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LEVEL II

12

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

Volume III - Installation Analysis

Part 1 - GALLATIN (378')

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February 1977

FINAL REPORT

PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
OFFICE OF RESEARCH AND DEVELOPMENT
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Volume III of a six volume report. Volume III has been published in six parts.

16. Abstract

Each of the 18 candidate Wastewater Management System (WMS) configurations developed in Volume IV was analyzed for installation aboard the GALLATIN (WHEC - 721). 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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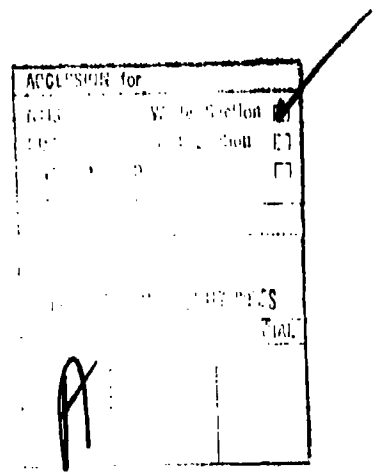
This study was conducted under the technical direction of Mr. Thomas S. Scarano of the Office of Research and Development, U.S. Coast Guard. Mr. Scarano and Lt. Ed Magsig of the Office of Engineering made available the vessel plans and provided valuable assistance in the formulation of the guidelines and assumptions governing this installation analysis.

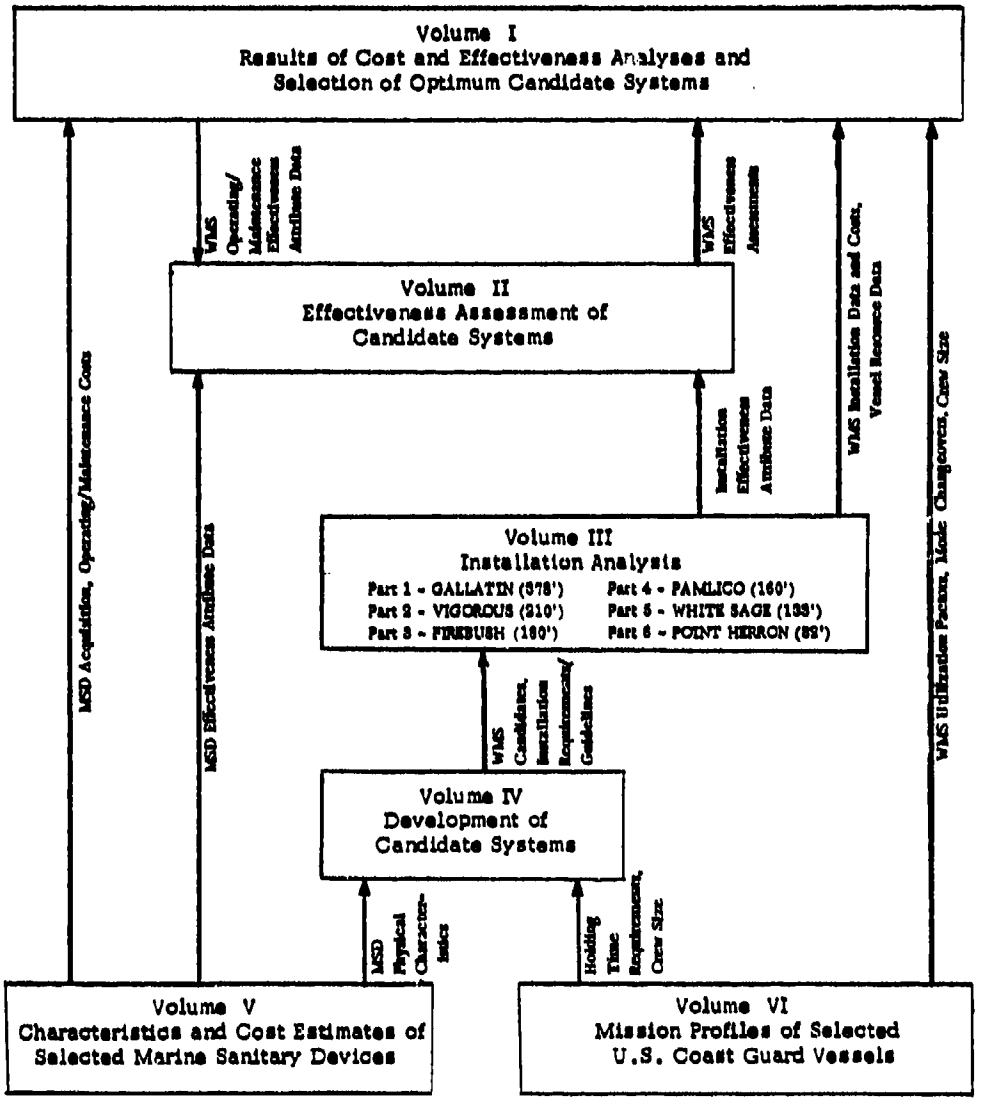
The installation analysis was performed in consultation with George G. Sharp, Inc., 100 Church Street, New York, N.Y. 10007.

The cooperation and assistance of the officers of U.S. Coast Guard Cutter GALLATIN (WHEC-721) 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: GALLATIN (378')

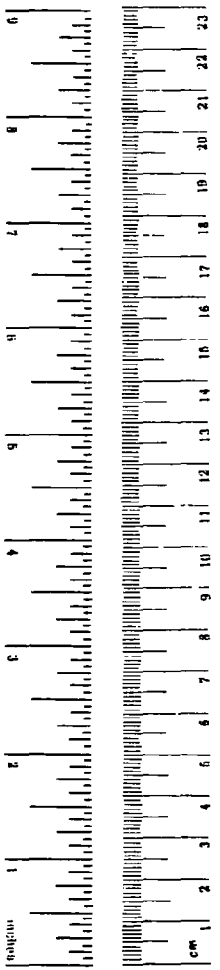
WMS No.	TYPE: Coll/Trans Subsys (Black)	TYPE: Treatment/Disposal Subsystem: Black	TYPE: Treatment/Disposal Subsystem: Gray	Holding Capacity: Black (%)	Holding Capacity: Gray (%)	INSTALLATION COST ($)
1	Gravity Collect.	Holding Tank	Holding Tank	100	19	47,260
2	Oil Recircul. (Chrysler)	Chrysler + Hld Tnk	Holding Tank	100	18	42,370
3		Chrysler + Incin.	Holding Tank	100	13	71,220
4	Gravity Collect. (Grumman)	Grum Flow Thru+HldTk	Holding Tank	100	17	39,980
5		Grumman Flow Thru + Holding Tank		N/A		
6	Gravity Collect.	Holding Tank	Grum Flow Thru+HldTnk	N/A		
7	Gravity Collect. (Grumman)	Grum Flow Thru+Incin.	Holding Tank	100	17	69,060
8		Grumman Flow Thru + Incinerator		N/A		
9	Vacuum Collect. (Jered)	Holding Tank	Holding Tank	100	21	48,310
10		Incinerator	Holding Tank	100	21	75,900
11		GATX Evap.	Holding Tank	100	17	47,340
12		Holding Tank	Grum Flow Thru+ Hld Tnk	N/A		
13		Incinerator	Grum Flow Thru + Incin.	N/A		
14	M/T Pump Collect. (GATX)	Holding Tank	Holding Tank	100	30	47,710
15		Incinerator	Holding Tank	100	33	78,120
16		GATX Evap.	Holding Tank	100	17	41,720
17		Holding Tank	Grum Flow Thru+Hld Tnk	N/A		
18		Incinerator	Grum Flow Thru + Incin.	N/A		

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

METRIC CONVERSION FACTORS

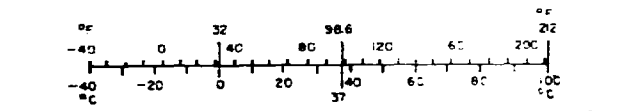
Approximate Conversions to Metric Measures

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



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 [illegible].
- 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]		
	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

GALLATIN (378')

Vessel Characteristic	Data
Class	WHEC - 721 Hamilton (378') Class
Type	High Endurance Cutter
Crew Size	152
Home Port	Governor's Island, New York

SHIPCHECK OBSERVATIONS OF EXISTING VESSEL CONDITIONS

GALLATIN (378')

Crew: 152

Waste Sources: (See tabulation sheets for details)

Deck	W.C.'s	Urinals	Showers	Lavatories
02 Level	3	-	2	3
01 Level	2	-	2	2
Main Deck	5	-	4	9
Second Deck	15	7	16	11
Third Deck	3	3	4	3
Total	28	10	28	28

Existing Arrangement

The Ship's waste sources are grouped in two zones; viz. one forward of Frame No. 192 (approx.) and one aft. All drains, whether black water or gray water, collect by gravity. Each zone is fitted with a holding tank and two pumps which discharge a mixture of black and gray water directly overboard and, in port, to shore connections on deck, port and stbd, for off-loading to a pierside facility.

The forward zone holding tank (approx. 1130 gallons capacity) and its off-loading pumps are located low in the ship, on the Fifth Deck, in the Sewage Sump and Ejector Room (5-144-O-Q). All sewage drains in the zone and all galley/turbid drains on the Third Deck of the zone gravitate to this tank. All turbid drains above the Third Deck gravitate directly overboard.

The aft zone holding tank (approx. 450 gallons capacity) and its off-loading pumps are located on the Third Deck, in Auxiliary Machinery Space No. 3 (3-272-O-E). All galley and sewage drains in the zone gravitate to this tank. Turbid drains in the zone gravitate directly overboard.

The two compartments containing the holding tanks are separated by a comparatively long distance in which are located the engine room, diesel oil fuel storage tanks, fresh water storage tanks, the flume stabilization tank (for controlling the ship's stability when rolling), workshops and berthing compartments.

Gallatin (378') (Cont'd)

Special Remarks

From an analysis of the vessel's drawings and available data, it appears that where gravity drainage is required the most practicable approach would be to retain the existing two-zone concept. There are too many complications and restrictions which will rule out trying to route piping through the aforementioned spaces between the two holding tank compartments in an attempt to consolidate the system arrangements. The distribution of personnel berthing and sanitary facilities is greater in the forward zone than the aft zone. Personnel distribution is almost three times as many forward as aft, and the sanitary facilities installed show sewage sources approximately two to one and turbid sources almost three to one. These factors have been taken into account when analyzing locations and space requirements for waste water management system components.

A check of the vessel verified the vessel arrangement drawings which indicate that all space has been allocated for the many functions for a ship of this type and that there is very little, if any, actual space available anywhere for reassignment. In addition, the interior of the vessel presents a neat covered joiner work appearance, concealing wireways, ducts, piping, etc. This made it practically impossible to suggest runs of ducting (such as incinerator stacks) with any reasonable assurance that there would be no interferences.

The vessel doesnot have ballast tanks as such. Fuel tanks are ballasted as they become depleted. The vessel is fitted with a flume stabilization system to minimize ship's rolling amplitude. It is reported that two Shipalts have been authorized (but have been deferred) which will delete the flume stabilization system and install bilge keels. These are Shipalt No. 378-X-112 dated 2 January 1974 for Bilge Keel Installation and Shipalt No. 378-X-143 dated 18 August 1975 for removal of the Flume Tank. This is mentioned only as information to indicate that should the flume tank's substantial area become available for reassignment, it appears that it could very well simplify locating waste disposal system equipment by centrally locating it and affording a comparatively interference-free place to install it. This, of course would modify to some extent the constraints which governed the selection and location of the various system components presented in this study.

In cases where equipment and/or tank space required aft could be obtained only by taking from the existing commissary stores and issue rooms, it was decided to leave approximately one-half of the commissary stores room still assigned for that purpose. Since there is no other space for re-allocation, the stores could continue to be located there while permitting these certain waste management systems aft to be considered viable. Some adjustment would have to be determined to ascertain the adequacy of the stores space remaining.

VESSEL RESOURCES

Vessel: GALLATIN (WHEC 721) - Hamilton (378') Class

1. Fresh Water
   a. Source of supply (i.e., storage tank, evaporator) In Port - Supplied from off shore source to storage tank
   Underway - Use evaporator - Capacity - 7200 gals per day.
   b. Capacity (# of gals, etc.) Storage tank capacity - 17,794 gals
   c. Usage rate (# of gpd, etc.) approximately - 6,000-6,500 gpd

2. Fuel Oil
   a. Tank capacity (# of gals) Tank Designation & Capacity:* (3-256-0-F) Flume Tank - 27,458 gals; (4-256-1-F) - 9,806 gals; (4-256-2-F) - 9378 gals;
   (5-168-1-F) -11,321 gals; (5-168-2-F) -11,321 gals; (5-120-0-F) -5,794 gals; (4-88-3 & 4-F) -2,311 gals each; (5-104-0-F) - 22,560 gals;
   (5-144-1-F) - 16,498 gals; (5-144-2) - 15,753 gals; (5-20-1 & 2-F) - 8,120 gals each; (3-328-1 & 2-F) - 71,189 gals each; (5-168-0-F) - 28,201 gals = Total - 243,999 gals.
   b. Usage Rate (gpd) Inport - 200-250 gpd; Underway - 3,000 gpd.

