incinerator installation additional fire protection will have to be provided and the ventilation system for Hold No. 2 will have to be modified.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 13 |
| SCALE: 1/2"=1'-0" \| SHEET No. 1 OF 2 |




USCGC WHITE SAGE
(133 FOOT CLASS)

HOLD No 2
PLAN

SYSTEM No. 13

SCALE: 1/2"=1'-0" | SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 13

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 2,130 [2] | 9,585 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 1,255 [4] | 691 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 950 [5] | 874 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 200 | 400 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 90 | 540 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 13,640 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 60 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

**WMS No. 14** GATX Reduced Volume Flush M/T Pump Collection/Holding Tank for Concentrated Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Sewage Holding Tank | 232 gal. (31 cu. ft.) | 2' x 3' x 5'-6" |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu. ft.) | 7' x 6' x 7' |
| Sewage Holding Tank Discharge Pumps | Two (2) | |
| Galley Turbid Holding Tank Discharge Pumps | Two (2) | |
| Macerator/Transfer Pumps | Three (3) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system would be required.

The components would be located as follows:

(a) Sewage Holding Tank in the Engine Room, Port Side, Frame 14, just aft of location of existing collecting tank.

(b) Sewage Holding Tank Discharge Pumps (overboard/pierside) just fwd of the tank.

(c) Galley/Turbid Holding Tank in Hold No. 2, Starboard side, in the location of the existing retention tank.

(d) Galley/Turbid Holding Tank Discharge Pumps (overboard/pierside) just forward of the tank.

(e) The existing 25 gallon Galley Retention Tank located on the operating level of the Engine Room, in the aft Starboard corner, would be retained. The tank has a built-in liquid level controlled discharge pump.

Drainage would be as follows:

(a) Sewage would be pumped to the Sewage Holding Tank by macerator/transfer pumps. The tank discharge pump's discharge line would be led to Hold No. 2 via the existing pipe tunnel passing through the lower inboard side of the Port Fuel Oil Tank. From there it would run to the existing overboard shell connection and to the existing weather deck discharge connections to pierside, port and starboard.

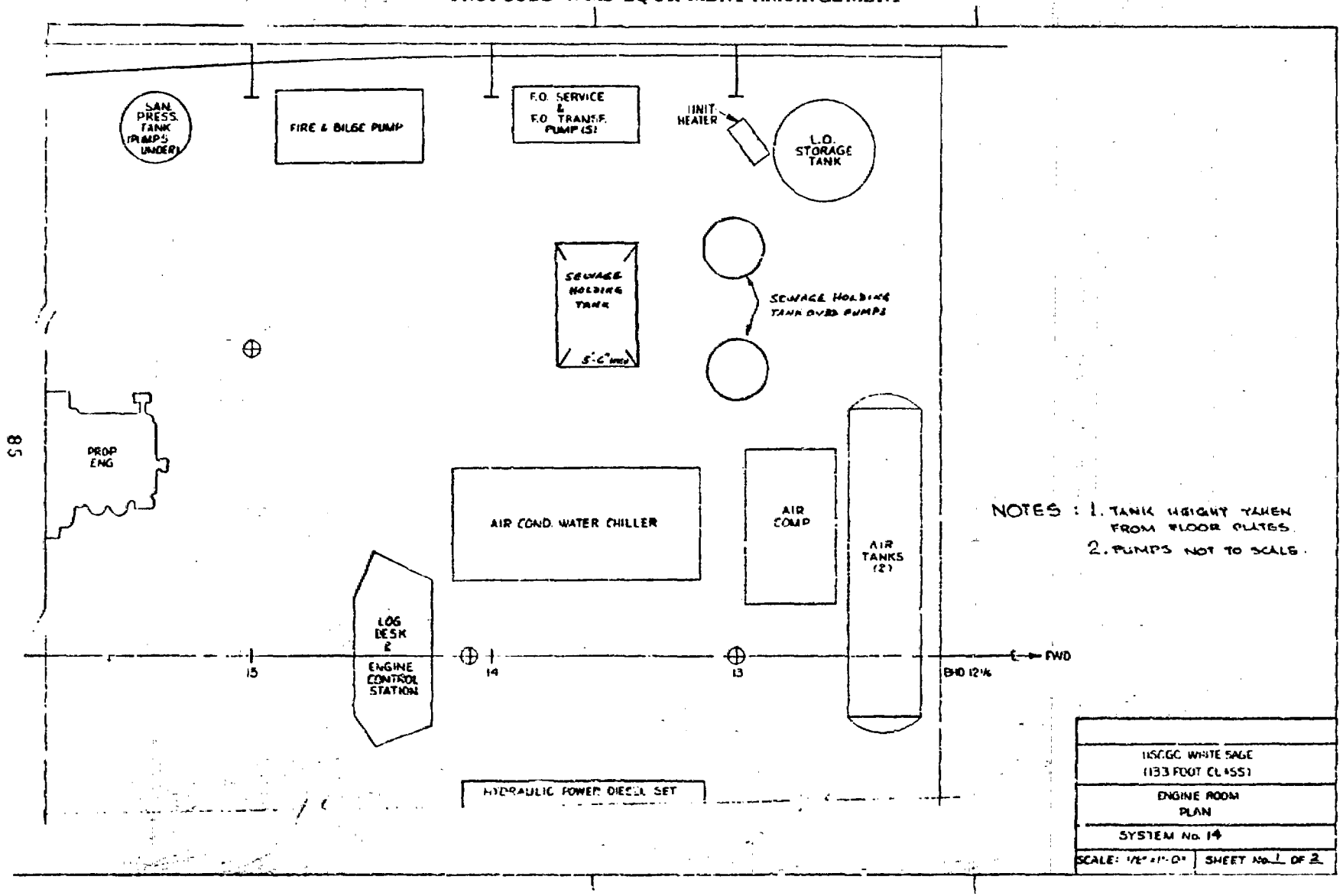
(b) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

(c) Drains from the drinking fountain on the Main Deck, Frame 14 to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(d) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pump would be capable of discharging the tank contents overboard and to pierside.

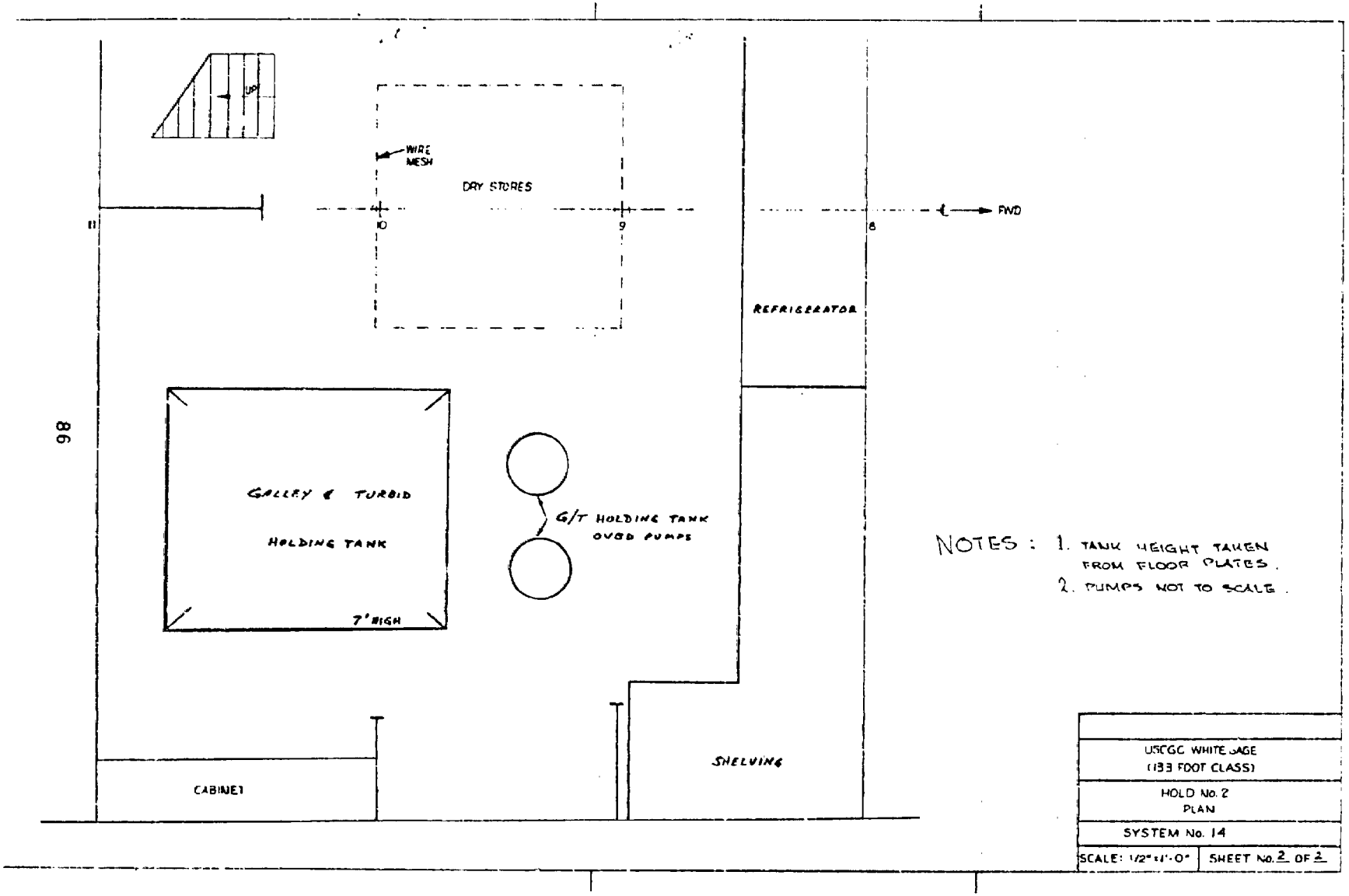
To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 14 |
| SCALE: 1/8" = 1'-0" \| SHEET No. 1 OF 2 |


UP
WIRE MESH
DRY STORES
11
10
9
8
FWD
REFRIGERATOR
98
GALLEY & TURBID
HOLDING TANK
7' HIGH
G/T HOLDING TANK
OVBD PUMPS
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.
CABINET
SHELVING
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No. 2
PLAN
SYSTEM No. 14
SCALE: 1/2"=1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 14

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,000 [2] | 4,500 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 4,430 [4] | 2,437 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,475 [5] | 2,277 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 250 | 500 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 35 | 525 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 95 | 570 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 11,984 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 15 GATX Reduced Volume Flush M/T Pump Collection/Incinerator for Concentrated Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Incinerator Feed Tank | 50 gal. (6.7 cu. ft.) | 2'-6" x 1' x 2'-7" |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu. ft.) | 7' x 6' x 7' |
| Fuel Oil Day Tank | 22 gal. (3 cu. ft.) | 1'-6" x 1'-6" x 1'-6" |
| Incinerator | One (1) Thiokol | |
| Incinerator Feed Pump | One (1) | |
| Incinerator Feed Tank Overboard Pump | One (1) | |
| Galley/Turbid Holding Tank Overboard Pump | Two (2) | |
| Macerator/Transfer Pumps | Three (3) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system would be required.

The components would be located as follows:

(a) The Incinerator Feed Tank and feed pump would be located in the Engine Room, port side, where the existing collection tank is fitted.

(b) The incinerator and blower would be located aft of the Incinerator Feed Tank.

The fuel oil day tank would be located on the Engine Room forward bulkhead near the feed tank.

The incinerator stack would go up the ship's stack alongside the diesel engine exhausts.

(c) The existing 25 gallon Galley Retention Tank located in the starboard aft corner of the Engine Room would be retained. The tank has a built-in liquid level controlled discharge pump.

(d) The Galley/Turbid Holding Tank and its discharge pumps would be located in Hold No. 2 in place of the existing retention tank.

Drainage would be as follows:

(a) Sewage would be pumped by the macerator/transfer pumps to the Incinerator Feed Tank and fed to the incinerator.

(b) The Incinerator Feed Tank would be pumped overboard and pierside by its overboard pump via the existing pipe tunnel through the lower part of the Port Fuel Oil Tank to the existing connections in Hold No. 2.