3. Electric Power
   a. Capacity kw (2) - 500 Kw Diesel; (1) Emergency Gas Turbine Generator - 500 Kw
   b. Usage rate (when) Inport - Use Shore Facility - Use Approximately - 250-300 Kw.
   Underway - 300-375 Kw
   c. Maximum kw used 350 Amp - or 375 Kw
   d. Average kwh per day 8,400 Kwh per day

4. Compressed Air
   a. Capacity (1) 100psi (95 Cu. Ft/Min); (2) Starting Compressors - 250 psi; (1) 3,000 psi.
   b. Usage rate Use for ships service: Air horn; Maintenance; Starting Engines
   c. No. of hours compressors run per day or percentage of time 60-70% day

5. Capacity of Ventilation Air in CFM
   Location - Type - CFM: See Attached Sheet

6. Drainage Forward Drainage System - Serves - 130 Men
   AFT. Drainage System - Serves - 50 Men

* SHIPALT exists for removal of flume tank = When SHIPALT is completed total capacity will be 215,550 gals.

VENTILATION:

LOCATION	TYPE	CFM	
04-121-2	Exhaust	350	
02-126-2	Exhaust	1276	
02-134-1	Recirculating	3500	2333
02-214-1	Repl. Supply	2665	1775
02-214-2	Recirculationg	2000	
01-101-1	Repl. Supply	2750	1835
01-101-2	Supply	6545	4350
01-105-1	Repl. Supply	5302	3335
01-106-2	Exhaust	2765	
01-134-2	Recirculating	1490	
01-207-1	Supply	26000	17334
01-207-2	Supply	26000	17334
1-154-2	Exhaust	1600	
1-203-1	Exhaust	1440	
1-232-1	Exhaust	26000	17334
1-232-2	Exhaust	26000	17334
1-269-2	Exhaust	5505	
1-301-2	Exhaust	5695	3795
1-306-1	Repl. Supply	2835	1890
1-306-2	Supply	7410	4950
2- 27-1	Supply	1100	
2- 27-2	Exhaust	1100	
2- 68-2	Exhaust	2780	1850
2- 78-2	Exhaust	4300	2867
2-324-1	Supply	1800	900
3- 76-2	Exhaust	5170	3446
3-102-2	Recirculating	2200	
3-169-1	Exhaust	3200	2135
3-188-1	Supply	3200	2135

LOCATION OF BLACK WATER*WASTE SOURCES ABOARD A VESSEL

Vessel: GALLATIN (WHEC - 721) - Hamilton (378') 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
97-102	02	P	C.O. WC, WR and SHR	1	0	1	
97-102	02	S	C.O. WC, WR and SHR	1	0	1	
126-131	02	S	WC (Passage)	1	0	8-10	
87-94	01	P	Engr. Officers' WC, WR and SHR	1	0	1	
87-94	01	S	Exec. Officers' WC, WR and SHR	1	0	1	
85-100	1	P	Officers' SR WC	1	0	2	
85-100	1	S	Officers' SR WC	1	0	2	
100-120	1	P	Officers' SR WC	1	0	2	
100-120	1	S	Officers' SR WC	1	0	2	
156-163	1	P	Sick Bay WC and Bath	1	0	1	
110-120	2	P	Meteorologist WC, WR and SHR	1	0	3	
110-120	2	S	Passengers' WC, WR and SHR	1	0	3	
120-128	2	P	C.P.O SR WC and WR	3	1	15	
161-168	2	S	Crew's WC, WR and SHR	1	1	10	
161-168	2	S	Crew's WC, WR and SHR	1	1	10	
168-176	2	P	Crew's WC, WR and SHR	3	1	30	
272-280	2	P	Crew's WC, WR and SHR	1	1	10	
272-280	2	S	Crew's WC, WR and SHR	1	1	10	

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

LOCATION OF BLACK WATER*WASTE SOURCES ABOARD A VESSEL

Vessel: GALLATIN (WHEC - 721) - Hamilton (378') 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
280-288	2	P	Crew's WC, WR and SHR	3	1	30	
137-143	3	P	Crew's WC, WR and SHR	1	1	10	
137-143	3	S	Crew's WC, WR and SHR	1	1	10	
144-152	3	P	Crew's WC, WR and SHR	1	1	30	

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

LOCATION OF GRAY WATER* WASTE SOURCES ABOARD A VESSEL

Vessel: GALLATIN (WHEC - 721) - Hamilton (378') Class

Bulhead Identification Frame #/To #	Level Identification	Compartment Location	Compartment Name	Waste Source	Comments
97-102	02	P	C.O. WR	Shower (1)	
97-102	02	P	C.O. WR	Lavatory (1)	
97-102	02	S	C.O. WR	Shower (1)	
97-102	02	S	C.O. WR	Lavatory (1)	
120-131	02	P	C.O. Pantry	Sink (1)	
120-131	02	P	C.O. Pantry	Drain from refrigerator	
120-131	02	S	WC (Passage)	Lavatory (1)	
87-94	01	P	Engr. Officers' WR	Shower (1)	
87-94	01	P	Engr. Officers' WR	Lavatory (1)	
87-94	01	S	Exec. Officers' WR	Shower (1)	
87-94	01	S	Exec. Officers' WR	Lavatory (1)	
85-100	1	P	Officers' SR	Shower (1)	
85-100	1	P	Officers' SR	Lavatories (2)	
85-100	1	S	Officers' SR	Shower (1)	
85-100	1	S	Officers' SR	Lavatories (2)	
100-120	1	P	Officers' SR	Shower (1)	
100-120	1	P	Officers' SR	Lavatories (2)	
100-120	1	S	Officers' SR	Shower (1)	
100-120	1	S	Officers' SR	Lavatories (2)	
156-163	1	P	Sick Bay Bath	Lavatory (1)	
156-163	1	P	Sick Bay Bath	Bath Tub (1)	
222-234	1	S	Scullery	Sink (1)	
225-227	1	S	Passage Way	Slop Sink	

* Galley and turbid wastewater.

LOCATION OF GRAY WATER*WASTE SOURCES ABOARD A VESSEL

Vessel: GALLATIN (WHEC - 721) - Hamilton (378') Class

Bulhead Identification Frame #/To #	Level Identification	Compartment Location	Compartment Name	Waste Source	Comments
222-234	1	S	Scullery	Dishwasher (1)	
222-234	1	S	Scullery	Garbage Grinder	
264-285	1	S	Galley	Kettles (4)	
269-285	1	P-S	Mess Deck	Drain (3)	
264-285		S	Galley	Garbage Disposal	
264-285	1	S	Galley	Sinks (3)	
72-96	2	P	Laundry	Washing Mach (2) overboard machine	
110-120	2	P	Meteorologist SR WR	Showers (2)	
110-120	2	P	Meteorologist SR WR	Lavatory (1)	
110-120	2	S	Passengers' SR WR	Showers (2)	
110-120	2	S	Passengers' SR WR	Lavatory (1)	
120-131	2	P	C.P.O SR WR	Showers (2)	
120-128	2	P	C.P.O SR WR	Lavatory (1)	
120-134	2	S	C.P.O. SR WR	Showers (2)	
161-168	2	P	Crew's WR	Shower (1)	
161-168	2	P	Crew's WR	Lavatory (1)	
161-168	2	S	Crew's WR	Shower (1)	
161-168	2	S	Crew's WR	Lavatory (1)	
168-176	2	P	Crew's WR	Showers (2)	
168-176	2	P	Crew's WR	Lavatory (1)	
272-280	2	P	Crew's WR	Shower (1)	
272-280	2	P	Crew's WR	Lavatory (1)	

* Galley and turbid wastewater.

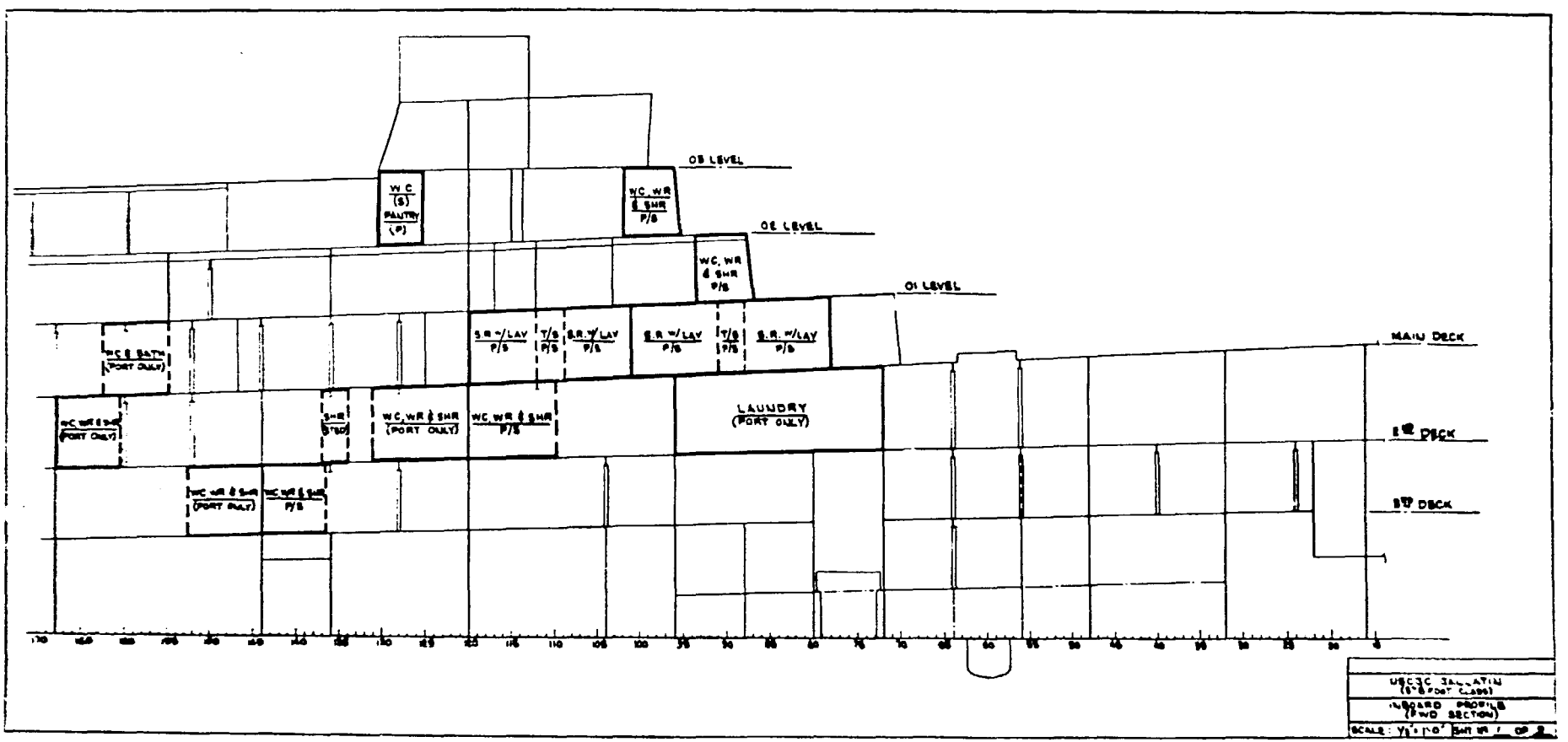
LOCATION OF GRAY WATER* WASTE SOURCES ABOARD A VESSEL

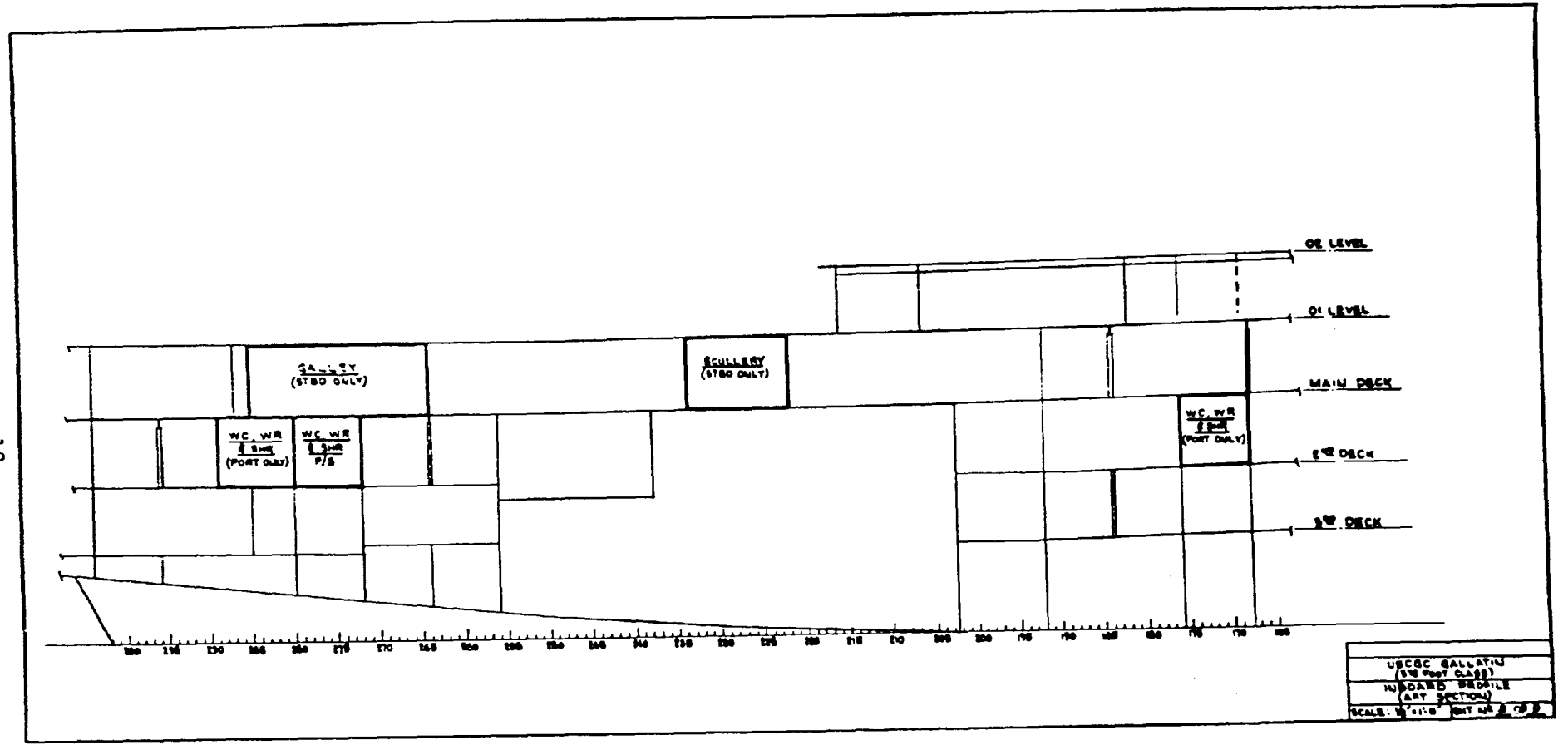
Vessel: GALLATIN (WHEC - 721) - Hamilton (378') Class

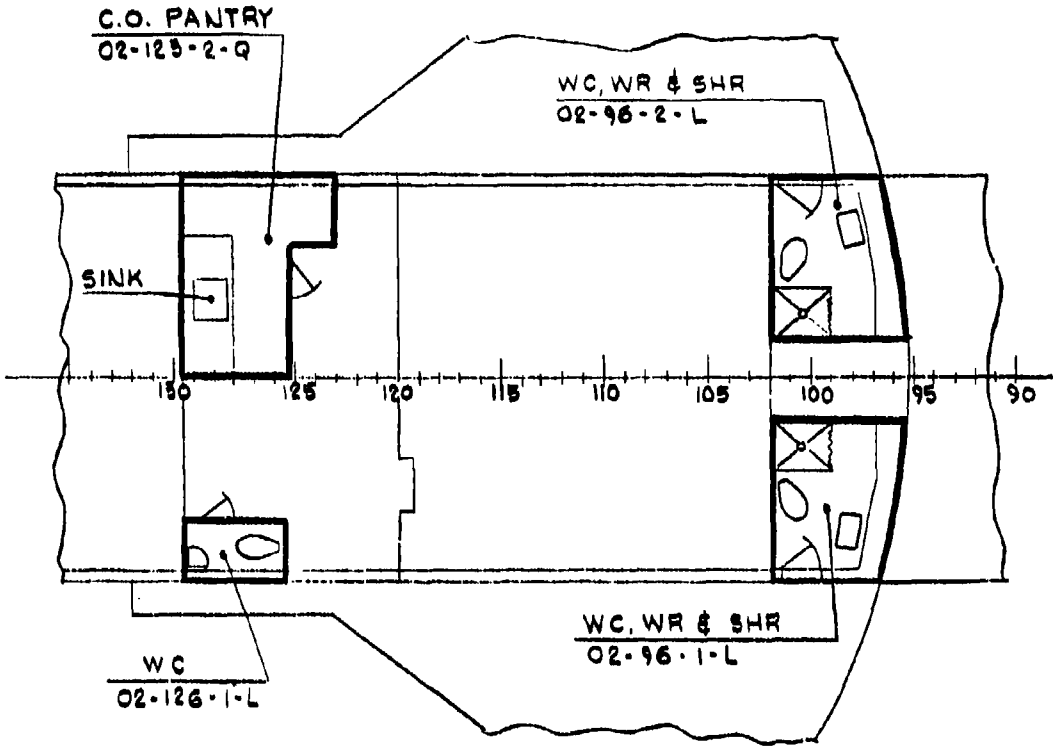
Bulhead Identification Frame #/To #	Level Identification	Compartment Location	Compartment Name	Waste Source	Comments
272-280	2	S	Crew's WR	Shower (1)	
272-280	2	S	Crew's WR	Lavatory (1)	
280-288	2	P	Crew's WR	Showers (2)	
280-288	2	P	Crew's WR	Lavatory (4)	
187-144	3	P	Crew's WR	Shower (1)	
137-144	3	P	Crew's WR	Lavatory (1)	
137-144	3	S	Crew's WR	Shower (1)	
137-144	3	S	Crew's WR	Lavatory (1)	
144-152	3	P	Crew's WR	Showers (2)	
144-152	3	P	Crew's WR	Lavatory (1)	
144-168	5		Forward	Sewage Disp. Tank 1300 gals.	
272-280	3		Aft	Sewage Disp. Tank 500 gals.	

* Galley and turbid wastewater.

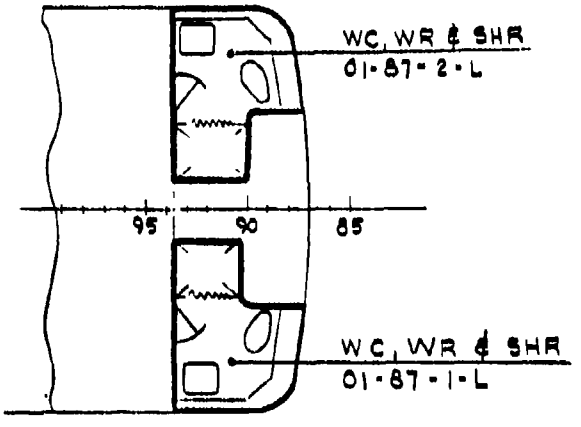
ARRANGEMENT OF BLACK AND GRAY WASTEWATER SOURCES




02 LEVEL
01 LEVEL
MAIN DECK
2ND DECK
3RD DECK
GALLEY
(STBD ONLY)
SCULLERY
(STBD ONLY)
WC WR
(PORT ONLY)
WC WR
P/S
WC WR
(PORT ONLY)
USCGC GALLATIN
(378 FOOT CLASS)
PROFILE
(ART SECTION)