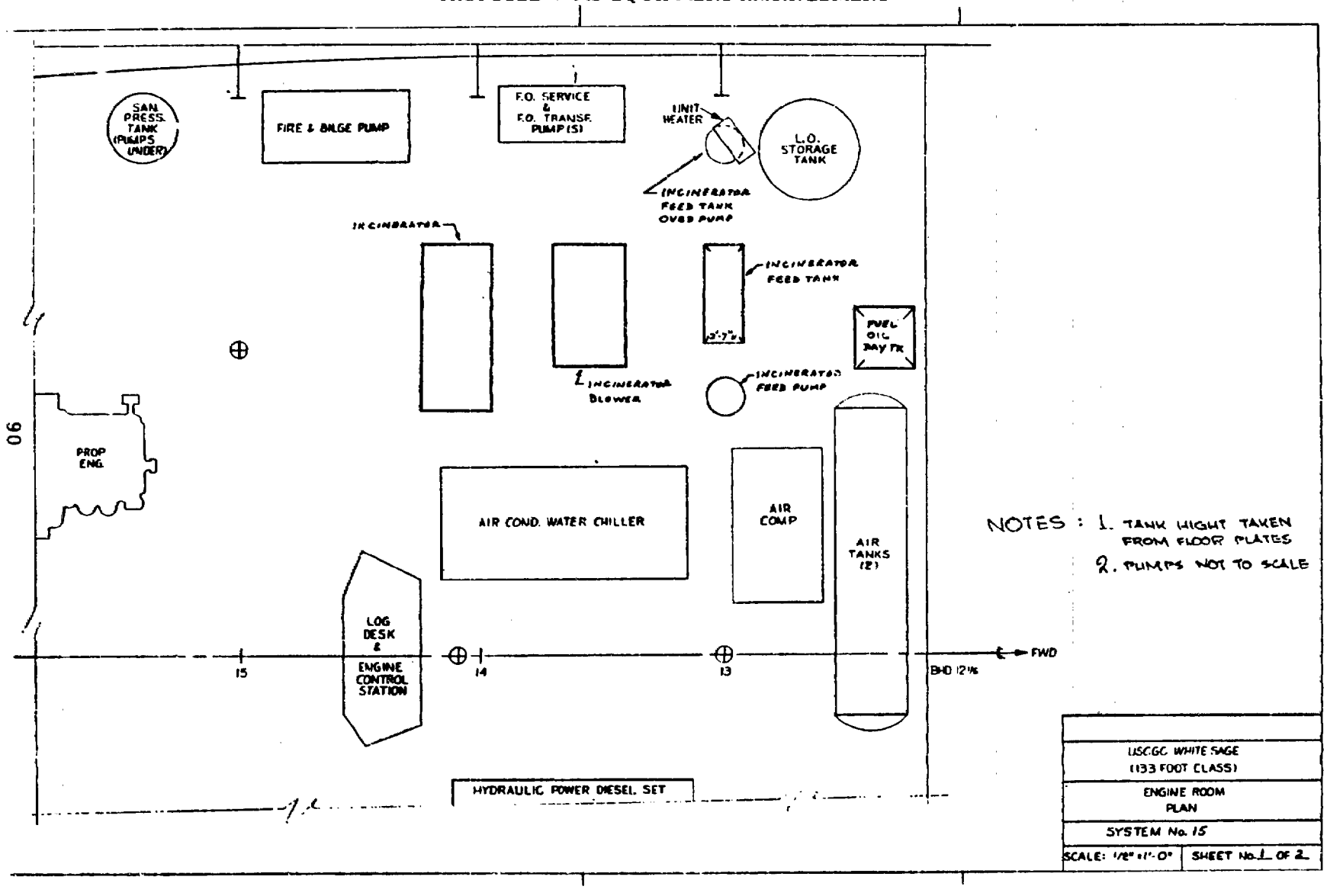
(c) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

(d) Drains from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(e) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pump would be capable of discharging the tank contents overboard and to pierside.

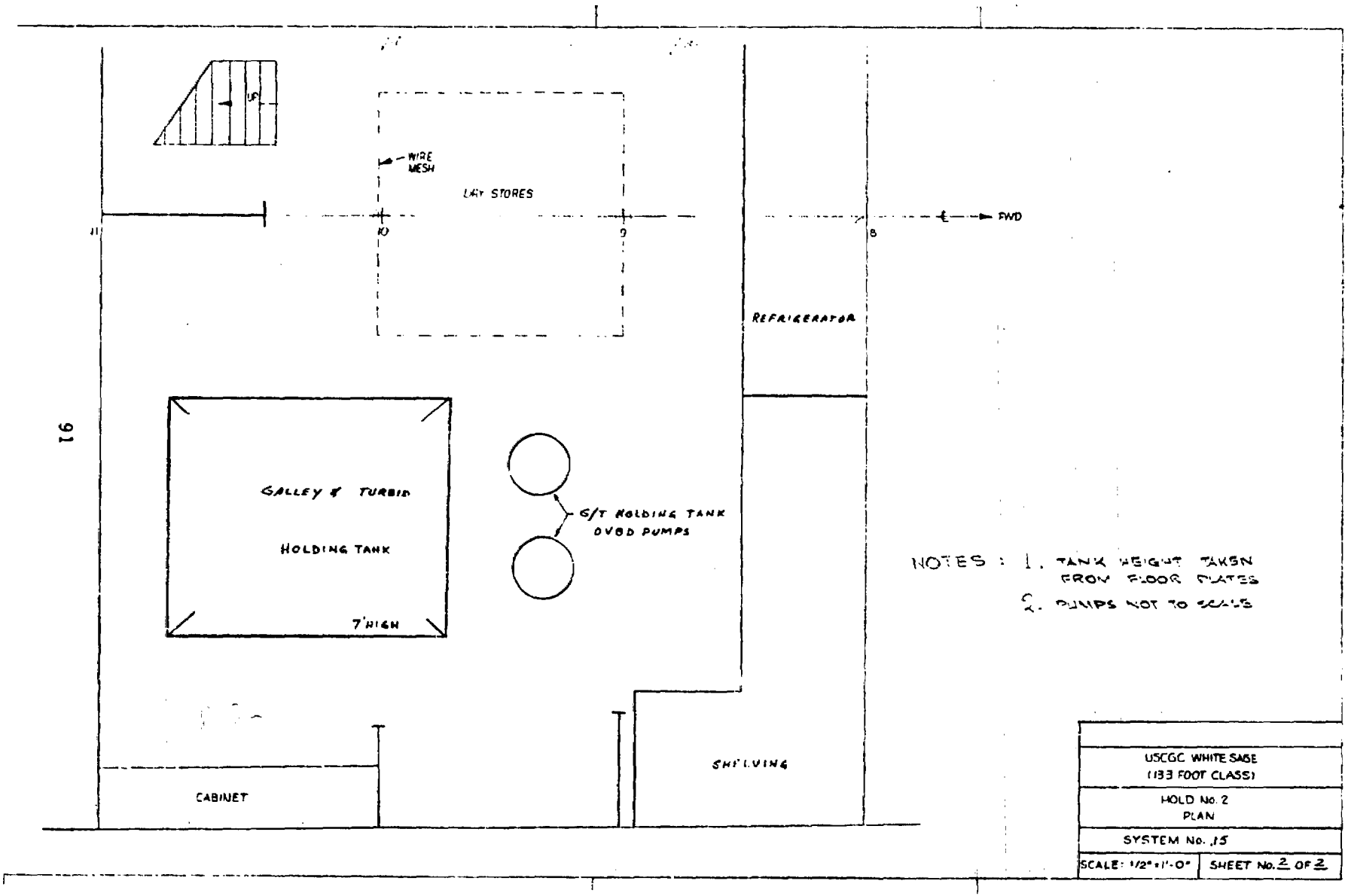
To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 15 |
| SCALE: 1/2" = 1'-0" \| SHEET No. 1 OF 2 |


WIRE MESH
LAY STORES
11
10
9
8
FWD
REFRIGERATOR
91
GALLEY & TURBIN
HOLDING TANK
7' HIGH
G/T HOLDING TANK
OVBD PUMPS
CABINET
SHELVING
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No. 2
PLAN
SYSTEM No. 15
SCALE: 1/2" = 1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 15

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,875[2] | 8,438 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 4,035[4] | 2,220 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,390[5] | 2,199 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 300 | 600 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 130 | 780 |
| Removals | Cutting | Hours | $50.00/Hr.[6] (Labor) | 15 | 750 |
| Removals | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 15,787 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: WHITE SAGE (133')

WMS No. 16 GATX Reduced Volume Flush M/T Pump Collection/GATX Evaporator for Concentrated Black Water/Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Galley/Turbid Holding Tank | 2063 gal. (276 cu.ft.) | 7' x 6' x 7' |
| Evaporator (GATX) | One (1) - 80 gal. | |
| Catalytic Oxidizer | One (1) | |
| Galley/Turbid Holding Tank Overboard Pumps | Two (2) | |
| Macerator/Transfer Pumps | Three (3) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system would be required.

The equipment would be located as follows:

(a) The GATX Evaporator and its catalytic oxidizer would be located in the Engine Room, Port side, in place of the existing collecting tank.

(b) The existing 25 gallon Galley Retention Tank located in the starboard aft corner of the Engine Room would be retained. The tank has a built-in liquid level controlled discharge pump.

(c) The Galley/Turbid Holding Tank would be located in Hold No. 2 in place of the existing retention tank. Its overboard pumps would be located inboard of the tank.

Drainage would be as follows:

(a) Sewage would be collected and discharged to the evaporator by macerator/transfer pumps.

(b) The macerator/transfer pumps would also be capable of discharging directly overboard or to pierside via existing connections.

(c) Sludge from the evaporator would be pumped overboard by the evaporator's sludge pump.

(d) The overboard and pierside discharge piping would pass from the Engine Room to Hold No. 2 via the existing pipe tunnel in the lower part of the Port Fuel Oil Tank.

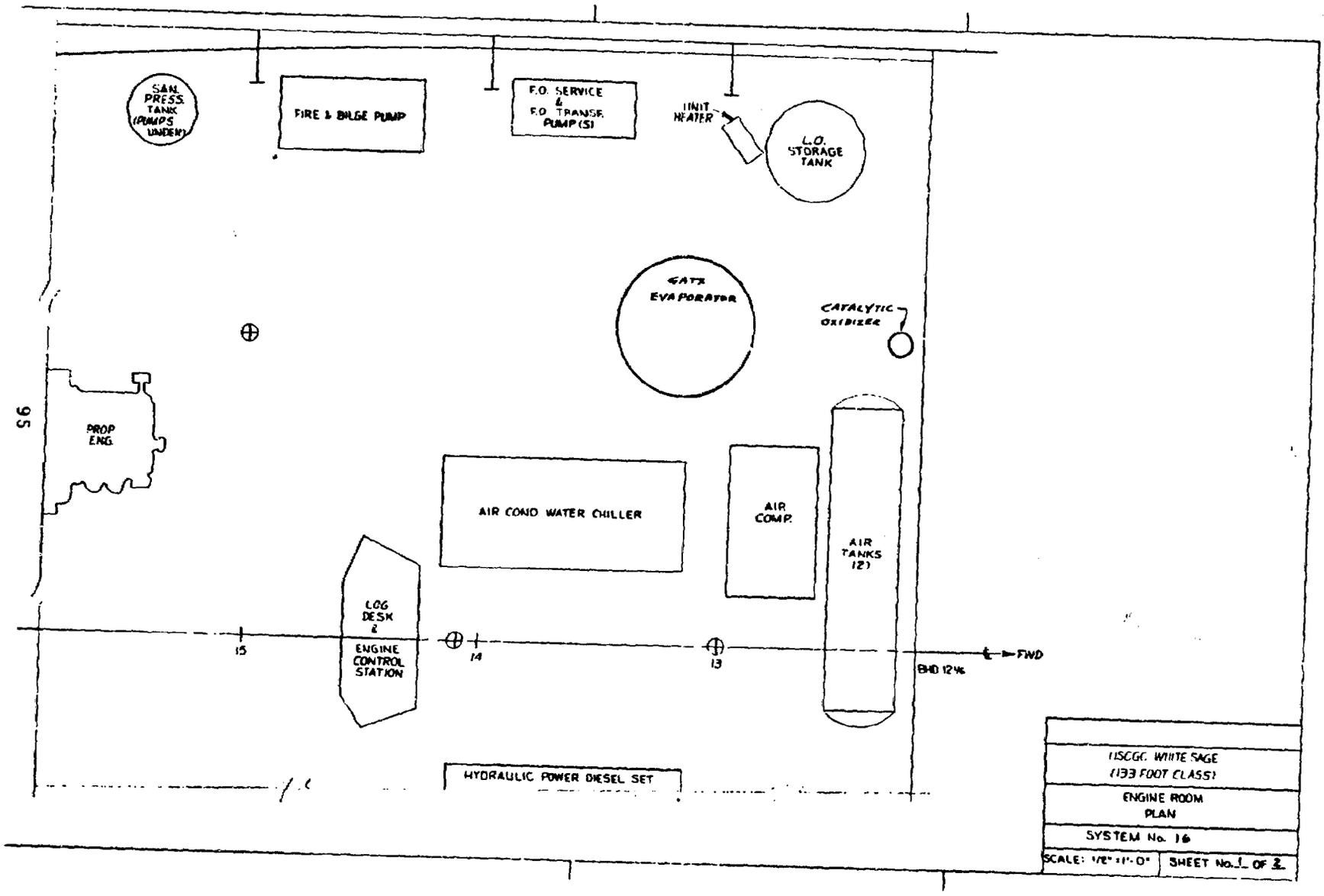
(e) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Holding Tank in Hold No. 2 via a new pipe tunnel through the Port Fuel Oil Tank similar to the existing one, but located through the upper part of the tank.