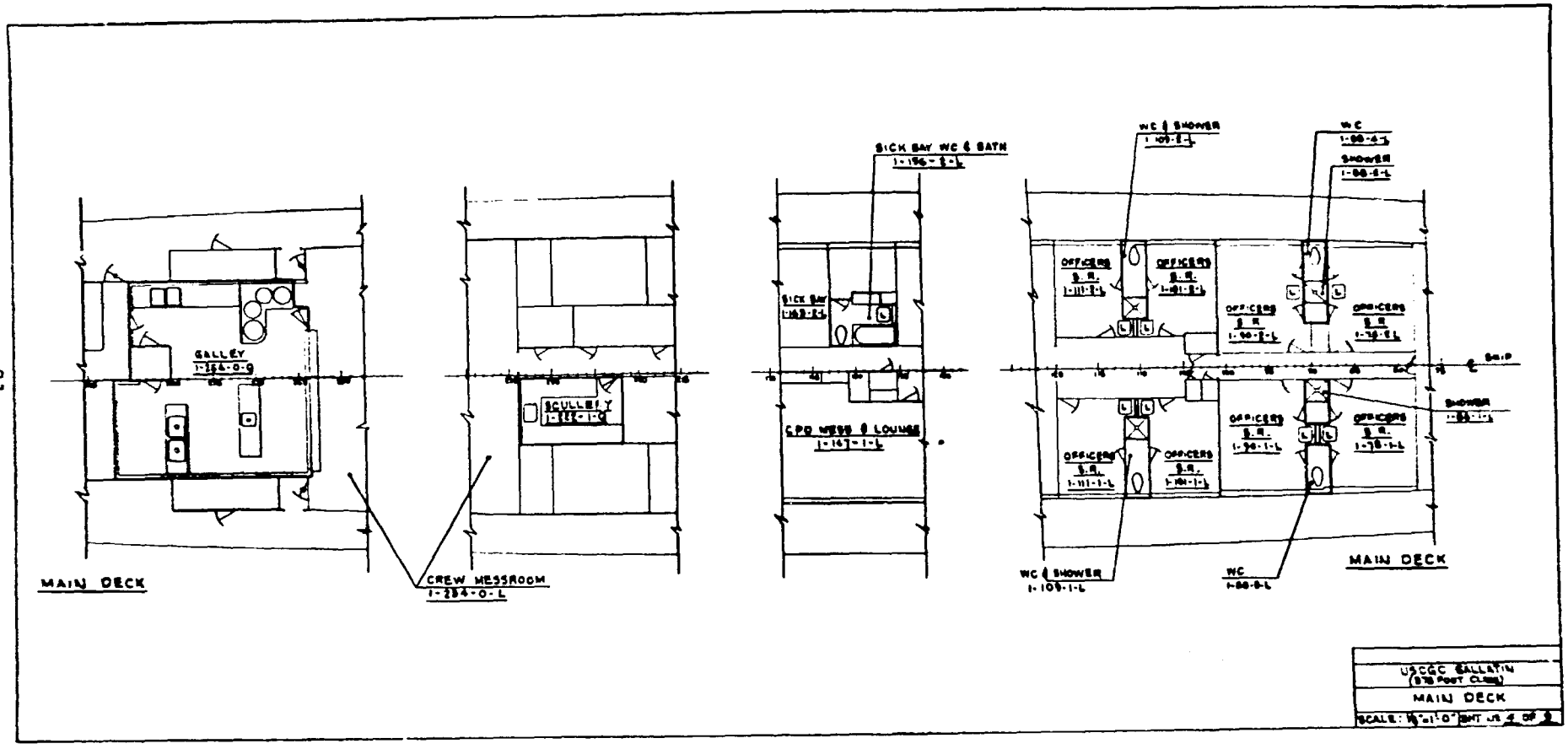


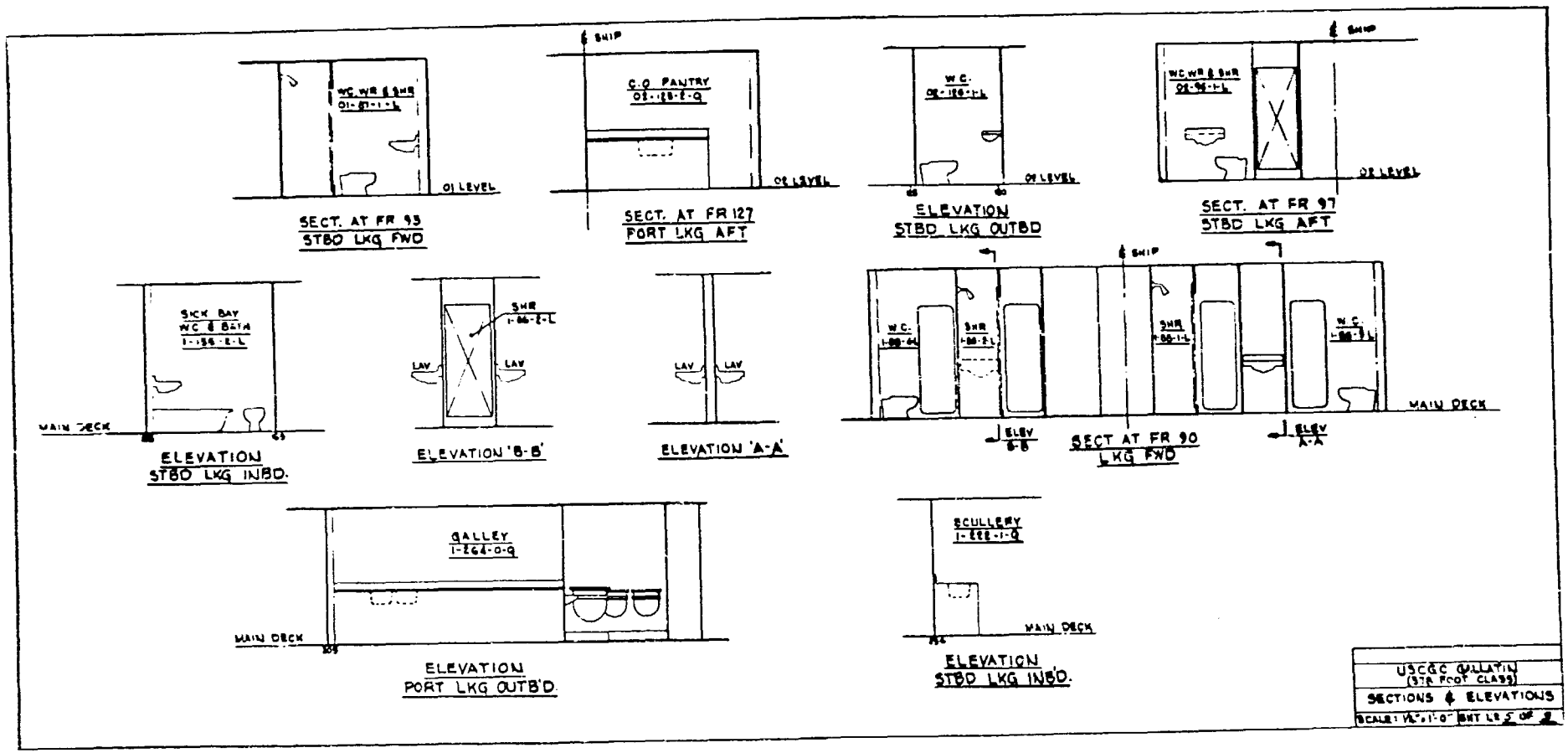
02 LEVEL

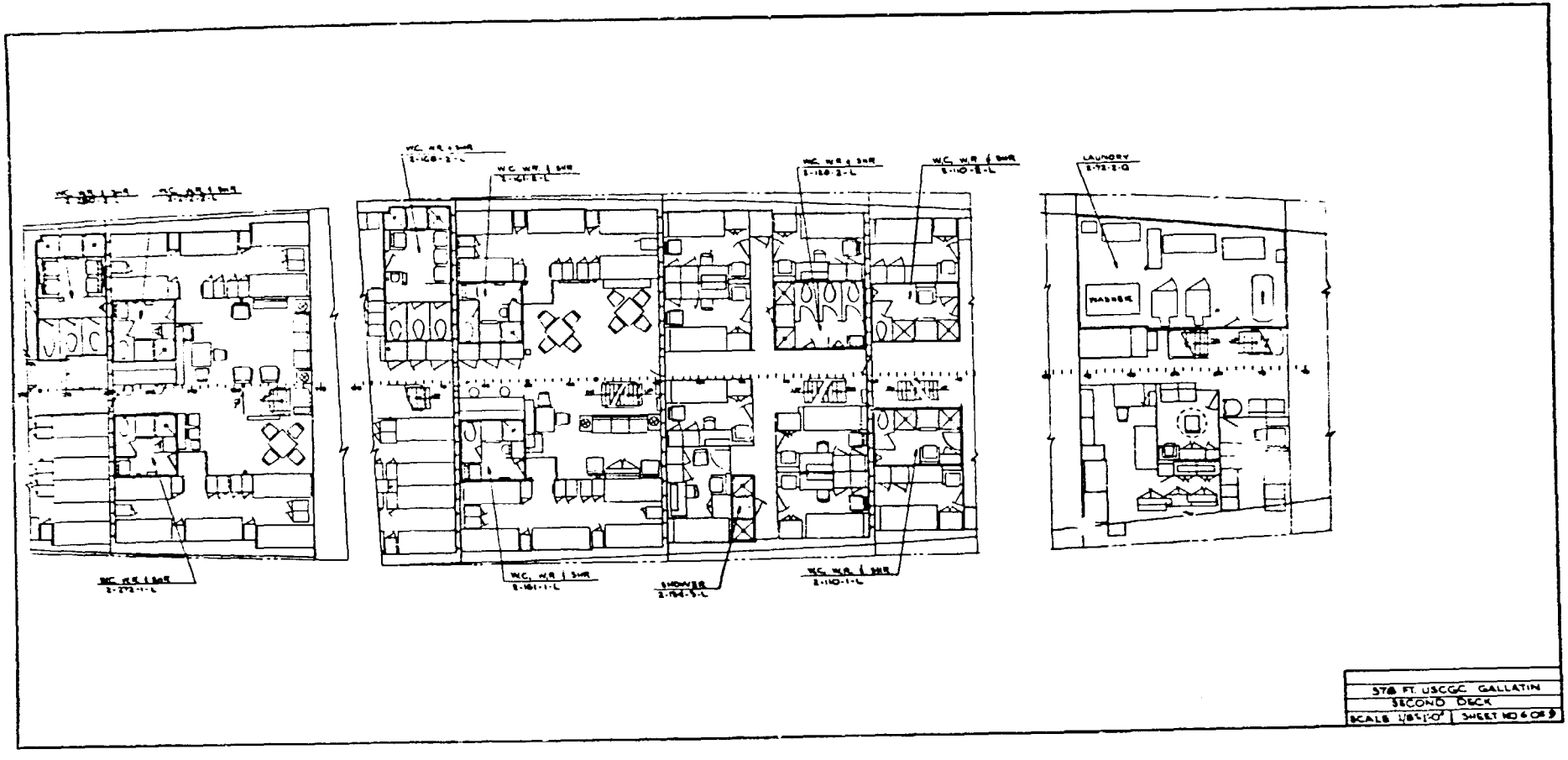


01 LEVEL

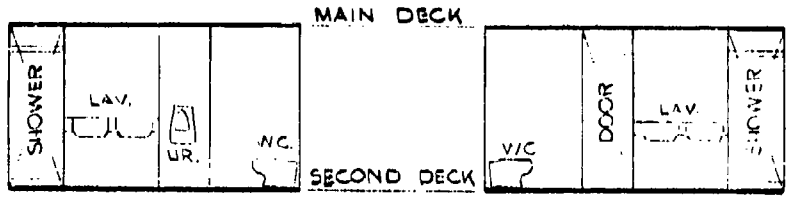
USCGC GALLATIN (378 FOOT CLASS)	
01 & 02 LEVELS	
SCALE: 1/8" = 1'-0"	SHT NO. 5 OF 9


GALLEY
1-154-0-G
MAIN DECK
CREW MESSROOM
1-284-0-L
SCULLERY
SICK BAY WC & BATH
1-196-1-L
SICK BAY
1-162-1-L
CPO MESS & LOUNGE
1-167-1-L
WC & SHOWER
1-109-1-L
WC
1-88-0-L
SHOWER
1-88-1-L
OFFICERS
S. R.
1-111-1-L
1-91-1-L
1-90-1-L
1-78-1-L
1-111-1-L
1-101-1-L
SHIP
MAIN DECK
USCGC GALLATIN
(378 FOOT CLASS)
MAIN DECK
SCALE: 1/8"=1'-0" SHT. NO. 4 OF 8


WC. WR & SHR
01-87-1-L
01 LEVEL
SECT. AT FR 93
STBD LKG FWD
℄ SHIP
C.O. PANTRY
02-128-2-Q
02 LEVEL
SECT. AT FR 127
PORT LKG AFT
W.C.
02-120-1-L
01 LEVEL
ELEVATION
STBD LKG OUTBD
℄ SHIP
WC. WR & SHR
02-96-1-L
02 LEVEL
SECT. AT FR 97
STBD LKG AFT
SICK BAY
WC & BATH
1-136-2-L
MAIN DECK
ELEVATION
STBD LKG INBD.
SHR
1-86-2-L
LAV
LAV
ELEVATION 'B-B'
LAV
LAV
ELEVATION 'A-A'
℄ SHIP
W.C.
1-88-4-L
SHR
1-88-2-L
SHR
1-88-1-L
W.C.
1-88-3-L
MAIN DECK
ELEV
B-B
SECT AT FR 90
LKG FWD
ELEV
A-A
GALLEY
1-264-0-Q
MAIN DECK
ELEVATION
PORT LKG OUTB'D.
SCULLERY
1-222-1-Q
MAIN DECK
ELEVATION
STBD LKG INB'D.
USCGC GULLATIN
(378 FOOT CLASS)
SECTIONS & ELEVATIONS
SCALE: 1/4"=1'-0" SHT 18 OF 2

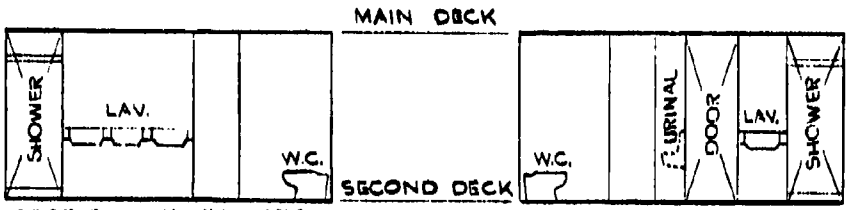


378 FT. USCGC GALLATIN
SECOND DECK
SCALE 1/8"=1'-0" | SHEET NO 6 OF 9



SECTION AT FR 284 LOOKING FWD.

SECTION AT FR. 284 LOOKING AFT



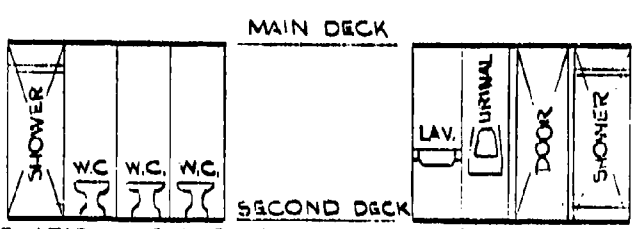
SECTION AT FR 173 LOOKING FWD

SECTION AT FR. 173 LOOKING AFT

NOTE
PORT SIDE IS OPPOSITE HAND

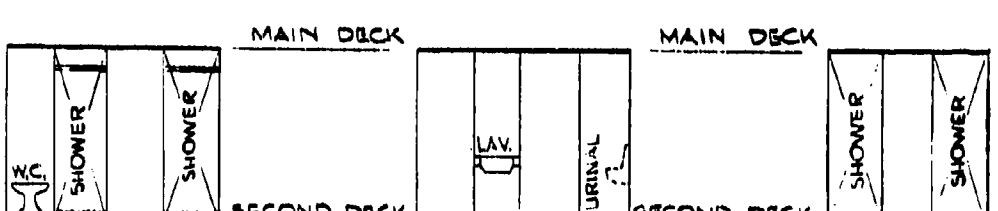
ELEVATION AT STBD SIDE FR. 272-279 LOOKING PORT FR. 160-168 SIMILAR

ELEVATION AT STBD SIDE FR. 272-279 LOOKING STBD FR. 160-165 SIMILAR



ELEVATION AT PORT SIDE FR. 120-133 LOOKING PORT

ELEVATION AT PORT SIDE FR. 120-133 LOOKING STBD



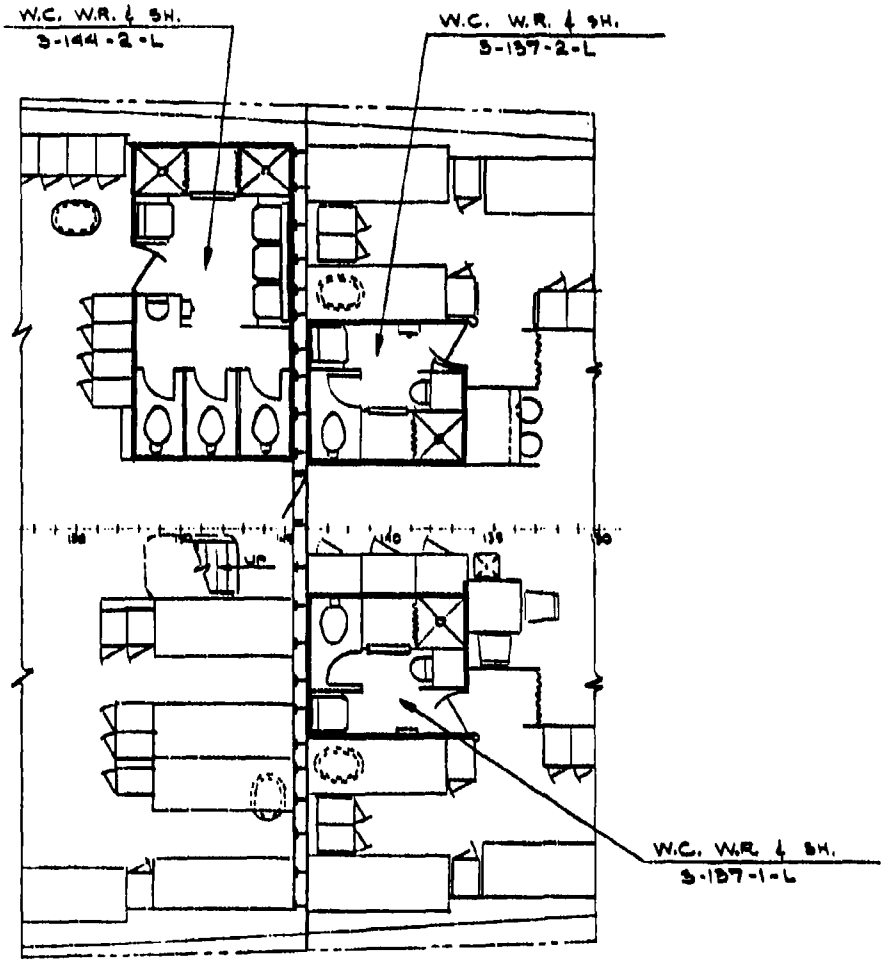
ELEVATION AT STBD SIDE FR. 105-120 LOOKING PORT

ELEVATION AT STBD SIDE FR. 105-120 LOOKING STBD

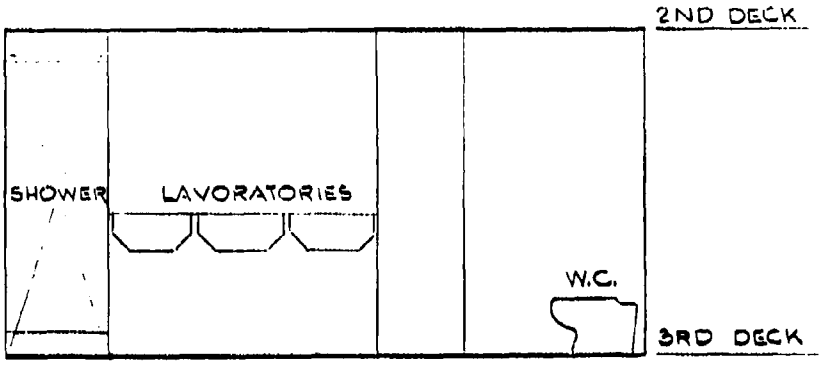
SECTION AT FR. 135 LOOKING AFT

NOTE
PORT SIDE AS THE OPPOSITE HAND

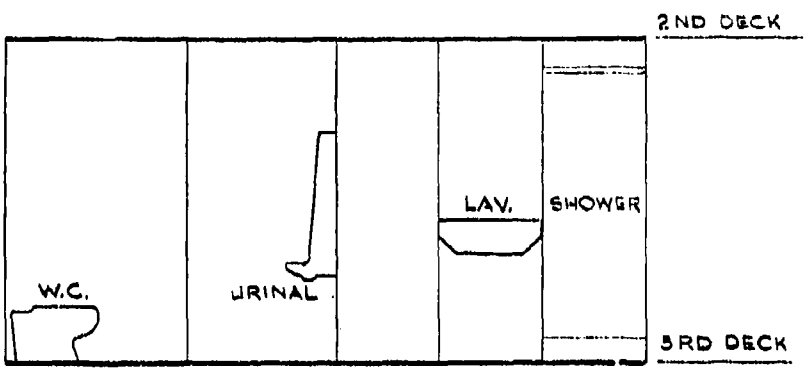
378 FT. USCGC GALLATIN	
SECOND DECK	
SCALE 1/8" = 1'-0"	SHEET NO. 7 OF 9



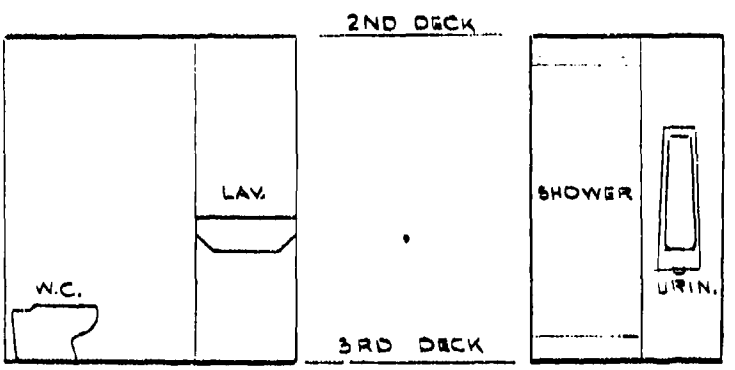
378 FT. USCGC GALLATIN
THIRD DECK
SCALE 1/8"=1'-0" SHEET NO 8 OF 9



SECTION AT FR. 149
LOOKING FWD



SECTION AT FR. 150
LOOKING AFT



SECTION AT FR. 140
LOOKING AFT.

SECTION AT FR. 140
LOOKING FWD.

378 FT. USCGC GALLATIN	
SECTIONS AT THIRD DECK	
SCALE 1/4" = 1'-0"	SHEET NO 9 OF 9

WMS EQUIPMENT REQUIREMENTS

Vessel GALLATIN (378')

WMS NUMBER	WMS ACCEPTABILITY: For Installation (Yes/No)	Holding Time (%) Black	Holding Time (%) Gray	Safety (Yes/No) (1)	NUMBER OF FIXTURES: Commodes (2)	Urinals (2)	JERED: NUMBER OF VCT's (Sized By Gallons) Small Boat 30	60	Large Boat 120	200	250	NUMBER OF INCINERATORS: Jered	Thiokol	GATX: Number of W/T Pumps	NUMBER OF EVAPORATORS (Sized By Gallons) 20	40	60	80	GRUMMAN: Number of Vapor Treatment Sections	Number of Treatment Subsystems	Number of Thiokol Incinerators	CHRYSLER: COLLECTION AND RECIRCUL. SUBSYSTEM: Number of Separator Tanks Model A	A/B	B	Number of P&FM Packages Model A	B	Number of Sludge Surge Tanks Model B	C	INCINERATOR SUBSYSTEM: Number of Incinerators Model A	C	TANKS (4) BLACK (Gallons Each Tank) FWD	AFT	GRAY (Gallons Each Tank) FWD	AFT
1	Yes	100	19	Yes	28S	10S																										5184B	2596B	1750B	2424B
2	Yes	100	18	Yes	28S	10S																3		3								965C	487C	1571B	2424B
3	Yes	100	13	Yes	28S	10S																3		3				1		2				539B	2424B
4	Yes	100	17	Yes	28S	10S													2													528A, 434C	265A, 217C	1750B	2020B
5	No																																					
6	No																																					
7	Yes	100	17	Yes	28S	10S													2	2												258A	265A	1750B	2020B
8	No																																					
9	Yes	100	21	Yes	28J	10S/9J			1	1																						1533B	763B	2244B	2424B
10	Yes	100	21	Yes	28J	10S/9J			1	1		2																						2244B	2424B
11	Yes	100	17	Yes	28J	10S/9J			1	1							6	6																1346B	2424B
12	No																																					
13	No																																					
14	Yes	100	30	Yes	28G	10S/10G								18																		1008B	530B	2693B	3994B
15	Yes	100	33	Yes	28G	10S/10G						1		18																				2693B	4668B
16	Yes	100	17	Yes	28G	10S/10G								18			6	6																1346B	2424B
17	No																																					
18	No																																					

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, 2	4, 14	9
Tank Height	6'0" (FWD and AFT)	5'-0" (FWD and AFT)	6'-0" (FWD) and 5'-6" (AFT)

Vessel: GALLATIN (378')

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

	Required
Sewage Holding Tank	7,781 gal. (1040 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sewage Holding Tank Overboard Pump	Two (2) per tank
G/T Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system is considered to be a viable candidate subject to certain considerations.

Location of Equipment

(a) Forward of Frame 192

It appears that the sewage holding tank capacity required for this forward zone (approx. 5184 gal.) can be installed in the Sewage Sump and Ejector Room. The tank would be approximately 9'-6" L x 12'-3" W x 6' H.

There does not appear to be sufficient space available to fit all the required galley/turbid holding tankage. It is estimated that tankage for approximately 1750 gal. can be fitted alongside the sewage holding tank. The tank would be approximately 6'-6" L x 6' W x 6' H.

(b) Aft of Frame 192

It appears that there sufficient space in the Issue Room to accommodate the estimated sewage holding tank requirement of approximately 2596 gal. The tank would be approximately 6' L x 9'-6" W x 6' H.

There is insufficient space available to fit all the required galley/turbid holding tankage. Space in the Commissary Stores can apparently accommodate approximately 2424 gal. The tank would be approximately 6' L x 9' W x 6' H.

The sewage holding tank overboard discharge pumps and the galley/turbid holding tank overboard discharge pumps would be located in Auxiliary Machinery Space No. 3 adjacent to the tank spaces.

(c) Some existing equipment will have to be relocated to accommodate the installation.

Drainages

(a) Forward of Frame 192

All sewage would gravitate to the holding tank for pumping overboard or pierside according to prevailing restrictions.

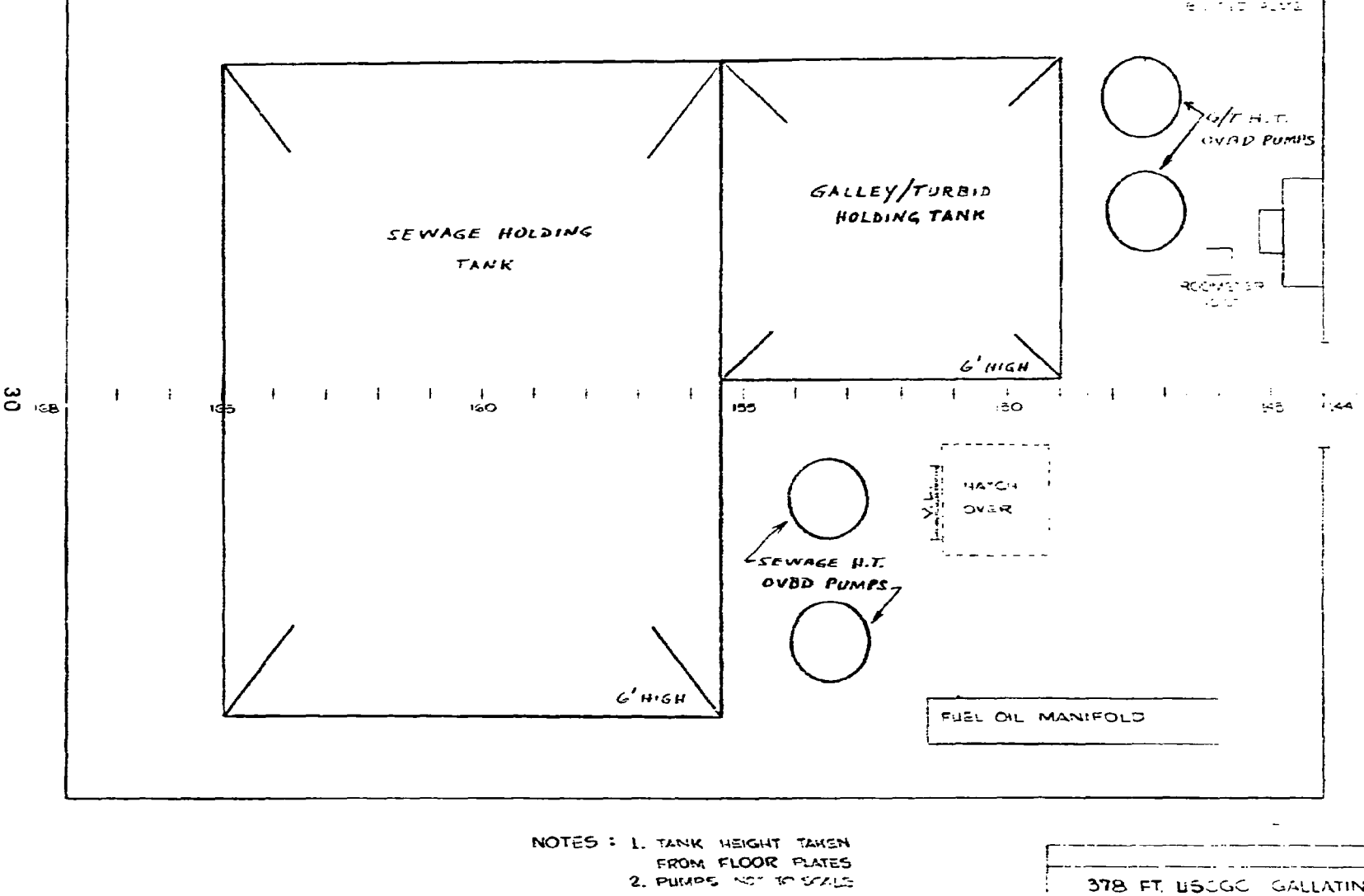
Galley/turbid drains from the Third Deck would have to drain to the G/T holding tank since they are below the waterline and cannot gravitate overboard. They would be pumped overboard/pierside according to prevailing restrictions. Galley/turbid drains above the Third Deck would gravitate overboard in unrestricted waters and to the G/T holding tank in restricted waters for pump discharge according to prevailing restrictions.

(b) Aft of Frame 192

All sewage would gravitate to the sewage holding tank for pumping overboard or pierside according to prevailing restrictions.