(f) Drains from the drinking fountain on the Main Deck, Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

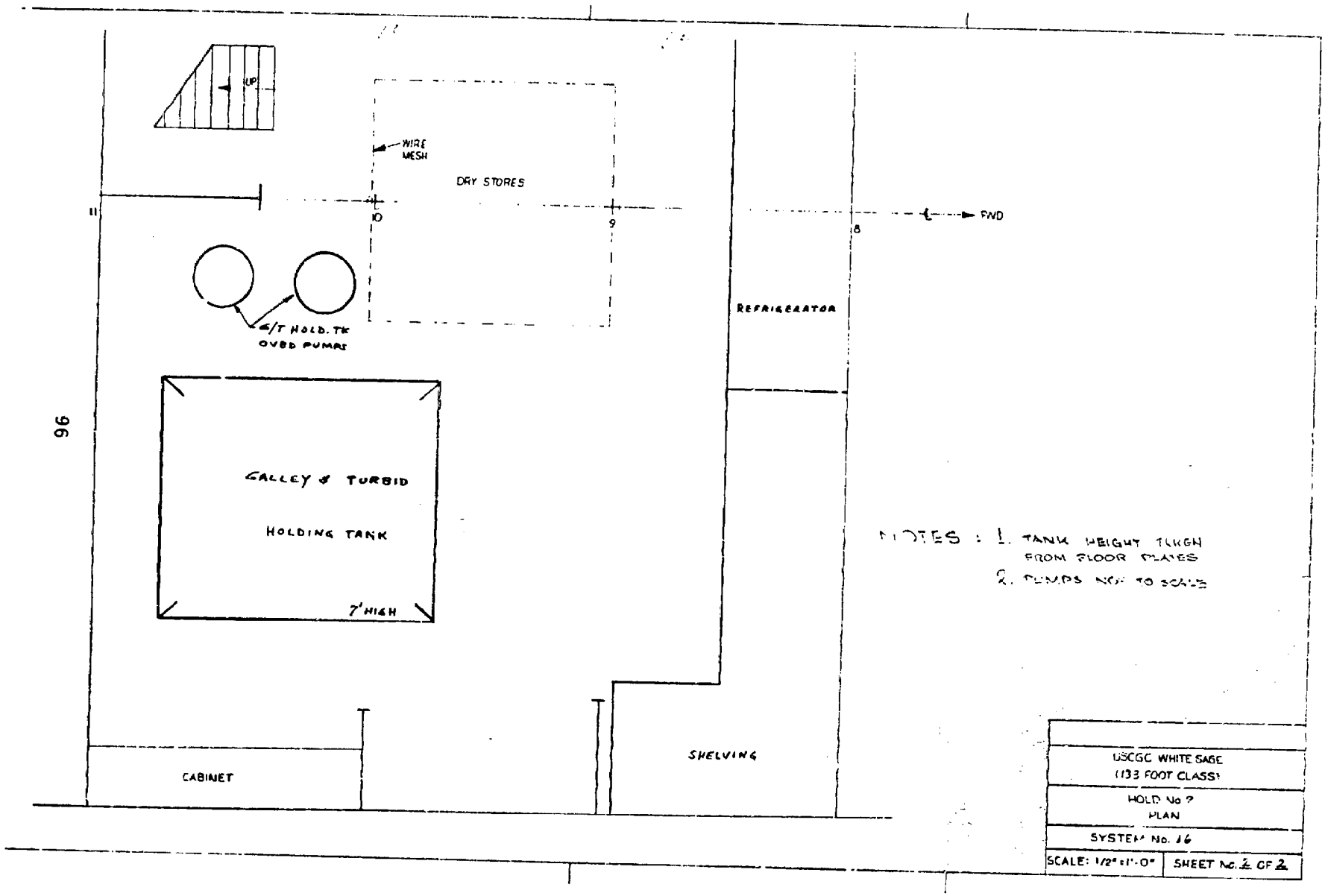
(g) Remaining Galley/Turbid drains would gravitate overboard and to the Holding Tank in Hold No. 2 via the new pipe tunnel indicated above. The tank discharge pump would be capable of discharging the tank contents overboard and to pierside.

To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10).

# PROPOSED WMS EQUIPMENT ARRANGEMENT




| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 16 |
| SCALE: 1/8" = 1'-0" \| SHEET No. 1 OF 2 |


UP
WIRE MESH
DRY STORES
11
10
9
8
FWD
REFRIGERATOR
S/T HOLD. TK OVBD PUMPS
96
GALLEY & TURBID
HOLDING TANK
7' HIGH
CABINET
SHELVING
NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE
USCGC WHITE SAGE
(133 FOOT CLASS)
HOLD No 7
PLAN
SYSTEM No. 16
SCALE: 1/2"=1'-0"
SHEET No. 2 OF 2

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 16

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,000[2] | 4,500 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 3,540[4] | 1,947 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 2,305[5] | 2,121 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 200 | 400 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 20 | 300 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 80 | 480 |
| Removals | Cutting | Hours | $50.00/Hr.[6] (Labor) | 15 | 750 |
| Removals | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 10,923 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

## DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

**WMS No. 17** GATX Reduced Volume Flush M/T Pump Collection/Holding Tank for Concentrated Black Water/Grumman Flow Through System with Sludge Holding Tank for Gray Water

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Sewage Holding Tank | 232 gal. (31 cu.ft.) | 2'-6" x 2'-6" x 5' |
| Galley/Turbid Influent Surge Tank | 323 gal. (43 cu.ft.) | 3' x 3' x 5' |
| Sludge Holding Tank | 172 gal. (23 cu.ft.) | 2'-6" x 2'-6" x 4' |
| Grumman Unit without Incinerator | One (1) | |
| Sewage Holding Tank Overboard Pumps | Two (2) | |
| Sludge Tank Transfer Pump | One (1) | |
| Influent Surge Tank Pumps | Two (2) | |
| Macerator/Transfer Pumps | Three (3) | |

Discussion

The system is considered to be a viable candidate.

A fresh water sanitary flushing system will be required.

The existing 25 gallon Galley Retention Tank in the starboard corner of the Engine Room would be retained. The tank has a built-in level controlled discharge pump.

Components would be located in Hold No. 2 as follows:

(a) The Sewage Holding Tank would be just forward of Bhd No. 11, to starboard of the ship's centerline.

(b) The Galley/Turbid Influent Surge Tank would be in place of the existing retention tank.

Vessel: WHITE SAGE (133')

System No. 17 (Cont'd)

(c) The Grumman MSD and Sludge Holding Tank would be forward of the Galley/Turbid Influent Surge Tank.

(d) Independent pumps would be grouped near the equipment served.

Drainage would be as follows:

(a) Sewage would be pumped by the macerator/transfer pumps to the Sewage Holding Tank in Hold No. 2. The sewage main would be led to Hold No. 2 via a new pipe tunnel (similar to the existing) passing through the upper inboard side of the Port Fuel Oil Tank. From there it would run to the existing overboard shell connection and to the existing weather deck dischargo connection to pierside, port and starboard.

(b) Existing galley sink and deck drains would continue to drain to the 25 gallon retention tank from which they would be pumped to the Galley/Turbid Influent Surge Tank Hold No. 2 via the new pipe tunnel mentioned above.

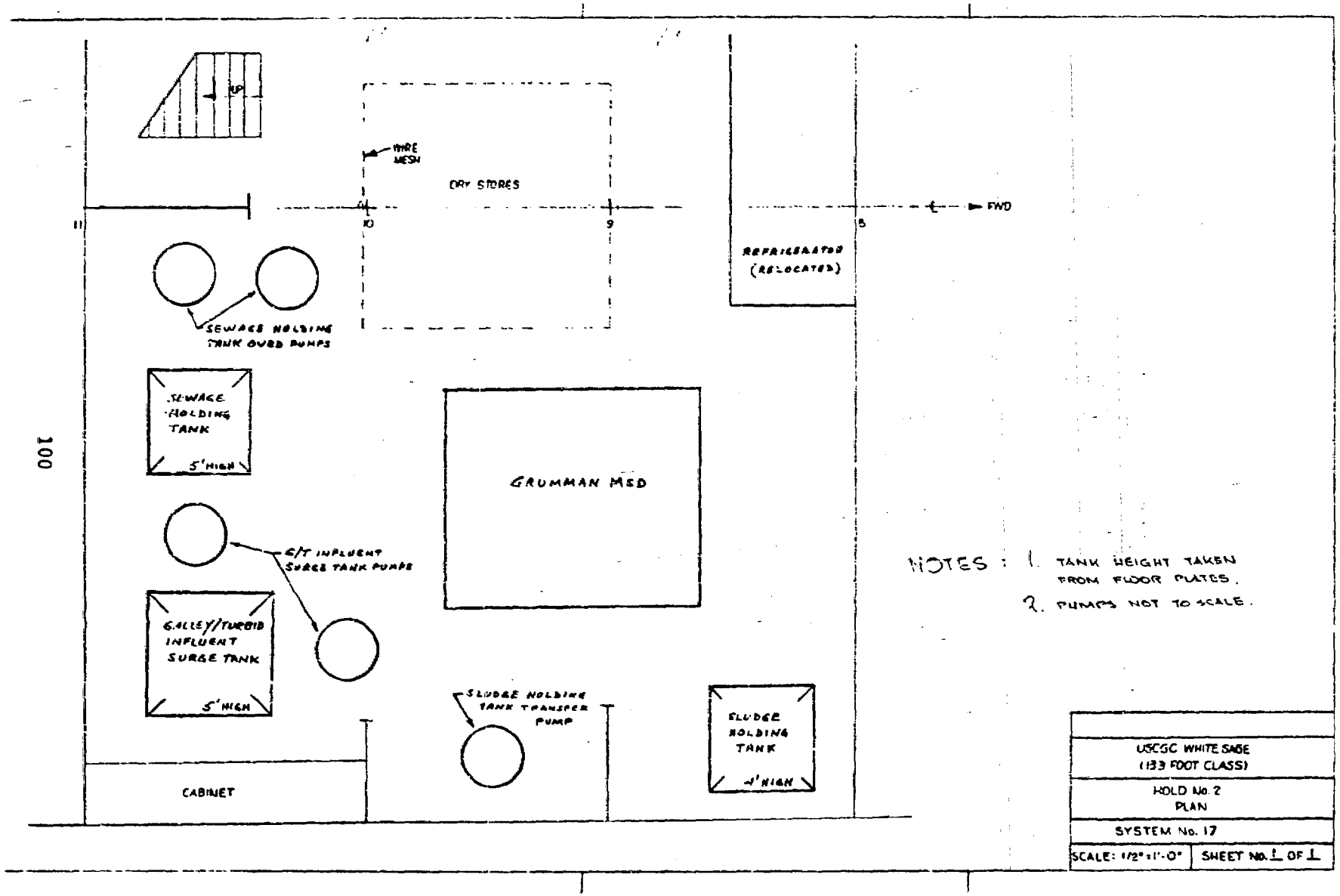
(c) drains from the drinking fountain on the Main Deck Frame 14, to starboard of ship's centerline would have to be re-routed to drain into the existing 25 gallon retention tank.

(d) Remaining Galley/Turbid drains would gravitate overboard and to the Influent Surge Tank in Hold No. 2 via the new pipe tunnel indicated above. One tank transfer pump would discharge to the Sewage Holding Tank, the other would discharge to the Grumman Feed Tank.

(e) The Sludge Holding Tank Transfer Pump would discharge to the Sewage Holding Tank for discharge overboard and to pierside.

To accommodate the equipment in Hold No. 2, there may be minor modifications required to the shelving on the starboard side (along the shell of the vessel) and the wire mesh enclosure for the ship's dry stores on the centerline of the vessel (between Frames 9 and 10). The ship stores refrigerator will have to be moved slightly to port.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES: 1. TANK HEIGHT TAKEN FROM FLOOR PLATES.
2. PUMPS NOT TO SCALE.

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 17 |
| SCALE: 1/2"=1'-0" \| SHEET No. 1 OF 1 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 17

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 1,195 [2] | 5,378 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 2,585 [4] | 1,422 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 1,280 [5] | 1,178 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 375 | 750 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 40 | 600 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 35 | 35 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 80 | 480 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 10,968 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

**Vessel:** WHITE SAGE (133')

**WMS No. 18** GATX Reduced Volume Flush M/T Pump Collection/Grumman Flow Through System for Gray Water/Incincerator for both Concentrated Black Water and Gray Water Sludge

| | Required | Approximate Dimensions (L x W x H) |
|---|---|---|
| Sewage Surge Tank | 43 gal. (5.7 cu.ft.) | 18" dia. x 48" H |
| Galley/Turbid Surge Tank | 323 gal. (43 cu.ft.) | 3' x 3' x 5' |
| Fuel Oil Day Tank | 22 gal. (3 cu. ft.) | 1'-6" x 1'-6" x 1'-6" |
| Grumman Unit with Incinerator | One (1) with One (1) Thiokol Incinerator | |
| Sewage Surge Tank Transfer Pump | One (1) | |
| Sewage Surge Tank Overboard Pump | One (1) | |
| Galley/Turbid Surge Tank Pump | One (1) | |
| Galley/Turbid Surge Tank Overboard Pump | One (1) | |
| Macerator/Transfer Pump | Three (3) | |

Discussion

The system is a viable candidate with certain considerations.

A fresh water sanitary flushing system would be required.