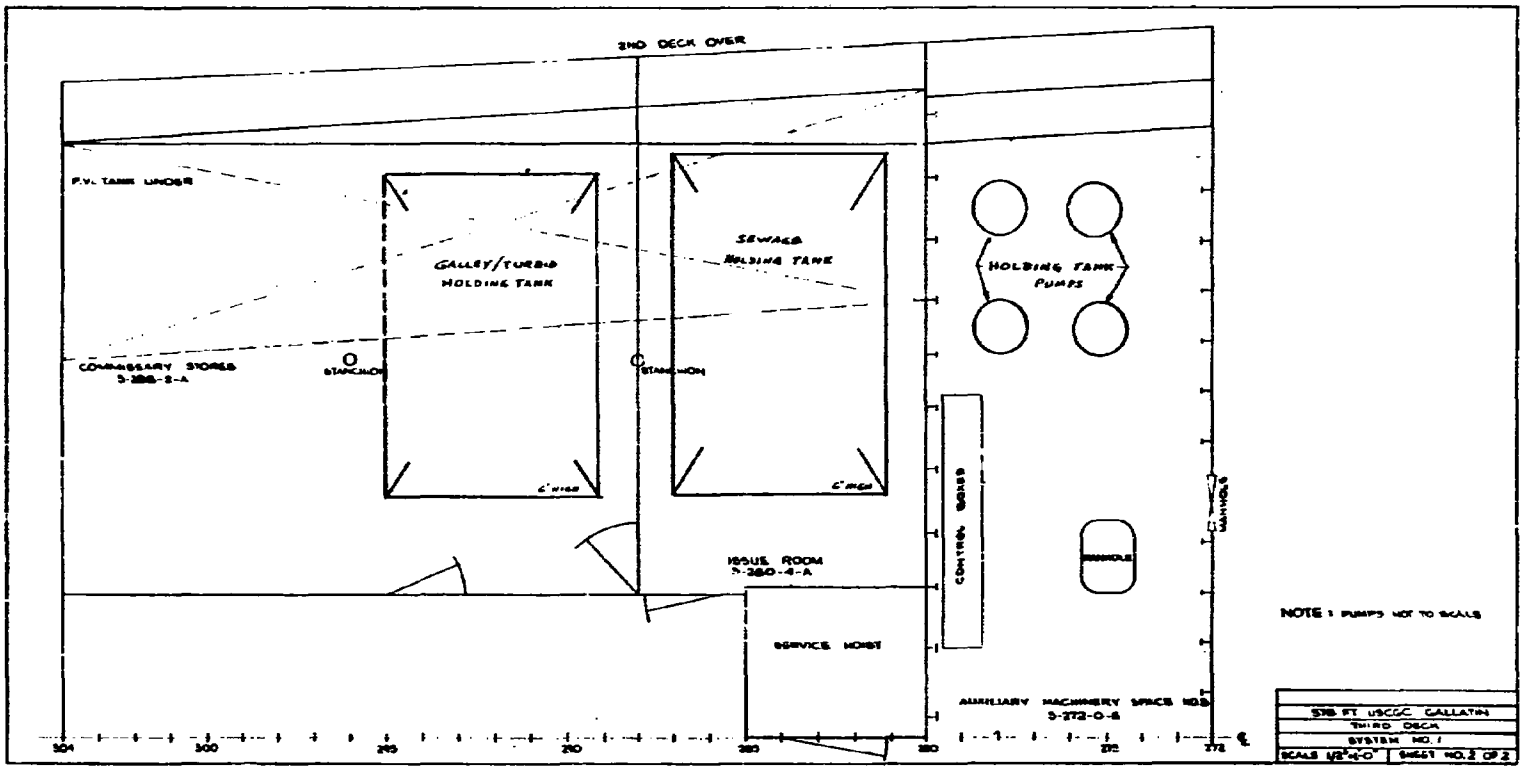
All galley/turbid drains would gravitate overboard in unrestricted waters and otherwise to the G/T holding tank for discharge according to prevailing restrictions.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM S-142-C-G
SYSTEM NO. 1
SCALE 1/2"-1-0 SHEET NO. 1 OF 2


2ND DECK OVER
F.V.L. TANK UNDER
GALLEY/TURBID HOLDING TANK
SEWAGE HOLDING TANK
HOLDING TANK PUMPS
COMMISSARY STORES S-288-2-A
O STANCHION
C STANCHION
MESS ROOM S-280-4-A
CONTROL BOARD
SERVICE HOIST
AUXILIARY MACHINERY SPACE NO.2 S-272-0-A
NOTE : PUMPS NOT TO SCALE
378 FT. USCGC GALLATIN
THIRD DECK
SYSTEM NO. 1
SCALE 1/8"=1'-0"
SHEET NO. 2 OF 2

WMS INSTALIATION COST ESTIMATES

Vessel GALLATIN (378')

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)	4,570[2]	20,565
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	16,718[4]	9,195
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	11,870[5]	10,921
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,100	2,200
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	65	975
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	105	105
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	225	1,350
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					47,261

(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: GALLATIN (378')

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	1,452 gal. (194 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)

Chrysler Model and Quantity	Option A	Option B
Separation Tank	One (1) - B	Three (3) - A/B
Fluid Maintenance Module	One (1) - B	
Pump Package	One (1) - B	
Oil Accumulator	One (1) - 46.8 cu. ft.	
Fluid Maintenance and Pump Package		Three (3) - A
Sewage Holding Tank Overboard Pump	Two (2) per tank	
G/T Holding Tank Overboard Pump	Two (2) per tank	

Discussion

The system is considered to be a viable candidate subject to certain considerations.

Location of Equipment

(a) Forward of Frame 192

It appears that all of the required sewage holding tankage (approx. 965 gal.) can be installed in the Sewage Sump and Ejector Room. The tank would be approximately 3'-6" L x 6' W x 6' H.

There is insufficient space available for all required galley/ turbid holding tankage. It is estimated that tankage for approximately 1571 gal. can be fitted alongside the sewage holding tank. The tank would be approximately 7' L x 5' W x 6' H.

The tank overboard discharge pumps would be located near the tanks served.

System No. 2 (Cont'd)

Chrysler equipment Option A would be impractical for a two zone ship with restrictions like the subject vessel, since it calls for only 1 set. Therefore, Option B is better adaptable, since two of the three required shipsets would be located in the Sewage Sump and Ejector Room.

(b) Aft of Frame 192

The estimated required sewage holding tank capacity can be met by installing the tank (approx. 487 gal.) in the Issue Room adjacent to Auxiliary Machinery Room No. 3. The tank would be approximately 4' L x 4' W x 4'-3" H.

The estimated required galley/turbid tankage (approx. 2424 gal.) could be installed in the Commissary Stores space adjacent to the Issue Room. The tank would be approximately 6' L x 9' W x 6' H.

The remaining Chrysler set could be installed in the Issue Room. The sewage tank overboard discharge pumps and the G/T holding tank overboard pumps would be located in Auxiliary Machinery Room No. 3.

(c) Some of the existing equipment will require relocation.

Drainage

(a) Forward of Frame 192

All sewage would gravitate to the Chrysler separation tanks for transfer to the sewage holding tank for off-loading overboard or to pierside according to prevailing restrictions.

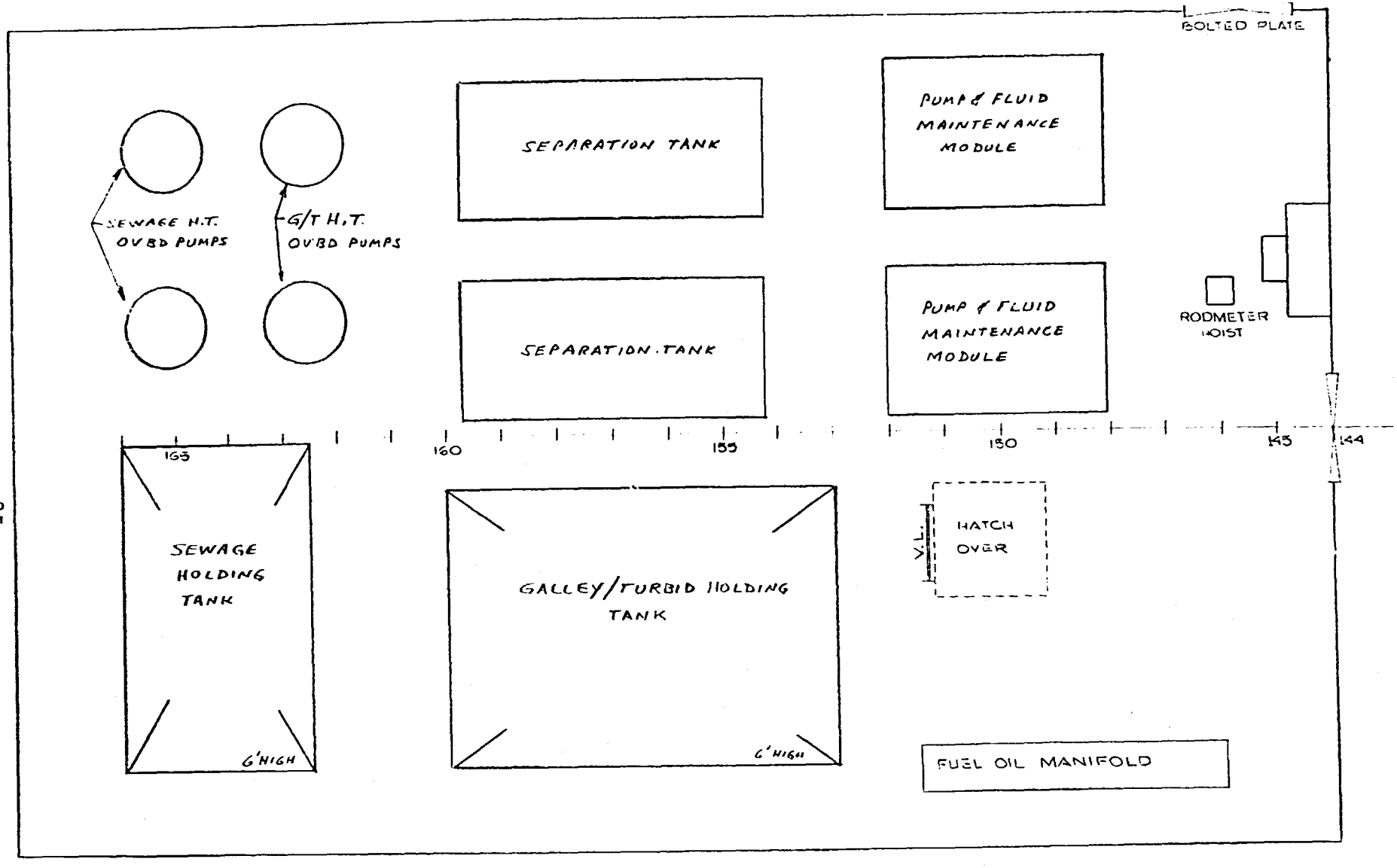
Galley/turbid drainage would be the same as in System No. 1.

(b) Aft of Frame 192

All sewage would be handled the same way as for spaces forward of Frame 192.

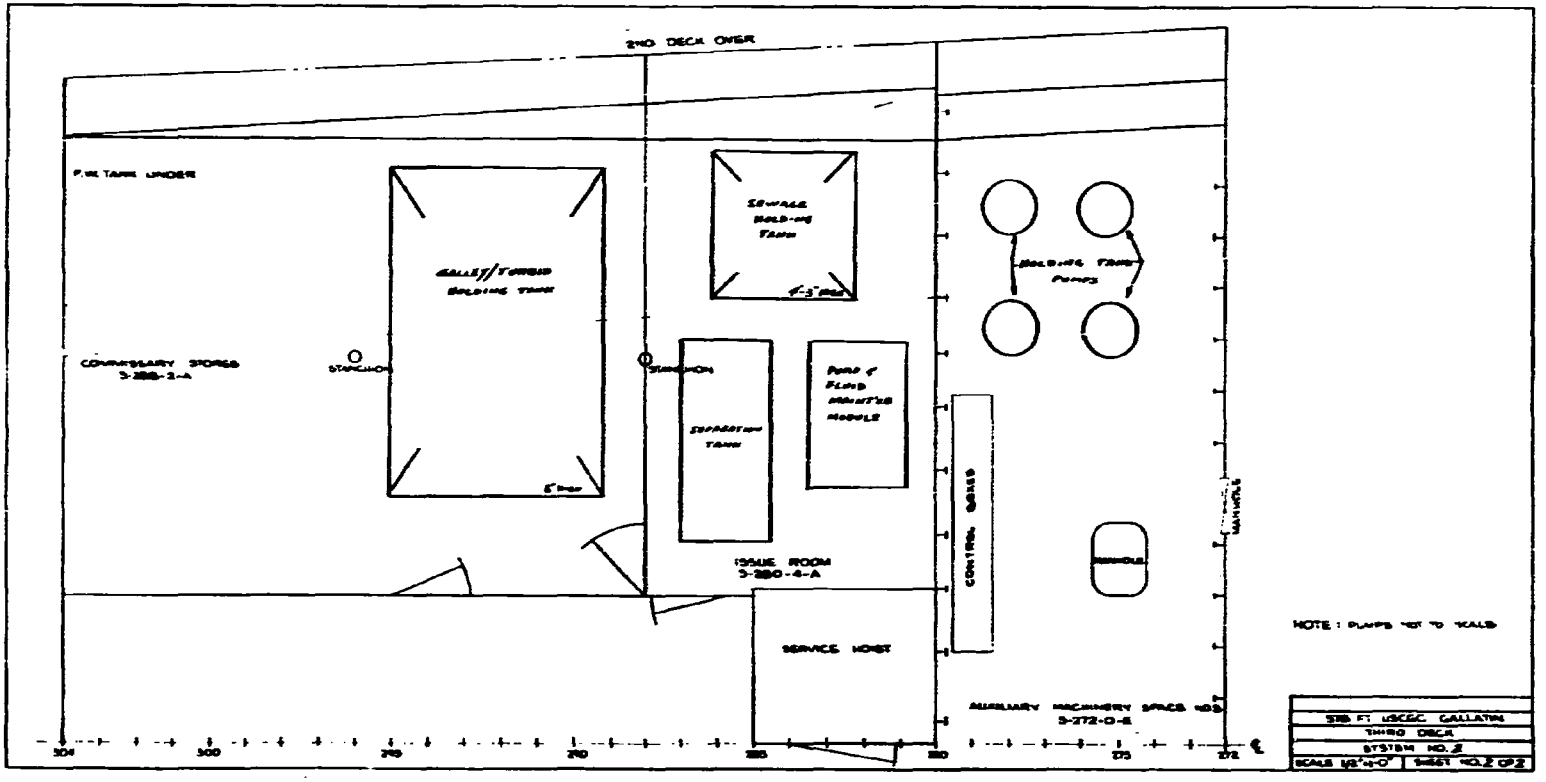
Galley/turbid drainage would be the same as in System No. 1.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-Q
SYSTEM NO. 2
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
F.W. TANK UNDER
GALLEY/TOWED BOILING TANK
SEWAGE BOILING TANK
BOILING TANK PUMPS
COMMISSARY STORES S-280-2-A
STANCHION
STANCHION
SEPARATION TANK
PUMP & FLUID MONITOR MODULE
ISSUE ROOM S-280-4-A
CONTROL GRASS
MANHOLE
SERVICE HOIST
AUXILIARY MACHINERY SPACE NO.2 S-272-0-E
304
300
295
290
285
280
275
272
NOTE : PLANS NOT TO SCALE
378 FT USCGC GALLATIN
THIRD DECK
SYSTEM NO. 2
SCALE 1/2"=1'-0"
SHEET NO. 2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	5,390[2]	24,255
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	10,085[4]	5,547
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	6,555[5]	5,755
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,375	2,750
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	65	975
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	85	85
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	175	1,050
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					42,367

(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: GALLATIN (378')

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	22,230 gal. (2972 cu. ft.)
Sludge Holding Tank	Two (2) - Model C
Incinerator Model and Quantity	Two (2) - Model C

Chrysler Model and Quantity

	Option A	Option B
Separation Tank	One (1) - B	Three (3) - A/B
Oil Accumulator	One (1) 46.8 cu. ft.	
Fluid Maintenance and Pump Package		Three (3) - A
Pump Package	One (1) - B	
Fluid Maintenance Module	One (1) - B	

Sludge Holding Tank	
Transfer Pump	One (1) per tank
Overboard Pump	One (1) per tank
Galley/Turbid Holding Tank	
Overboard Pump	Two (2) per tank

Discussion

The system is considered to be a viable candidate subject to certain considerations and reservations.

This system is essentially the same as System No. 2 except that in place of a sewage holding tank, an incinerator with a sludge holding (surge) tank has been substituted. Therefore the discussion for System No. 2 would apply. For the forward zone an incinerator with its sludge holding (surge) tank would be fitted in the Sewage Sump and Ejector Room. For the aft zone an incinerator would be fitted in Auxiliary Machinery Room No. 3. Its sludge holding (surge) tank would be fitted in the adjacent Issue Room.

Vessel: GALLATIN (378')

System No. 3 (Cont'd)

The required galley/turbid tank capacity cannot be fully accommodated. A tank of approximately 539 gallons (3' L x 4' W x 6' H) can be fitted in the Sewage Sump and Ejector Room for the forward zone. For the aft zone a tank of approximately 2424 gallons (6' L x 9' W x 6' H) would be located in the commissary Stores.

The pumps would be located near the tanks served.

It should be noted that the requirements call for only one (1) sludge holding tank (Model C) to feed both incinerators. However, due to the required zoning of the vessel only one incinerator can be located forward and one aft, but the one sludge holding tank cannot feed the two incinerators. There would have to be an additional tank.

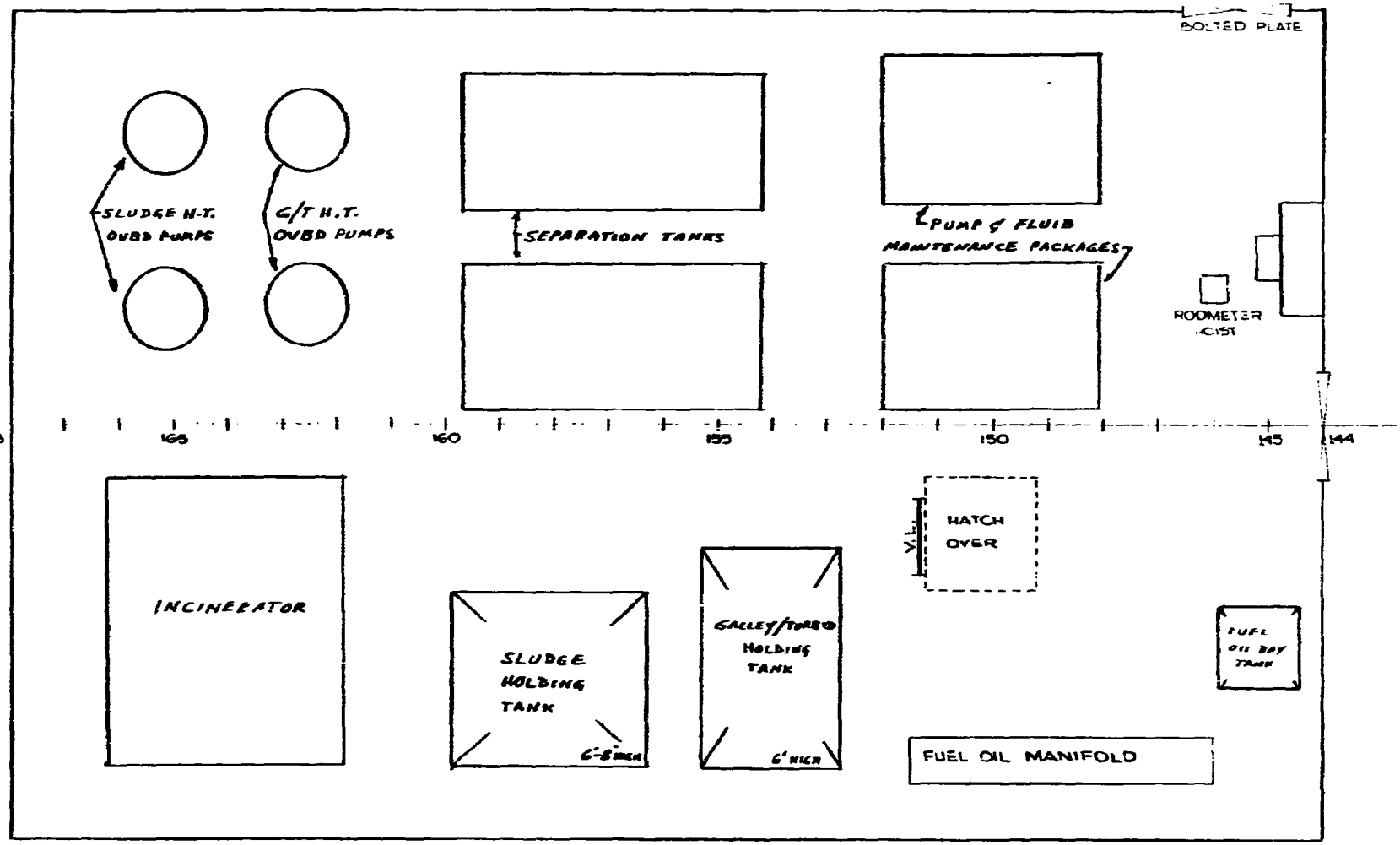
The incinerator stack runs were very difficult to estimate since the compartments other than machinery spaces are sheathed, concealing structure, piping, directing, and wireways. However, as an approximation, consideration could be given to the following:

(a) for the forward zone the stack could be run outboard in the overhead of the Crew's Berthing and then up along the ship's side to the underside of the 01 Level in the weather. From there it would be led aft to the gas turbine exhaust casing for discharge to the weather.

(b) for the aft zone the stack could be run up along the shell of the ship to the underside of the 01 Level in the weather and then to the turbine exhaust casing for discharge to the weather.

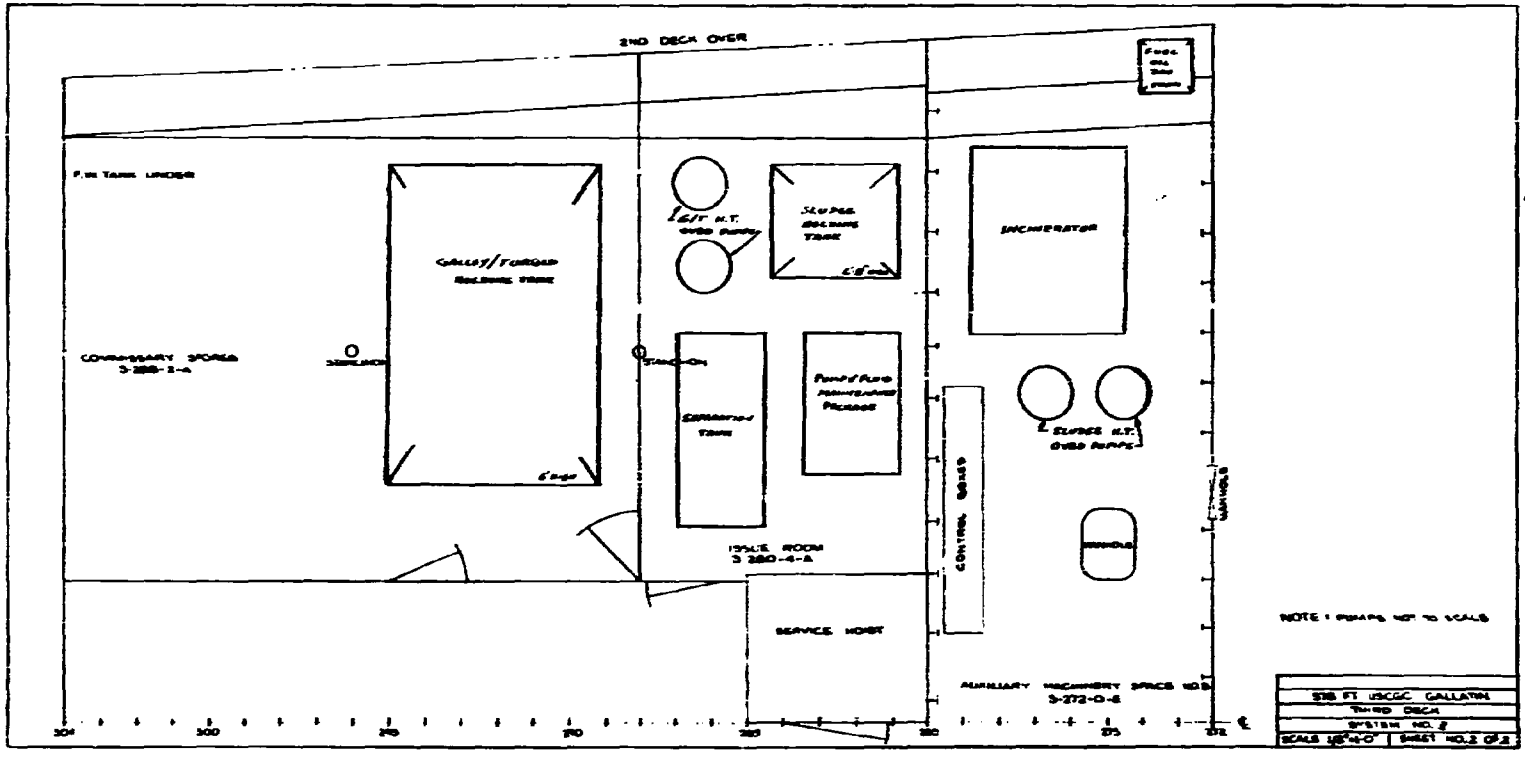
Installation of an incinerator may require additional fire protection equipment and modification of the ventilation for the space.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-Q
SYSTEM NO. 3
SCALE 1/2"=1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
F.W. TANK UNDER
GALLEY/GARBAGE
COMMISSARY STORES
3-280-2-A
ISSUE ROOM
3-280-4-A
SERVICE HOIST
INCINERATOR
CONTROL BOARD
AUXILIARY MACHINERY SPACE NO.2
3-272-0-E
NOTE: FRAMES NOT TO SCALE
378 FT USCGC GALLATIN
THIRD DECK
SCALE 1/8"=1'-0"
SHEET NO. 2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	12,560[2]	56,520
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	6,570[4]	3,614
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	4,550[5]	4,186
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,375	2,750
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	65	975
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	185	1,110
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					71,220

(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: GALLATIN (378')

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	793 gal. (106 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sludge Holding Tank	648 gal. (87 cu. ft.)
Grumman Unit without Incinerator	Two (2)
Influent Surge Tank Pump	Tow (2)
Influent Surge Tank Overboard Pump	Four (4)
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank
Sludge Holding Tank Transfer Pump	Two (2)

Discussion

The system is considered to be a viable candidate subject to certain considerations and reservations.