The components would be located as follows:

(a) The Galley/Turbid Surge Tank and the Sewage Surge Tank would be located in the Engine Room, Port side, in place of the existing collecting tank. Their associated transfer and overboard pumps would be located aft of each tank.

(b) The existing 25 gallon Galley Retention Tank located in the aft Starboard corner of the Engine Room would be retained. The tank has a built-in liquid level controlled pump.

(c) The Grumman MSD with the incinerator would be located on the Starboard side of Hold No. 2 in place of the existing retention tank.

(d) In view of the arrangement of the vessel as described in the discussion of existing conditions at the beginning of this section, the incinerator stack run to the weather seems to be severely limited. The only apparent solution is to run it up through the Main Deck alongside the port or starboard sheer leg of the cargo boom tripod support structure. The structure legs begin near the overhead in Hold No. 2. Carge would have to be exercised due to tight house access arrangements on the Main Deck and the navigational and operational clearances needed.

Drainage would be as follows:

(a) Sewage would be collected and pumped to the Sewage Surge Tank by the macerator/transfer pumps. The transfer pump would discharge the tank contents to the Grumman Sludge Feed Tank. The overboard pump would discharge overboard and to pierside via the existing connections. Both discharge lines would go to Hold No. 2 via the existing pipe tunnel through the lower part of the Port Fuel Oil Tank.

(b) The existing 25 gallon Galley Retention Tank would discharge to the G/T Influent Surge Tank. Remaining G/T drains would gravitate to the surge tank.

(c) Drains from the drinking fountain on the Main Deck, Frame 14, would have to be re-routed to the 25 gallon retention tank.

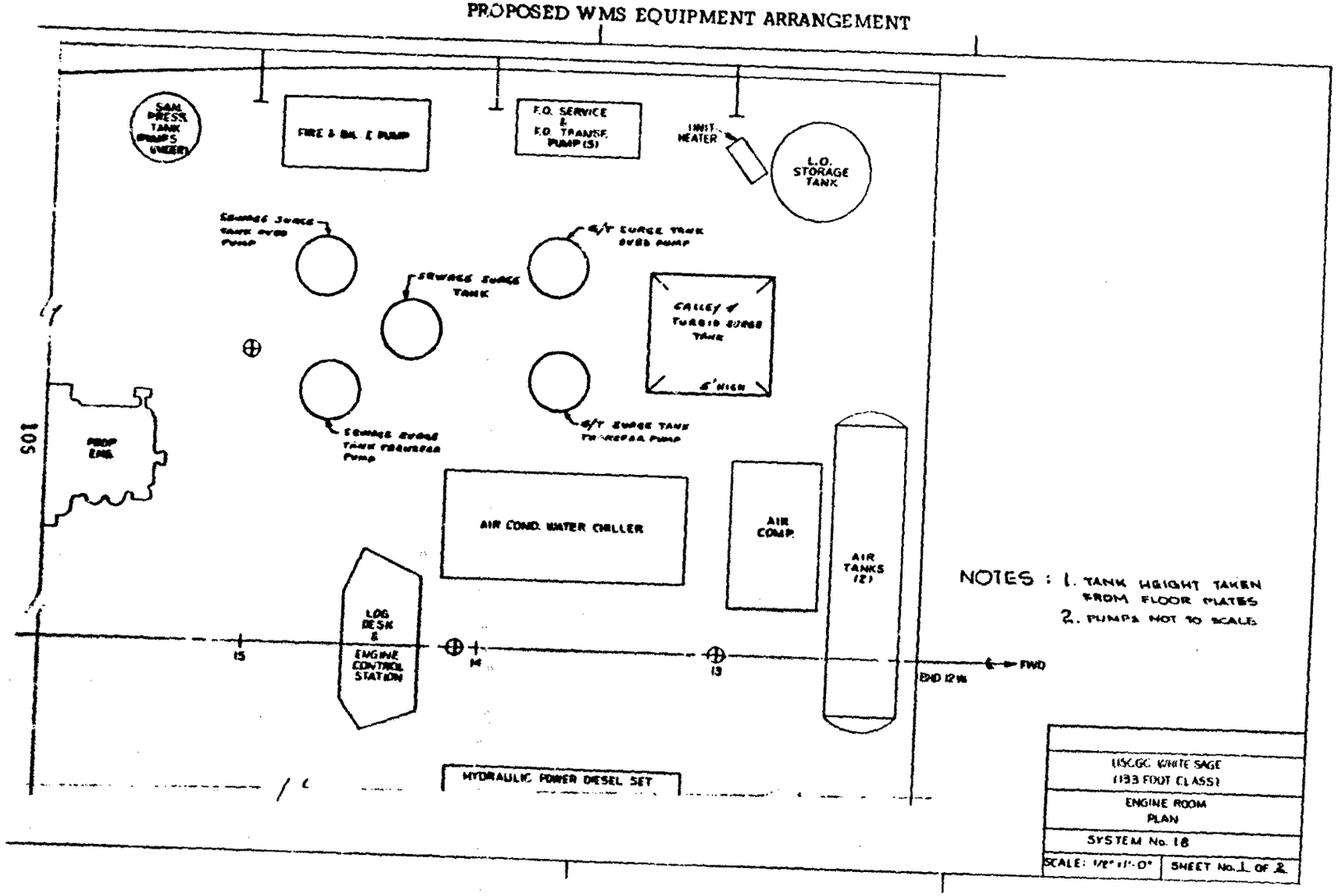
(d) The G/T Surge Tank Pump would discharge to the Grumman Feed Tank via the aforementioned pipe tunnel to Hold No. 2.

The G/T Surge Tank Overboard Pump would discharge via the same pipe tunnel to Hold No. 2 and then to the existing overboard and pierside connections.

To accommodate the equipment in Hold No. 2, the shelving along the starboard shell will have to be modified and the ship's stores wire mesh enclosure on the centerline moved to port.

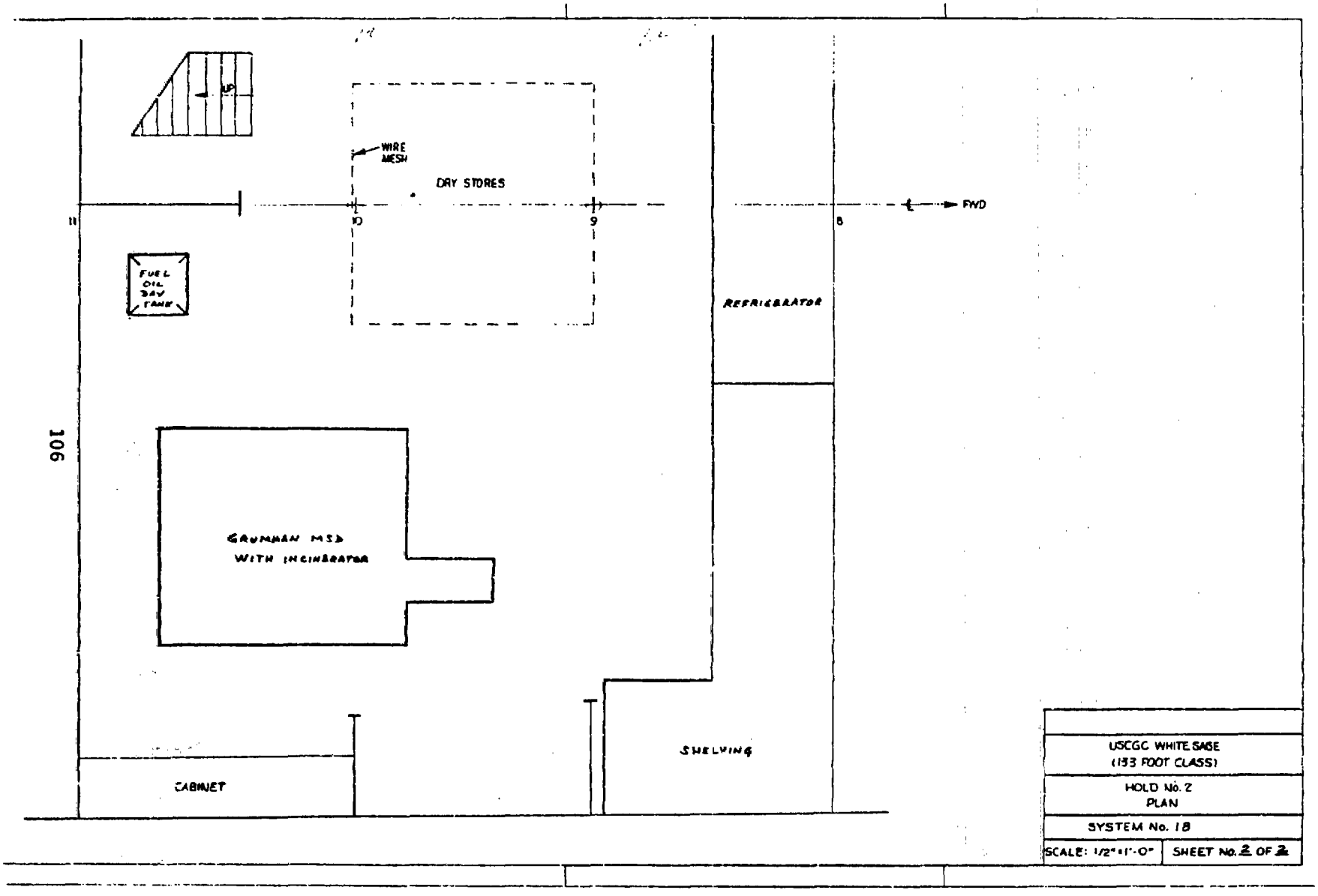
Due to the incinerator installation, additional fire protection will have to be provided and the ventilation system for Hold No. 2 will have to be modified.

# PROPOSED WMS EQUIPMENT ARRANGEMENT




NOTES : 1. TANK HEIGHT TAKEN FROM FLOOR PLATES
2. PUMPS NOT TO SCALE

| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| ENGINE ROOM PLAN |
| SYSTEM No. 18 |
| SCALE: 1/8"=1'-0" \| SHEET No. 1 OF 2 |




| |
|---|
| USCGC WHITE SAGE (133 FOOT CLASS) |
| HOLD No. 2 PLAN |
| SYSTEM No. 18 |
| SCALE: 1/2"=1'-0" \| SHEET No. 2 OF 2 |

## WMS INSTALLATION COST ESTIMATES

Vessel WHITE SAGE (133')

WMS No. 18

| Installation Cost Element | | Unit | Assumed Unit Cost | Quantity Required (estimated number of units) | Cost ($) |
|---|---|---|---|---|---|
| Piping[1] | | Pounds | $ 4.50/Lb. (Materials and Labor) | 2,460 [2] | 11,070 |
| Tank Steel[3] | | Pounds | $ .55/Lb. (Materials and Labor) | 1,540 [4] | 847 |
| Foundations | | Pounds | $ .92/Lb. (Materials and Labor) | 990 [5] | 911 |
| Electric Cables | | Feet | $ 2.00/Ft. (Materials and Labor) | 275 | 550 |
| Miscellaneous Installations (pumps, motors, skid-mounted components, etc.) | | Man-Hours | $15.00/MH (Labor) | 40 | 600 |
| Access Cuts (in hull, deck plating or bulkhead to provide passageway) | | Feet | $ 1.00/Ft. (Labor) | 50 | 50 |
| Welding | | Feet | $ 6.00/Ft. (Materials and Labor) | 80 | 480 |
| Removals | Cutting | Hours | $50.00/Hr. [6] (Labor) | 15 | 750 |
| | Other (miscellaneous handling) | Man-Hours | $15.00/MH (Labor) | 25 | 375 |
| Total Installation Cost ($) | | | | | 15,633 |

(1) Copper-nickel assumed.
(2) Estimate includes a factor of 50% added to allow for valves, flanges, fittings, take-down joints, etc.
(3) One-quarter inch plate assumed.
(4) Estimate includes a factor of 30% added to allow for required structural stiffening for proper support.
(5) Estimated on the basis of 10% of the weight which has to be supported.
(6) Based on an assumed cutting rate of 50 ft./hr.

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133')



M/E I - ADAPTABILITY FOR SHIPBOARD INSTALLATION

Factor/Subfactor Ident. No. | INSTALLATION CHARACTERISTIC

**111** Required black water handling capacity for vessel versus actual capacity of WMS

(a) Actual capacity of WMS equals or exceeds required capacity for vessel.
(b) WMS marginally suitable for vessel (has 95-99% of required capacity).
(c) WMS capacity insufficient for vessel (less than 95% of required capacity).

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

**112** Required gray water handling capacity for vessel versus actual capacity of WMS

(a) Actual capacity of WMS equals or exceeds required capacity for vessel.
(b) WMS marginally suitable for vessel (has 95-99% of required capacity).
(c) WMS capacity insufficient for vessel (less than 95% of required capacity).

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

**13** Extent of additional support systems or equipment required to accommodate WMS[1]

(a) No additional support systems or equipments required.
(b) Some additional support systems or equipments required.[2]
(c) Many additional support systems or equipments required.[3]

[1] Examples: . Fireflighting system must be installed with incinerator.
. Bilge alarm required if large tank is installed above bilge.
. Compressor required on vessels that do not already have one.
. Detectors of toxic or noxious gases should be installed with any system that, as an inherent design feature, uses such gases in processing wastes.

[2] Need for support system/equipment does not significantly reduce WMS suitability for on-board installation.
[3] Suitability of WMS for installation on vessel significantly reduced.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |

**21** Extent of fixture modifications required for WMS installation

(a) No fixtures need modification or replacement.
(b) Some fixtures need modification or replacement.
(c) All commodes need replacement and modification of urinal-associated equipment (e.g., urinal discharge valves) is required.
(d) All fixtures need replacement or modification (e.g., replacement or commodes and urinal flushometers).
(e) All fixutres need replacement or modification and each fixture has additional hookup requirements associated with it.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | c | c | c | c | c | e | e | e | e | e |

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133') Sheet 2 of 10

Factor/Subfactor Ident. No.

M/E I - ADAPTABILITY FOR SHIPBOARD INSTALLATION (Cont'd)

INSTALLATION CHARACTERISTIC

22 Extent of flush medium supply modifications required for WMS installation

(a) Existing flush medium is used.
(b) WMS requires conversion of flush medium to potable water.
(c) WMS requires conversion of flush medium to recirculating non-aqueous medium.
(d) WMS requires conversion of flush medium to salt water.(1)

(1) Conversion to salt water requires pump re-sizing, tapping into the sea-chest and provision for its corrosive properties. For PAMLICO, salt water would be used if the drain system were converted to a standard flush system (C.G. supplied information).

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | c | c | a | a | a | a | a | b | b | b | b | b | b | b | b | b | b |

231 Hookup requirements(1) for WMS Collection/Transport subsystem installation

(a) No additional hookup requirements beyond existing ones.
(b) Requires piping for recirculation of flush medium (in existing gravity drain system).
(c) Special and centralized Collection/Transport subsystem required.
(d) Special and non-centralized Collection/Transport subsystem required (includes conversion from reduced flush vacuum collection to a standard gravity drain system, with or without recirculation).

(1) Drain piping; electric cables connecting commode, M/T pump and control panel in GATX, but not in JERED, etc.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | b | b | a | a | a | a | a | c | c | c | c | c | d | d | d | d | d |

232 Routing flexibility for drain piping modifications(1) associated with WMS Collection/Transport subsystem installation(2)

(a) Routing is highly flexible.(3)
(b) Routing is moderately flexible, with some restrictions.
(c) Routing is highly inflexible.

(1) Of the three relevant categories of routing of lines (piping, ventilation, electrical), piping is the most important for assessing use of WMS installation.

(2) Notes: . With gravity drainage, lines must always slope downward and require venting.
. Smaller size lines are inherently more flexible.
. With the pump or vacuum Collection/Transport subsystem, sharp bends, rises and long runs can be accommodated in piping.

(3) In all cases, WMS installation is to be considered from the point of view of modifications required to existing conditions.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | b | b | b | b | b | b | b | b | b | b |

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133')



M/E I - ADAPTABILITY FOR SHIPBOARD INSTALLATION (Cont'd)

| Factor/Subfactor Idcns. No. | INSTALLATION CHARACTERISTIC |
|---|---|
| 233 | Space requirements for WMS Collection/Transport subsystem installation.<br>(a) No additional space required.(1)<br>(b) Some additional space required.(2)<br>(c) Large amount of additional space required.<br>(1) E.g., M/T pumps in GATX; or small influent surge tank.<br>(2) E.g., large VCT in JERED; or large influent surge tank, if not already installed. |

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | b | b | a | a | a | a | a | a | b | b | b | b | a | a | a | a | a |

| | |
|---|---|
| 234 | Modularity of WMS Collection/Transport subsystem (as it affects installation)(1)<br>(a) Degree of modularity of subsystem aids in installation of C/T subsystem.<br>(b) Degree of modularity of subsystem results in some (minimal) difficulty in installation of C/T subsystem.<br>(c) Degree of modularity of subsystem results in moderate difficulty in installation of C/T subsystem.<br>(1) On vessels that do not currently have a WMS, a high degree of modularity aids in installation, and a high degree of subsystem centralization (as in the JERED) results in difficulties for installation. |

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

| | |
|---|---|
| 235 | Vent requirements for WMS Collection/Transport subsystem installation<br>(a) No vents are required other than the existing vents.<br>(b) Few vents are required in addition to the existing vents.<br>(c) Many vents are required in addition to existing vents. |

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | b | b | a | a | a | b | b | b | b | b | b | b | a | a | a | a | a |

| | |
|---|---|
| 241 | Space requirements for WMS waste Treatment/Disposal subsystem installation<br>(a) Volume required is minimal and dimensions(1) of equipment present no problems in fitting equipment into available compartment space.<br>(b) Volume required is moderate and dimensions(1) of equipment present no problems in fitting equipment into available compartment space.<br>(c) Volume and dimension(1) of equipment do present problem in fitting equipment into available compartment space.<br>(d) Large volume required and dimension(1) of equipment do present problem in fitting equipment into available compartment space.<br>(1) The two main factors are (i) deck area required and (ii) height required. |

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | b | b | b | a | b | b | b | a | b | b | b | b | b | b | b | b | b |

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133') Sheet 4 of 10

M/E I - ADAPTABILITY FOR SHIPBOARD INSTALLATION (Cont'd)

INSTALLATION CHARACTERISTIC

242 Hookup requirements[1] for WMS waste Treatmenr/Disposal subsystem installation

(a) Pipes, ducts and/or cable requirements are minimal.
(b) Pipes, ducts and/or cable requirements are moderate.
(c) Pipes, ducts and/or cable requirements are extensive.

[1] Piping for fuel oil, fresh water, cooling water, compressed air, interconnecting remotely located equipment, overboard discharge line, etc.; electric cables for power supply, remote control panels, etc.; ducting for ventilation, etc.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |

243 Degree of modularity of WMS waste Treatment/Disposal (as it affects installation)[1]

(a) Degree of modularity of subsystem aids in installation of T/D subsystem.
(b) Degree of modularity of subsystem results in some (minimal) difficulty in installation of T/D subsystem.
(c) Degree of modularity of subsystem results in moderate difficulty in installation of T/D subsystem.

[1] Decentralization of components may require additional hookups and piping runs.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

244 Vent requirements for WMS waste Treatment/Disposal subsystem installation[1]

(a) No vents are required.
(b) Vents are required.

[1] Vents that are only internal to the compartment in which subsystem is located are not considered here.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |

245 Exhaust stack requirements for WMS waste Treatment/Disposal subsystem installation[1]

(a) Exhaust not required.
(b) Exhaust required, size of stack relatively small and stack can be run via existing ship's stack enclosure (fiddley).
(c) Exhaust required, size of stack relatively large and stack can be run via existing ship's stack enclosure.
(d) Exhaust required, size of stack relatively small and stack cannot be run via existing ship's stack enclosure.
(e) Exhaust required, size of stack relatively large and stack cannot be run via existing ship's stack enclosure.

[1] Notes: . Electric incinerator requires small (2") exhaust.
. Fuel incinerator requires large (10") exhaust.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | c | a | a | a | e | e | a | c | a | a | e | a | c | a | a | e |

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133')



M/E I - ADAPTABILITY FOR SHIPBOARD INSTALLATION (Cont'd)

Factor/Subfactor Ident. No.

INSTALLATION CHARACTERISTIC

25 Ease of installing WMS support equipment[1]

(a) No support equipment required.
(b) Some support equipment required but easy to install.
(c) Much support equipment required and difficult to install.

[1] Examples:
- Firefighting system must be installed with incinerator.
- Bilge alarm required if large tank is installed above bilge.
- Compressor required on vessels that do not already have one.
- Detectors of toxic or noxious gases should be installed with any system that, as an inherent design feature, uses such gases in processing wastes.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |

26 Ease of compensating for added weight of WMS

(a) No or minimal compensation for added weight required.
(b) Moderate compensation for added weight required.
(c) Extensive compensation for added weight required.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | b | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

271 Extent of SHIPALTS (permanent modifications) required for WMS installation[1]

(a) No SHIPALTS required.
(b) Minor SHIPALTS required.
(c) Extent of SHIPALTS required is moderate.
(d) Extensive SHIPALTS required.

[1] Foundations, enlarged doors/hatches, increased capacity requirements for air compressor, etc.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | b | c | c | c | b | b | b | b | b | c | c | c | c | b | b | b | b | c |

272 Extent of temporary modification[1] required for WMS installation

(a) No temporary modifications required.
(b) Temporary modifications required are minor.
(c) Extent of temporary modifications required are moderate.
(d) Temporary modifications required are extensive.

[1] Cutting access openings, etc.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | b | c | c | c | c | c | c | c | b | b | b | c | c | b | c | c | c | c |

## WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133') Sheet 6 of 10

### M/E I - ADAPTABILITY FOR SHIPBOARD INSTALLATION (Cont'd)

#### INSTALLATION CHARACTERISTIC

**31** Effect of WMS on vessel stability

(a) No effect on existing stability characteristics of vessel.
(b) Some effect on existing stability characteristics of vessel, easily compensated for.
(c) Severe effect on existing stability characteristics of vessel, compensation required extensive modifications to vessel (e.g., no tankage in Point Herron).

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

**32** Effect of WMS on vessel trim and list

(a) No effect on trim or on list.
(b) Some easily compensated for effect on trim or list.
(c) Compensation for effect on trim or list requires extensive modification to vessel.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | b | b | b | b | a | a | a | a | a | a | a | a | a | b | a |

**33** Effect of WMS on normal range of vessel

Vessel resource capacity and usage rates.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | | | | | | - Presented on Vessel Resource Data Sheet - | | | | | | | | | | | | |

**34** Degree of space trade-off/reallocation required for WMS installation

(a) No space trade-off/reallocation required.
(b) Minimal degree of space trade-off/reallocation required.
(c) Moderate degree of space trade-off/reallocation required.
(d) High degree of space trade-off/reallocation required.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |

### M/E II - PERFORMANCE

#### PERFORMANCE CHARACTERISTIC

**12** WMS per capita wet weight (lb)[1] - $W_1$

[1] Drain piping material is assumed to be copper-nickel (Cu-Ni).

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | 1692 | 1467 | 1493 | 1574 | 719 | 1068 | 1074 | 670 | 1387 | 1497 | 1333 | 746 | 672 | 1441 | 1462 | 1351 | 818 | 718 |

## WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133')



Factor/Subfactor Ident. No.

### M/E II - PERFORMANCE (Cont'd)

### PERFORMANCE CHARACTERISTIC

**13** WMS per capita volume ($ft^3$)(1) = $V_i$

(1) Volumes are calculated as follows:
- Fixture volumes are calculated using smallest space envelopes.
- Pipe volume is the volume of a square tube with side = outside diameter of pipe.
- Other equipment: Deck area: smallest rectangle enclosing all equipment in a single package plus extra dimension area required for operation and maintenance.
  Height: either maximum height of equipment, or full compartment height, if space above package is not usable for any other purposes.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | 89.7 | 100.7 | 103.8 | 109.6 | 92.2 | 117.1 | 137.3 | 89.7 | 103.9 | 97.9 | 91.4 | 98.9 | 80.6 | 77.7 | 86.3 | 71.6 | 116.6 | 88.9 |

**21** Adequacy of WMS black water holding times

$HT_b$ = % of required black water holding time met by WMS(1)

(1) A WMS which employs an incinerator is considered to meet 100% of the required holding time. The holding time of a WMS which employs a holding tank (for wastewater or sludge) is determined by the ratio of available tank capacity to required capacity.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

**22** Adequacy of WMS gray water holding times

$HT_g$ = % of required gray water holding time met by WMS(1)

(1) A WMS which employs an incinerator is considered to meet 100% of the required holding time. The holding time of a WMS which employs a holding tank (for wastewater or sludge) is determined by the ratio of available tank capacity to required capacity.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

**311** Effect of peak hydraulic loads in black water stream on WMS performance

$GIST_b$ = % of required Grumman (or other) influent surge tank capacity in black water stream met by installation.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | -- | -- | -- | 100 | 100 | -- | 100 | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 100 |

**312** Effect of peak hydraulic loads in gray water stream on WMS performance

$GIST_g$ = % of required Grumman influent surge tank capacity in gray water stream met by installation.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | -- | -- | -- | -- | 100 | 100 | -- | 100 | -- | -- | -- | 100 | 100 | -- | -- | -- | 100 | 100 |

**331** Ability of black water portion of WMS to handle additional personnel (on a long-term basis)

$HTC_b$ = % of required black water (or sludge) holding tank capacity met by installation.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | 100 | 100 | -- | 100 | 100 | 100 | -- | -- | 100 | -- | -- | 100 | -- | 100 | -- | -- | 100 | -- |

## WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133')



### M/E II - PERFORMANCE (Cont'd)

#### PERFORMANCE CHARACTERISTIC

| Factor/Subfactor Ident. No. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 332 | Ability of gray water portion of WMS to handle additional personnel (on a long term basis)<br>$HTC_g$ = % of required gray water (or sludge) hodling tank capacity met by installation. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | 100 | 100 | 100 | 100 | 100 | 100 | 100 | -- | 100 | 100 | 100 | 100 | -- | 100 | 100 | 100 | 100 | -- |

### M/E IV - PERSONNEL SAFETY

#### SAFETY CHARACTERISTIC

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Hazard of explosive potential for operator/maintainer due to inherent WMS design.<br>I - Installation index (for personnel safety)<br>(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.<br>(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.<br>(c) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to fuel storage area. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | a | a | a | a | a | a | c | c | a | a | a | a | c | a | b | a | a | c |
| 22 | Hazard of explosive potential for operator/maintainer due to procedural error/equipment failures of WMS.<br>I - Installation index (for personnel safety)<br>(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.<br>(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.<br>(c) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to fuel storage area. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | a | a | a | a | a | a | c | c | a | a | a | a | c | a | b | a | a | c |
| 31 | Hazard of fire ignition potential due to inherent WMS design<br>I - Installation index (for personnel safety)<br>(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.<br>(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.<br>(c) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to fuel storage area. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | a | a | a | a | a | a | c | c | a | a | a | a | c | a | b | a | a | c |
| 32 | Hazard of fire ignition potential due to procedural errors/equipment failures of WMS.<br>I - Installation index (for personnel safety)<br>(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.<br>(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.<br>(c) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to fuel storage area. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | a | a | a | a | a | a | c | c | a | a | a | a | c | a | b | a | a | c |

## WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133') Sheet 9 of 10

Factor/Subfactor Ident. No.

M/E V - HABITABILITY

HABITABILITY CHARACTERISTIC

**41** Heat generation for nearby personnel[1] due to inherent WMS design

I - Installation index (for heat)

(a) Location of WMS is not likely to raise heat level due to proximity to working and berthing areas.
(b) Location of WMS is likely to raise heat level due to proximity to working and berthing areas.

[1] For operator/maintainer/adjacent berthing and working areas.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | b | a | a | a | b | b | a | b | a | a | b | a | b | a | a | b |

**42** Heat generation for nearby personnel[1] due to procedural errors/equipment failures of WMS

I - Installation index (for heat)

(a) Location of WMS is not likely to raise heat level due to proximity to working and berthing areas.
(b) Location of WMS is likely to raise heat level due to proximity to working and berthing areas.

[1] For operator/maintainer/adjacent berthing and working areas.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | b | a | a | a | b | b | a | b | a | a | b | a | b | a | a | b |

**5** Noise level for personnel in vicinity of WMS[1]

I - Installation index (for noise)

(a) Location of WMS is not likely to raise noise level due to proximity to working and berthing areas.
(b) Location of WMS is likely to raise noise level due to proximity to working and berthing areas.

[1] For operator/maintainer/adjacent berthing and working areas.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | b |

**6** Vibration levels for nearby personnel[1] produced by WMS machinery

I - Installation index (for vibration)

(a) Location of WMS is not likely to raise vibration level due to proximity to working and berthing areas.
(b) Location of WMS is likely to raise vibration level due to proximity to working and berthing areas.

[1] For operator/maintainer/adjacent berthing and working areas.

| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | b |

## WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel WHITE SAGE (133')



| Factor/Subfactor Ident. No. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **M/E VI - RELIABILITY** | | | | | | | | | | | | | | | | | | |
| **RELIABILITY CHARACTERISTIC** | | | | | | | | | | | | | | | | | | |
| 22 | Extent of WMS configuration redundancy<br>WMS equipment requirements. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | | | | | - Presented on WMS Equipment Resources Data Form - | | | | | | | | | | | | | |
| **M/E VII - MAINTAINABILITY** | | | | | | | | | | | | | | | | | | |
| **MAINTAINABILITY CHARACTERISTIC** | | | | | | | | | | | | | | | | | | |
| 131 | Accessibility of replaceable WMS components<br>I - Installation index (for accessibility)<br>(a) High degree of physical clearance around WMS equipment.<br>(b) Moderate degree of clearance around WMS equipment.<br>(c) Very tight, i.e., very little clearance around WMS equipment. | | | | | | | | | | | | | | | | | |
| WMS # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Data | a | b | c | b | a | a | a | a | a | c | a | b | a | a | b | a | b | b |

## CONCLUDING REMARKS

The following are points of consideration and observation relevant to this vessel, some of which have been included in the shipcheck observations, and are reiterated for emphasis and convenience.

(a) The vessel is presently fitted with a CHT system, components of which occupy space in the Engine Room and in Hold No. 2 just forward of the Engine Room. The piping runs and space for equipment locations are convenient and well arranged for the most part with separate black and gray water mains lending themselves readily adaptable to the WMS configurations studied.

(b) Possibly the only major problem for which there is no readily apparent solution is the manner in which incinerator stacks can be led to the weather when the arrangement does not permit them to go up via the Engine Room fidley along with the existing diesel exhaust piping. The general arrangement of the ship seemingly precludes the possibility of making these runs due to interference with cargo handling equipment, navigational aids, visibility from the bridge and the undesirable path the smoke could take from the top of the incinerator stack.

(c) Present waste disposal system equipment in the Engine Room offer no apparent problem into removals. In Hold No. 2 however, the 810 gallon retention tank installation is quite substantial with a very large supporting foundation. This would require a large amount of labor and cutting up to remove from the vessel.

(d) The ship's dry stores in Hold No. 2 are contained in an expanded metal enclosure on the ship's centerline. This would have to be relocated, most likely to the port side of the vessel.

(e) The ship's stores refrigerator is a free-standing self-contained unit in Hold No. 2. For some proposed WMS installations the refrigerator would have to be shifted to port to provide more space for system components. This would involve foundation extension.

(f) Most of the remaing existing equipment on Hold No. 2 involves storage shelving and miscellaneous cabinetry which should offer no real problem. There is ample space in the hold for relocation.

(g) In order to pass piping between the Engine Room and Hold No. 2, another pipe tunnel through the port side fuel oil tank would be required, similar to the one already existing for this purpose. This would involve tank washing and gas freeing before any hot work can be done.

(h) The ship is outfitted with the required support systems, flushing water, fuel, compressed air, etc. It would be required that for some WMS proposals the present salt water flushing system be changed over to fresh water.

(i) Existing piping runs and connections lend themselves readily to reuse for many of the WMS proposals.

(j) For systems involving installation of incinerators, the existing ventilation system would have to be studied for adequacy.

The same would apply to the fire extinguishing apparatus.

(k) Access cuts for shipping WMS components would have to be made in the deck head or in the ship's side.

(l) There are no ballasting provisions per se aboard the vessel. Therfore any weight compensations required would have to be at the expense of on-board existing material.

# APPENDIX A

## PRELIMINARY INSTALLATION ANALYSIS

## WHITE SAGE (133')

| Vessel Characteristics | Data |
|---|---|
| Class | WLM - 544<br>White Summac (133') Class |
| Type | Buoy Tender (Coastal) |
| Crew Size | 21 |
| Home Port | Woods Hole, Mass. |

SUMMARY OF PRELIMINARY INSTALLATION ANALYSIS RESULTS

WHITE SAGE (133')

| WMS No. | TYPE: Coll/Trans Subsys (Black) | TYPE: Treatment/Disposal Subsystem: Black | TYPE: Treatment/Disposal Subsystem: Gray | SYSTEM ACCEPTABILITY FOR INSTALLATION(1) |
|---|---|---|---|---|
| 1 | Gravity Collect. | Holding Tank | Holding Tank | Yes |
| 2 | Oil Recircul. (Cnrysler) | Chrysler + Hld Tnk | Holding Tank | Yes |
| 3 | | Chrysler + Incin. | Holding Tank | Yes |
| 4 | Gravity Collect. (Grumman) | Grum Flow Thru+HldTk | Holding Tank | Yes |
| 5 | | Grumman Flow Thru + Holding Tank | | Yes |
| 6 | Gravity Collect. | Holding Tank | Grum Flow Thru+HldTnk | Yes |
| 7 | Gravity Collect. (Grumman) | Grum Flow Thru+Incin. | Holding Tank | Yes |
| 8 | | Grumman Flow Thru + Incinerator | | Yes |
| 9 | Vacuum Collect. (Jered) | Holding Tank(2) | Holding Tank | Yes |
| 10 | | Incinerator | Holding Tank | Yes |
| 11 | | GATX Evap. | Holding Tank | Yes |
| 12 | | Holding Tank(3) | Grum Flow Thru+ Hld Tnk | Yes |
| 13 | | Incinerator | Grum Flow Thru + Incin. | Yes |
| 14 | M/T Pump Collect. (GATX) | Holding Tank | Holding Tank | Yes |
| 15 | | Incinerator | Holding Tank | Yes |
| 16 | | GATX Evap. | Holding Tank | Yes |
| 17 | | Holding Tank | Grum Flow Thru+Hld Tnk | Yes |
| 18 | | Incinerator | Grum Flow Thru + Incin. | Yes |

(1) Based on:
- Information contained in available vessel plans.
- WMS installation requirements.
- WMS installation criteria and guidelines.

(2) Two subchoices available for WMS No. 9 as follows:
- 9a - Concentrated black water transferred from VCT to holding tank (acceptable for all vessels).
- 9b - Concentrated black water held in VCT (acceptable for Point Herron only).

(3) Two subchoices available for WMS No. 12 as follows:
- 12a - Concentrated black water transferred from VCT to holding tank (acceptable for all vessels).
- 12b - Concentrated black water held in VCT (acceptable for Point Herron only).

PERTINENT VESSEL INFORMATION

WHITE SAGE (133')

Crew: 21 men

Sanitary Fixtures: 4 Waterclosets, 1 Urinal, 4 showers, 5 lavatories

Existing Arrangement:

(a) One (1) 25 gallon Galley Retention Tank in aft Machinery Compartment receives drainage from galley sinks, galley deck drain and drinking fountain.

(b) Galley drains can discharge overboard via gravity or drain to the Galley Retention Tank. The tank can pumpout to a 220 gallon Collection Tank in the Engine Room.

(c) The 220 gallon Collection Tank also receives all Sewage and turbid drains via separate piping systems. The turbid drain system can also discharge directly overboard.

(d) The 220 gallon Collection Tank can pumpout to a 810 gallon Retention Tank located in Hold No. 2 Storeroom, forward of the Engine Room. It can also pumpout overboard or to the deck discharge connections.

(e) The 810 gallon Retention Tank receives only the 220 gallon Collection Tank pumpout. It can pumpout to the deck discharge connections or directly overboard.

(f) The Retention and Collection Tank pump piping is so arranged that either pump can serve either tank, thereby providing a standby pump for each tank.

Note:

The drawings of the existing ship that were provided to accomplish this work are contradictory regarding the location of the Collection and Retention Tanks and other items of machinery:

| | | |
|---|---|---|
| (1) | 540 WAGL - 4808-2 | Secondary Drainage System<br>Alterations Fleet - Dated 8-9-71 |
| (2) | 540 WAGL - 0103-8 | Booklet of General Drawings<br>U.S.C.G.C. Whitebush - Dated 5-30-74 |
| (3) | 540 WAGL - 4000-1 | Whitebush Engine Room<br>Rearrangement - Elevation & Plan - Dated 3-18-74 |

Vessel: WHITE SAGE (133')

Existing Arrangement (Cont'd)

Drawing (1) locates the collecting and retention tanks a considerable distance from the location shown on drawings (2) and (3). In view of the fact that drawing (1) is a piping system installation plan that involves the tanks and is intended as a Fleet Alteration, it was decided to use this drawing as applicable to the Whitesage. Further, drawings (2) and (3) apply specifically to the Whitebush which is not the subject ship in this discussion. As a result of the above, the conclusions that are arrived in the following discussions must be considered with somewhat below average accuracy.

PRELIMINARY INSTALLATION ANALYSIS OF INDIVIDUAL CANDIDATE SYSTEMS

Vessel: WHITE SAGE (133')

WMS No. 1 Full Volume Flush Gravity Collection/Holding Tank for Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Sewage Holding Tank | 722 gal. (97 cu. ft.) |
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |

Discussion

The system installation appears to be acceptable as follows:

It is advisable to locate two pumps and a Sewage Holding Tank in the location presently occupied by the Collecting Tank in the Engine Room with very minor rearrangement of existing equipment. Very minor modifications in the sewage and garbage grinder piping will be necessary.

A Galley/Turbid Holding Tank and two pumps could be located in the area presently occupied by the existing Retention Tank in the Hold No. 2 storeroom with very minor rearrangement of the space.

It will be necessary to run the Galley/Turbid piping mains from the Engine Room to the Hold No. 2 storeroom area in order to connect to the G/T Holding tank. This piping can run through a void space separating the Fresh Water and Fuel Oil Tanks (if fitted) or through a pipe tunnel in the Fuel Oil Tank.

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the G/T Holding Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the G/T Holding Tank. The overboard discharge is to be blanked off.

Existing overboard discharge connections and deck discharge connections can be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 2 Full Volume Flush Oil Recirculation and Gravity Collection/ Chrysler System with Sludge Holding Tank for Sewage/Holding Tank for Gray Water

| | Required |
|---|---|
| Sewage Holding Tank | 135 gal. (18 cu. ft.) |
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm. |
| Chrysler Model and Quantity | Model A One (1) |

Discussion

The system installation is acceptable subject to the following:

The Galley/Turbid Holding Tank plus two discharge pumps can be located in the area presently occupied by the existing Retention Tank in the Hold No. 2 storeroom with very minor rearrangement of existing equipment.

The Sewage Holding Tank with two discharge pumps, Separation Unit and the Pressurization and Fluid Package can be located in the area presently occupied by the existing Collecting Tank in the Engine Room and in the area inboard of the boiler and fire & bilge pump on the port side.

This arrangement will require the routing of the Galley/Turbid piping mains from the Engine Room to the Hold No. 2 storeroom area in order to connect to the new G/T Holding Tank. The piping can run through a void space separating the Fresh Water and Fuel Oil Tanks (if fitted) or through a pipe tunnel in the Fuel Oil Tank.

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the G/T Holding Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the G/T Holding Tank. This overboard discharge is to be blanked off.

The existing overboard discharge shell connections and deck discharge connections can be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 3 Full Volume Flush Oil Recirculation and Gravity Collection/ Chrysler System with Incinerator for Sewage/Holding Tank for Gray Water

| | Required | |
|---|---|---|
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) | |
| Sludge Ejection Tank | 50 gal. (6.7 cu. ft.) | |
| Discharge Pumps (4) | 10 - 30 gpm | |
| Chrysler Model and Quantity | Model A | One (1) |
| Incinerator Model and Quantity | Model A | One (1) |

Discussion

The system installation appears to be acceptable as follows:

The Galley/Turbid Holding Tank plus two discharge pumps could be located in the space presently occupied by the existing Retention Tank in the Hold No. 2 storeroom with possible minor rearrangement of existing equipment.

The Separation Unit Pressurization and Fluid Package and the Sludge Ejection Tank can be located in the Engine Room in the area presently occupied by the existing Collecting Tank and in the area inboard of the boiler and fire & bilge pump on the port side.

The Incinerator can be located on or near the centerline at Frame 15 under the casing opening in order to facilitate routing the incinerator stack up the stack along with the diesel engine exhaust pipes.

This arrangement will necessitate the running of the Galley/Turbid piping mains from the Engine Room to the Hold No. 2 storeroom area in order to connect to the new G/T Holding Tank. The piping can be run through a void space between the Fresh Water and Fuel Oil Tanks (if fitted) or through a pipe tunnel in the Fuel Oil Tank.

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the G/T Holding Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the G/T Holding Tank. The overboard discharge can be blanked off.

Existing overboard discharge shell connections and deck discharge connections can be retained for use with the new installation.

**Vessel:** WHITE SAGE (133')

**WMS No. 4** Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Holding Tank for Black Water/ Holding Tank for Gray Water

| | Required |
|---|---|
| Sewage Influent Surge Tank | 110 gal. (15 cu. ft.) |
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Sludge Holding Tank | 60 gal. (8 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |
| Grumman Unit | One (1) |

Discussion

The system installation is acceptable as follows:

It appears that the Sewage Influent Surge Tank and the Sludge Holding Tank plus four discharge pumps can be located in the space presently occupied by the existing Collecting Tank in the Engine Room with some minor equipment relocation.

The Grumman Unit can be located in the Engine Room on the port side of the center line between frames 14 and 15. The stack can run up the machinery casing. This will require the relocation of the Log Desk and Telephone Booth plus other minor items of machinery and possibly the Air Cond. Water Chiller.

The Galley/Turbid Holding Tank plus two discharge pumps can be located in the area presently occupied by the existing Retention Tank in the Hold No. 2 storeroom with possible minor rearrangement of existing equipment.

An alternative location for the Grumman unit is the Hold No. 2 Storeroom area near the G/T Holding Tank, thereby placing all treatment equipment in the same vicinity.

This will require the extension of the Galley/Turbid piping mains from the Engine Room to the Hold No. 2 Storeroom area in order to connect to the G/T Holding Tank. The G/T piping can be run through a void space between the Fresh Water and Fuel Oil Tanks (if fitted) or through a pipe tunnel in the Fuel Oil Tank.

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the G/T Holding Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the G/T Holding Tank. The overboard discharge could be blanked off.

Vessel: WHITE SAGE (133')

System No. 4 (Cont'd)

The existing overboard discharge deck and shell connections can remain for use in the new installation.

**Vessel:** WHITE SAGE (133')

**WMS No. 5 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Holding Tank for Combined Black and Gray Waters**

| | Required |
|---|---|
| Sludge Holding Tank | 232 gal. (31 cu. ft.) |
| Influent Surge Tank | 432 gal. (58 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |
| Grumman Unit | One (1) |

Discussion

The system installation appears to be acceptable as described in the following:

The Sludge Holding Tank and the Influent Surge Tank plus pumps can be located in the area presently occupied by the existing Collecting Tank in the Engine Room. Minor rearrangement of equipment may be required for this installation.

The Grumman Unit can be located in the Engine Room port side near the centerline between frames 14 and 15. This location will require the relocation of the Log Desk and Telephone Booth plus other minor machinery items.

Fewer items of existing equipment will require relocation if the Influent Surge Tank is installed in the area presently occupied by the Retention Tank in the Hold No. 2 Storeroom area. This will require the extension of the combined waste piping mains from the Engine Room to the Hold No. 2 Storeroom area via a pipe tunnel or through a void space, if fitted.

An alternate location for the Grumman Unit and the Sludge Holding Tank is the Hold No. 2 Storeroom in the general area presently occupied by the Retention Tank. This location can accommodate all the required components thereby having all treatment equipment together in Hold No. 2. Minor modifications will be necessary to the space.

Vessel: WHITE SAGE (133')

System No. 5 (Cont'd)

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the Influent Surge Tank. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the Influent Surge Tank. The overboard discharge would be blanked off.

Existing deck and shell overboard discharge connections can remain for use with the new equipment.

Vessel: WHITE SAGE (133')

WMS No. 6 Full-Volume Flush Gravity Collection/Holding Tank for Black Water/Grumman Flow Through System with Sludge Holding Tank for Gray Water

| | Required |
|---|---|
| Influent Surge Tank | 323 gal. (43 cu. ft.) |
| Sludge Holding Tank | 172 gal. (23 cu. ft.) |
| Sewage Holding Tank | 722 gal. (97 cu. ft.) |
| Optional Comb. Sewage/Sludge Holding Tank | 894 gal. (120 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |
| Grumman Unit | One (1) |

Description

The system installation appears to be acceptable as described in the following:

Although it is possible to locate the Grumman Unit in the Engine Room between frames 14 and 15, port side near centerline, it may be advisable to locate this unit and the Sludge Holding Tank (2.5' x 2.5' x 4' H) in the Hold No. 2 Storeroom area in the location of the present Retention Tank because the size of the associated tanks makes it impossible to locate all equipment in the Engine Room without considerable rearrangement.

The Influent Surge Tank (3'W x 3' L x 5' H) and the Sewage Holding Tank or the Optional Combined Holding Tank can be located in the Engine Room in the area presently occupied by the existing Collecting Tank. It may be necessary to relocate the Log Desk and Telephone Booth. As an alternate the tanks can be located in Hold No. 2 Storeroom area thereby keeping all related equipment in the same space. Only minor rearrangement of the existing space will be required.

The 25 gal. Galley Drain Tank could remain in use and the pump piping revised to discharge to the Influent Surge Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the Influent Surge Tank. The overboard discharge is to be blanked off.

Existing shell and deck discharge connections can remain for use with the new equipment.

Vessel: WHITE SAGE (133')

WMS No. 7 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Incinerator for Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Sewage Influent Surge Tank | 110 gal. (15 cu. ft.) |
| Fuel Oil Day Tank | 25 gal. (3.3 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |
| Grumman Unit | One (1) |
| Thiokol Incinerator | One (1) |

Discussion

The system installation appears to be acceptable subject to certain limitations as follows:

The Galley/Turbid Holding Tank can be located in the Hold No. 2 Storeroom area in the space presently occupied by the existing Retention Tank with very minor rearrangement of the space.

The Grumman MSD fitted with an Incinerator can be installed in the Engine Room between frames No. 14 and 15 port side near the centerline. The incinerator stack can be led up the machinery casing along with the existing diesel engine exhaust pipes. This location will require the rearrangement of the Log Desk and Telephone Booth and perhaps the Air Conditioning Water Chiller.

The Sewage Influent Surge Tank can be located in the Engine Room in the area presently occupied by the Collecting Tank. The Incinerator Fuel Tank can be located in the overhead in the same area.

This arrangement will require that the Galley/Turbid main be routed to the No. 2 Hold Storeroom area via the void space between Fuel Oil and Fresh Water Tanks (if fitted) or through a pipe tunnel in the Fuel Oil Tank.

Vessel: WHITE SAGE (133')

System No. 7 (Cont'd)

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the G/T Holding Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the G/T Holding Tank. This overboard discharge is to be blanked off.

The existing shell and deck connections can remain for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 8 Full Volume Flush Gravity Collection/Grumman Flow Through System with Sludge Incinerator for Combined Black and Gray Waters

| | Required |
|---|---|
| Influent Surge Tank | 432 gal. (58 cu. ft.) |
| Fuel Oil Day Tank | 25 gal. (3.3 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |
| Grumman Unit | One (1) |
| Thiokol Incinerator | One (1) |

Discussion

The system installation is acceptable within the following limitations:

The Influent Surge Tank can be located in the area presently occupied by the existing Collecting Tank in the Engine Room.

The Grumman Unit with the Thiokol Incinerator can be located in the Engine Room between Frames No. 14 and 15, Port Side near the centerline. This will require the relocation of the Telephone Booth, Log Desk and probably the Air Conditioning Water Chiller.

The Fuel Oil Day Tank can be located overhead near the Grumman Unit.

The incinerator stack can be led up the machinery casing along with the existing diesel engine exhaust pipes.

The 25 gal. Galley Drain Tank should remain in use and the pump piping revised to discharge to the Influent Surge Tank in Hold No. 2. The single drinking fountain (Frames 14/15) discharging overboard should be reconnected to drain to the gravity G/T drain line to the Influent Surge Tank. This overboard discharge is to be blanked off.

The existing overboard discharge shell and deck connections can remain for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 9 JERED Reduced Volume Flush Vacuum Collection/Holding Tank for Concentrated Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) |
| Sewage Holding Tank | 200 gal. (27 cu. ft. ) |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu. ft. ) |

Discussion

The system installation appear to be acceptable subject to certain limitations.

Reuse of existing piping arrangement should be considered. A fresh water flushing system is required for this system.

The Vacuum Collection Tank, its vacuum equipment, Sewage Holding Tank and sewage overboard pumps can be located in the Engine Room in the area where the existing Collecting Tank is presently installed.

The Galley/Turbid Holding Tank and overboard pumps can be located in the Hold No. 2 Storeroom area where the Retention Tank is presently installed.

Minor rearrangements of existing equipment may be necessary in both compartments.

The Galley/Turbid drains in the Engine Room must be manifolded and led to the G/T Holding Tank via a pipe tunnel through the fuel oil tanks or the void space (depending on the vessel's arrangement) between the Engine Room and Hold No. 2.

It is recommended that the galley and turbid drains aft of Frame 17 continue to utilize the existing 25 gallon collecting tank and pump. This must be rearranged to discharge forward to the new G/T Holding Tank in Hold No. 2. The single drinking fountain drain between Frames 14 and 15 must be tied in to the gravity system going forward instead of retaining its own independent overboard discharge. This overboard connection could be blanked off.

Vessel: WHITE SAGE (133')

System No. 9 (Cont'd)

The existing pipe tunnel between the Engine Room and Hold No. 2 could be retained for sewage transfer to the existing overboard discharge connection in Hold No. 2 or to the existing piersde deck connection.

Existing overboard discharge connections and deck discharge connections can be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 10 JERED Reduced Volume Flush Vacuum Collection/Incinerator for Concentrated Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Vacuum Collection Tank | 120 gal. (18 cu. ft.) |
| Galley/Turbid Holding Tank | 2063 gal. (276 cu. ft.) |
| Incinerator Feed Tank (Sludge) | 50 gal. (6.5 cu. ft.) |
| Fuel Oil Day Tank | 22 gal. (3.0 cu. ft.) |
| Incinerator | One (1) Thiokol |

Discussion

The system installation appears to the acceptable subject to certain limitations.

Reuse of existing piping arrangements should be considered. A fresh water sanitary flushing system is required.

The Vacuum Collection Tank, vacuum equipment and overboard discharge pump could be located in the Engine Room in the area where the existing Collecting Tank is fitted. The Incinerator, its feed (sludge) tank, blower, fuel tank, controls, etc. would be located just aft of the Vacuum Collection Tank. The incinerator stack can be run to the weather alongside the exhausts from the existing diesel engines up the machinery casing.

The Galley/Turbid Holding Tank and its overboard pumps would be located in the Hold No. 2 Storeroom area where the present Retention Tank is installed.

Minor rearrangements of existing spaces and machinery may be necessary in both compartments to accommodate the new units.

The existing 25 gallon Galley Drain Tank should remain in use and the pump discharge piping revised to discharge to the Galley/Turbid Holding Tank in Hold No. 2. The single drinking fountain drain between Frames 14 and 15 should be connected to the gravity Galley/Turbid drain running to the G/T Holding Tank and the independent overboard discharge disconnected and blanked off.

VESSEL: WHITE SAGE (133')

System No. 10 (Cont'd)

The existing pipe tunnel between the Engine Room and Hold No. 2 would be used for the piping necessary to pump out the Vacuum Collection Tank.

The existing overboard shell and deck connections should be retained for use with the new system.

The G/T drain main in the Engine Room should be run to the G/T Holding Tank in Hold No. 2 via the pipe tunnel.

Vessel: WHITE SAGE (133')

WMS No. 11 JERED Reduced Volume Flush Vacuum Collection/GATX Evaporator for Concentrated Black Water/Holding Tank for Grey Water

| | Required |
|---|---|
| Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) |
| Galley/Turbid Holding Tank | 2063 ga. (276 cu. ft. ) |
| Evaporator (GATX) | One (1) - 80 gal. |
| Catalytic Oxidizer | One (1) |

Discussion

The system installation appears to be acceptable as follows:

Reuse of existing piping arrangements would have to be considered. A fresh water sanitary flushing system is required with this system.

The Vacuum Collection Tank, Evaporator and Catalytic Oxidizer can be located in the area presently occupied by the Collection Tank in the Engine Room.

The Galley/Turbid Holding Tank could be located in the Hold No. 2 Storeroom area presently occupied by the Retention Tank.

The existing 25 gallon Galley Drain Tank should remain in use and the pump piping revised to discharge to the Galley/Turbid Holding Tank in Hold No. 2. The single drinking fountain discharging overboard at frames 14/15 should be reconnected to the gravity G/T drain to the G/T Holding Tank. The overboard discharge should be blanked off.

Existing overboard shell and pierside deck connections should remain for use by the new system.

The pipe tunnel between Engine Room and Hold No. 2 would be used for the piping necessary to pump out the Vacuum Collection Tank.

The G/T drain main in the Engine Room should be run to the G/T Holding Tank in Hold No. 2 via the pipe tunnel.

Vessel: WHITE SAGE (133')

WMS No. 12 JERED Reduced Volume Flush Vacuum Collection/Holding Tank for Concentrated Black Water/Grumman Flow Through System with Sludge Holding Tank for Gray Water

| | Required |
|---|---|
| G/T Influent Surge Tank | 323 gal. (43 cu. ft.) |
| Sludge Holding Tank | 172 gal. (23 cu. ft.) |
| Sewage Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) |
| Sewage Holding Tank | 200 gal. (27 cu. ft.) |
| Grumman Unit | One (1) |

Discussion

The system installation appears to be acceptable subject to certain limitations.

Reuse of existing piping arrangements would have to be considered. A fresh water sanitary flushing system would be required.

The Vacuum Collection Tank, Vacuum equipment, Sewage Holding Tank and sewage overboard pumps could be located in the Engine Room in the area where the existing Collecting Tank is fitted.

The Galley/Turbid Influent Surge Tank and its pump would be located just aft of the aforementioned sewage equipment, also in the Engine Room. This will require minor rearrangement of existing equipment.

The Grumman MSD, Sludge Holding Tank (and its discharge pump) could be located in the Hold No. 2 Storeroom area in where the existing Retention Tank is fitted. Some rearrangement of this compartment may be necessary.

The existing 25 gallon Galley Drain Tank should remain in use and discharge to the Influent Surge Tank. The single drinking fountain drain between Frames 14 and 15 should be connected to the gravity G/T drain to the Influent Surge tank and the independent overboard connection disconnected and blanked off.

Vessel: WHITE SAGE (133')

System No. 12 (Cont'd)

The pipe tunnel between the Engine Room and Hold No. 2 would be used to transfer wastes from the Sludge Holding Tank to the Sewage Holding Tank (for pierside discharge) and from the Sewage Holding Tank to overboard and pierside discharge.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 13 JERED Reduced Volume Flush Vacuum Collection/Grumman Flow Through System for Gray Water/Incinerator for both Concentrated Black Water and Gray Water Sludge

| | Required |
|---|---|
| Galley/Turbid Surge Tank | 323 gal. (43 cu. ft.) |
| Vacuum Collection Tank | 30 gal. (4.4 cu. ft.) |
| Fuel Oil Day Tank | 40 gal. (5.3 cu. ft.) |
| Grumman Unit | One (1) |
| Incinerator | One (1) Thiokol |

Discussion

The system installation appears acceptable as follows:

Reuse of existing piping arrangements would have to be considered. A fresh water sanitary flushing system would be required for this system.

The Vacuum Collection Tank and vacuum equipment would be located in the Engine Room in the area where the existing 220 gallon Collecting Tank is fitted. The Galley/Turbid Surge Tank and its pump would be located just aft of the Vacuum Collection Tank and equipment. This may require some relocation of existing equipment.

There are two possible locations to be considered for the location of the Grumman MSD and its incinerator. One location would be in the Engine Room just aft of the Vacuum Collection arrangement near the centerline, with its stack going to the weather alongside the existing diesel engine exhausts. The other location would be in Hold No. 2 in the place occupied by the 810 gallon Retention Tank in the storeroom area, with the Incinerator stack running to the weather alongside the kingpost.

There would be some equipment relocations to be considered.

The existing pipe tunnel between the Engine Room and Hold No. 2 would be used for piping runs to overboard and pierside connections and the Grumman MSD, if located in Hold No. 2.

The existing 25 gallon Galley Drain Tank will remain in use with the pump discharge piping revised to connect to the G/T Surge Tank. The single drinking fountain at frames 14/15 would be reconnected to the gravity G/T drain to the G/T Surge Tank. The overboard discharge should be blanked off.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 14 GATX Reduced Volume Flush M/T Pump Collection/Holding Tank for Concentrated Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Sewage Holding Tank | 232 gal. (31 cu. ft.) |
| Discharge Pumps (4) | 10 - 30 gpm |

Discussion

The system installation appears to be acceptable as follows:

Reuse of existing piping arrangements should be considered. A fresh water flushing system is required for this system.

The Galley/Turbid Holding Tank could be located in the Hold No. 2 Storeroom area in the space presently occupied by the Retention Tank.

The Sewage Holding Tank can be located in the Engine Room in the space now occupied by the Collection Tank.

The existing pipe tunnel between the Engine Room and Hold No. 2 would be used for piping runs to overboard and pierside connections and from G/T Holding Tank to the Sewage Holding Tank.

The existing 25 gallon Galley Drain Tank will remain in use with the pump discharge piping revised to connect to the G/T Holding Tank. The single drinking fountain at frames 14/15 would be reconnected to the gravity G/T drain to the G/T Holding Tank. The overboard discharge should be blanked off.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

**Vessel:** WHITE SAGE (133')

WMS No. 15 GATX Reduced Volume Flush M/T Pump Collection/Incinerator for Concentrated Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Incinerator Feed Tank | 50 gal. (6.7 cu. ft.) |
| Fuel Oil Day Tank | 22 gal. (3 cu. ft.) |
| Incinerator | One (1) Thiokol |

Discussion

The system installation appears to be acceptable subject to the following:

Reuse of existing piping arrangements should be considered. A fresh water flushing system is required for this system.

The Galley/Turbid Holding Tank can be located in the Hold No. 2 Storeroom area where the existing Retention Tank is located. Minor space rearrangement may be necessary.

The Incinerator, Fuel Oil Day Tank and Incinerator Feed Tank can be installed in the area presently occupied by the Collecting Tank in the Engine Room. Minor equipment rearrangement may be required. Stack can run up the casing.

The pipe tunnel between the Engine Room and Hold No. 2 would be used for piping runs to overboard and pierside connections.

The existing 25 gallon Galley Drain Tank will remain in use with the pump discharge piping revised to connect to the G/T Holding Tank. The single drinking fountain at frames 14/15 would be reconnected to the gravity G/T drain to the G/T Holding Tank. The overboard discharge should be blanked off.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 16 GATX Reduced Volume Flush M/T Pump Collection/GATX Evaporator for Concentrated Black Water/Holding Tank for Gray Water

| | Required |
|---|---|
| Galley/Turbid Holding Tank | 2,063 gal. (276 cu. ft.) |
| Catalytic Oxidizer | One (1) |
| Evaporator (GATX) | One (1) 80 gal. |
| Discharge Pumps (4) | 10 - 30 gpm |
| Macerator/Transfer Pumps (2) | |

Discussion

The system installation appears to be acceptable within certain limitations:

Reuse of existing piping arrangement should be considered. A fresh water flushing system is required for this system.

The Galley/Turbid Holding Tank and pumps can be located in the Hold No. 2 Storeroom area to replace the existing Retention Tank. Minor space rearrangement may be necessary.

The Evaporator, Catalytic Oxidizer and pumps can be installed in the Engine Room in the area where the existing Collecting Tank is located. Minor machinery rearrangement may be required.

The existing pipe tunnel between the Engine Room and Hold No. 2 would be used for piping runs to overboard and pierside connections.

The existing 25 gallon Galley Drain Tank will remain in use with the pump discharge piping revised to connect to the G/T Holding Tank. The overboard discharge should be blanked off.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 17 GATX Reduced Volume Flush M/T Pump Collection/Holding Tank for Concentrated Black Water/Grumman Flow Through System with Sludge Holding Tank for Gray Water

| | Required |
|---|---|
| Sewage Holding Tank | 232 gal. (31 cu. ft.) |
| Influent Surge Tank | 323 gal. (43 cu. ft.) |
| Sludge Holding Tank | 172 gal. (23 cu. ft.) |
| Grumman Unit | One (1) |
| Macerator/Transfer Pumps (2) | |
| Discharge Pumps (4) | 10 - 30 gpm |

Discussion

The system installation appears to be acceptable within certain limitations and alternatives:

Reuse of existing piping arrangement should be considered. A fresh water flushing system is required for this system.

In view of the close piping interconnection between the components, and the fact that pierside discharge is via Hold No. 2, it appears advisable to locate the Grumman Unit, Sludge Holding Tank, Sewage Holding Tank and Influent Surge Tank in the Hold No. 2 Storeroom area presently occupied by the Retention Tank. This will probably require minor rearrangement of the space.

An alternate is to locate the Sewage Holding Tank in the Engine Room in the space now filled by the Collection Tank. This will, however, require extra lengths of piping between Hold No. 2 and the Engine Room for Sludge Tank discharge and Influent Tank discharge to the Sewage Tank and Sewage Tank discharge to pierside connections.

The Galley/Turbid drain main in the Engine Room must be led to the Influent Surge Tank in Hold No. 2 via a pipe tunnel through the fuel oil tanks or the void space between the fresh water tanks and the fuel oil tanks (if fitted).

The existing 25 gallon Galley Drain Tank will remain in use with the pump discharge piping revised to connect to the G/T Surge Tank. The single drinking fountain at frames 14/15 would be reconnected to the gravity G/T drain to the G/T Surge Tank. The overboard discharge should be blanked off.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

Vessel: WHITE SAGE (133')

WMS No. 18 GATX Reduced Volume Flush M/T Pump Collection/Grumman Flow Through System for Gray Water/Incincerator for both Concentrated Black Water and Gray Water Sludge

| | Required |
|---|---|
| Sewage Surge Tank | 43 gal. (5.7 cu. ft.) |
| Galley/Turbid Surge Tank | 323 gal. (43 cu. ft.) |
| Fuel Oil Day Tank | 22 gal. (3.0 cu. ft.) |
| Grumman Unit | One (1) |
| Incinerator | One (1) Thiokol |

Discussion

The system installation appears to be acceptable as follows:

Reuse of existing piping arrangement should be considered. A fresh water flushing system is required for this system.

The Galley/Turbid Surge Tank and the Sewage Surge Tank can be located in the Engine Room in the space now occupied by the Collecting Tank.

The Grumman Unit, Incinerator and Fuel Oil Day Tank can be located in the Engine Room between Frames 14 and 15, port side near the centerline. This will require the relocation of the Log Desk, Telephone Booth and possibly the Air Conditioning Water Chiller. The incinerator stack could run up the casing to the weather with the existing Diesel engine exhaust piping. In this arrangement, the pipe tunnel between the Engine Room and Hold No. 2 would be used for piping runs to overboard and pierside connections.

An alternate would be to locate the Grumman Unit, Incinerator and Fuel Oil Day Tank in the Hold No. 2 Storeroom area in the space now occupied by the Retention Tank. The stack could be led up the side of the kingpost up to the towing light.

In this arrangement the pipe tunnel would be used for overboard and pierside discharge piping plus feed piping to the Grumman Unit.

Possibly the best arrangement is to locate all of the equipment in the Hold No. 2 Storeroom area. In this arrangement the separate Sewage and G/T mains must be led from the Engine Room to the Hold No. 2 Storeroom area via the pipe tunnel.

The existing 25 gallon Galley Drain Tank will remain in use with the pump discharge piping revised to connect to the G/T Surge Tank. The single drinking fountain at frames 14/15 would be reconnected to the gravity G/T drain to the G/T Surge Tank. The overboard discharge should be blanked off.

Existing overboard discharge connections and deck discharge connections could be retained for use with the new installation.

* U.S.G.P.O. 727-078/1302-1638