Location of Equipment

(a) Forward of Frame 192

One of the two Grumman units could be located in the Sewage Sump and Ejector Room, together with an influent surge tank and sludge holding tank.

There does not appear to be sufficient room in the Sewage Sump and Ejector Room for all the required galley/turbid holding tankage.

Tank capacities and sizes would be approximately as follows:

Sewage Influent Surge Tank	528 gal.	3'-9" L x 3'-9" W x 5' H
Sludge Holding Tank	434 gal.	3'-6" L x 3'-6" W x 5' H
Galley/Turbid Holding Tank	1750 gal.	10' L x 4' W x 6' H

The associated pumps would be located functionally near equipment served.

System No. 4 (Cont'd)

(b) Aft of Frame 192

The second Grumman unit and the sludge holding tank would be located in the Issue Room; the influent surge tank adjacent in Auxiliary Machinery Room No. 3; the galley/turbid holding tank in the Commissary Stores space.

Tank capacities and sizes would be approximately as follows:

Sewage Influent Surge Tank	265 gal.	2' L x 3'-6" W x 5' H
Sludge Holding Tank	217 gal.	2' L x 3' W x 5' H
Galley/Turbid Holding Tank	2020 gal.	5' L x 9' W x 6' H

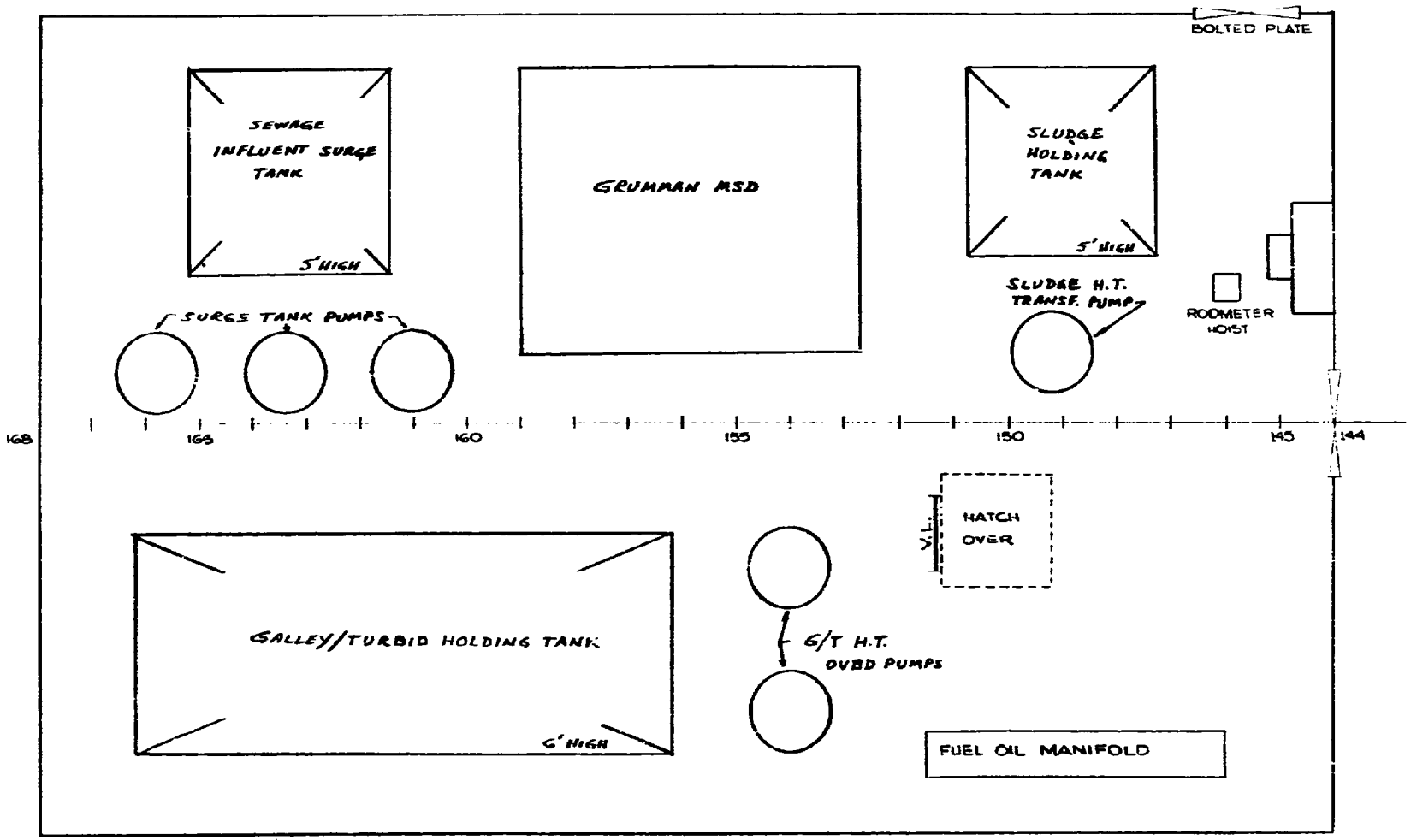
The associated pumps would be located functionally near the equipment served.

Drainages

All sewage in both zones would gravitate to the respective influent surge tanks for transfer to the Grumman units. The surge tanks would be pumped overboard or pierside according to prevailing restrictions.

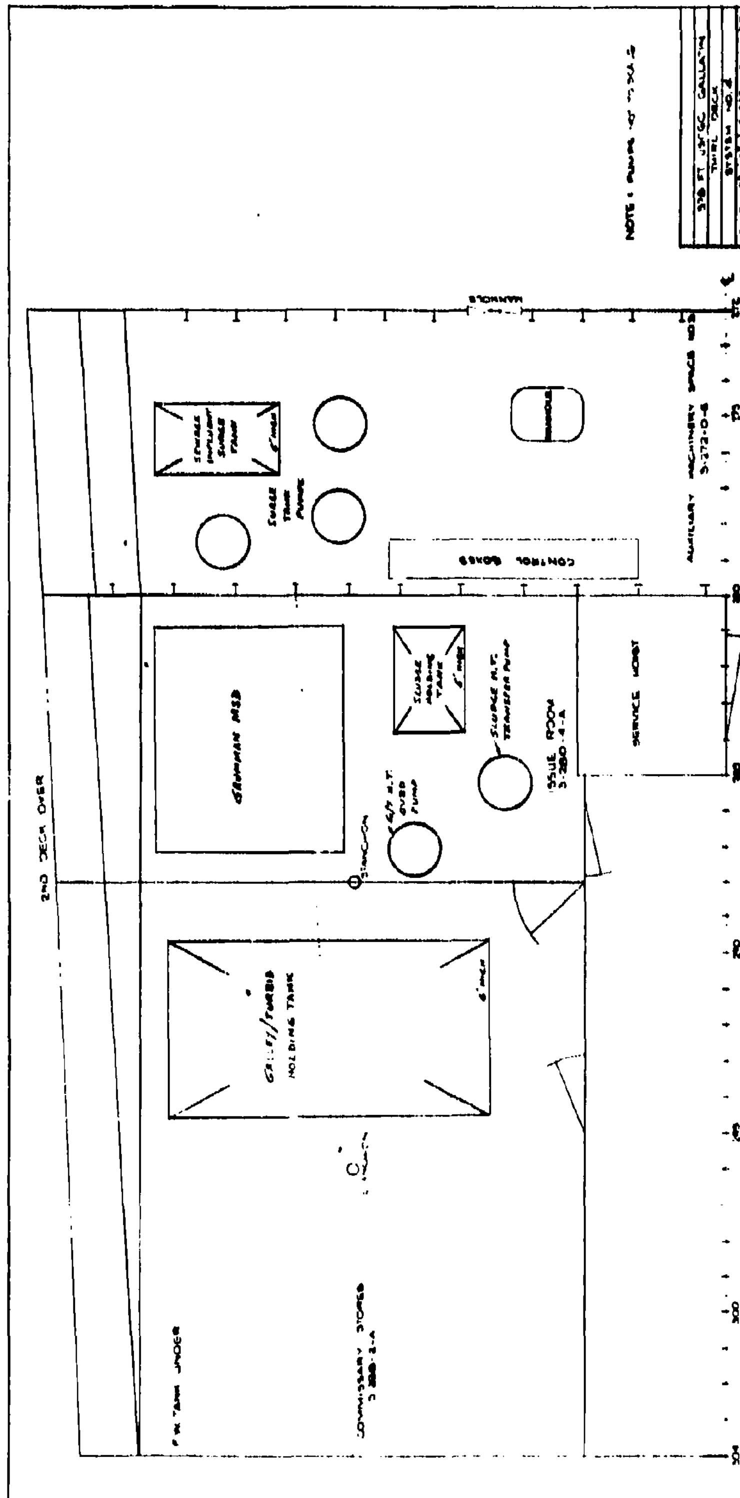
The galley/turbid drainage for each zone would be as described in System No. 1.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-G
SYSTEM NO. 4
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2



378 FT. USCGC GALLATIN
THIRD DECK
SHEET NO. 2 OF 2
2ND DECK OVER
CONTROL BOXES
AUXILIARY MACHINERY SPACE NO. 2
3-272-0-E
SURGE TANK PUMPS
GRUMMAN MSD
SLUDGE HOLDING TANK
SLUDGE H.T. TRANSFER PUMP
ISSUE ROOM
3-280-4-A
SERVICE HOIST
STANCHION
HOLDING TANK
COMMISSARY STORES
F.W. TANK UNDER
MANHOLE

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

WMS No. 4

Installation Cost Element		Unit	Assumed Unit Cost	Quantity Required (estimated number of units)	Cost ($)
Piping[1]		Pounds	$ 4.50/Lb. (Materials and Labor)	4,465[2]	20,093
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	10,935[4]	6,015
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	6,215[5]	5,718
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,650	3,300
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	90	1,350
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	240	1,440
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					39,981

(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: GALLATIN (378')

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

	Required
Influent Surge Tank	3,128 gal. (418 cu. ft.)
Sludge Holding Tank	2,501 gal. (334 cu. ft.)
Grumman Unit without Incinerator	Five (5)
Influent Surge Tank Pump	Five (5)
Influent Surge Tank Overboard Pump	Two (2) per tank
Sludge Holding Tank Transfer Pump	Five (5)

Discussion

The system is not a viable candidate.

Due to the zoning requirements for the vessel, the best distribution proportions for the five Grumman units would appear to be three units in the forward zone in the Sewage Sump and Ejector Room and two units in the aft zone.

There does not appear to be sufficient room in the forward space for three Grumman units, an influent surge tank, sludge holding tanks, three surge tank transfer pumps (to feed the Grumman unit), two surge tank overboard discharge pumps and sludge holding tank transfer pump(s).

The situation aft is similarly very tight and cannot support a practicable arrangement.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: GALLATIN (378')

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
G/T Influent Surge Tank	2,335 gal. (312 cu. ft.)
Sewage Holding Tank	7,781 ga. (1040 cu. ft.)
Sludge Holding Tank	1,853 gal. (248 cu. ft.)
Optional Combined Sewage/Sludge Holding Tank	9,633 gal. (1288 cu. ft.)
Grumman Unit without Incinerator	Four (4)
Sewage Holding Tank Overboard Pump	Two (2) per tank
Influent Surge Tank Pump	Four (4)
Influent Surge Tank Transfer Pump	One (1) per tank
Sludge Holding Tank Transfer Pump	One (1) per tank

Discussion

The system is not a viable candidate.

The situation is the same as for System No. 5; that is, there is insufficient space available in each zone to permit a practicable arrangement for all the equipment required.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: GALLATIN (378')

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	22,230 gal. (2972 cu. ft.)
Sewage Influent Surge Tank	793 gal. (106 cu. ft.)
Fuel Oil Day Tank	25 gal. (3.3 cu. ft.)
Grumman Units with Incinerator	Two (2) with Two (2) Thiokol Incinerators
Influent Surge Tank Pump	Two (2)
Influent Surge Tank Overboard Pump	Four (4)
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

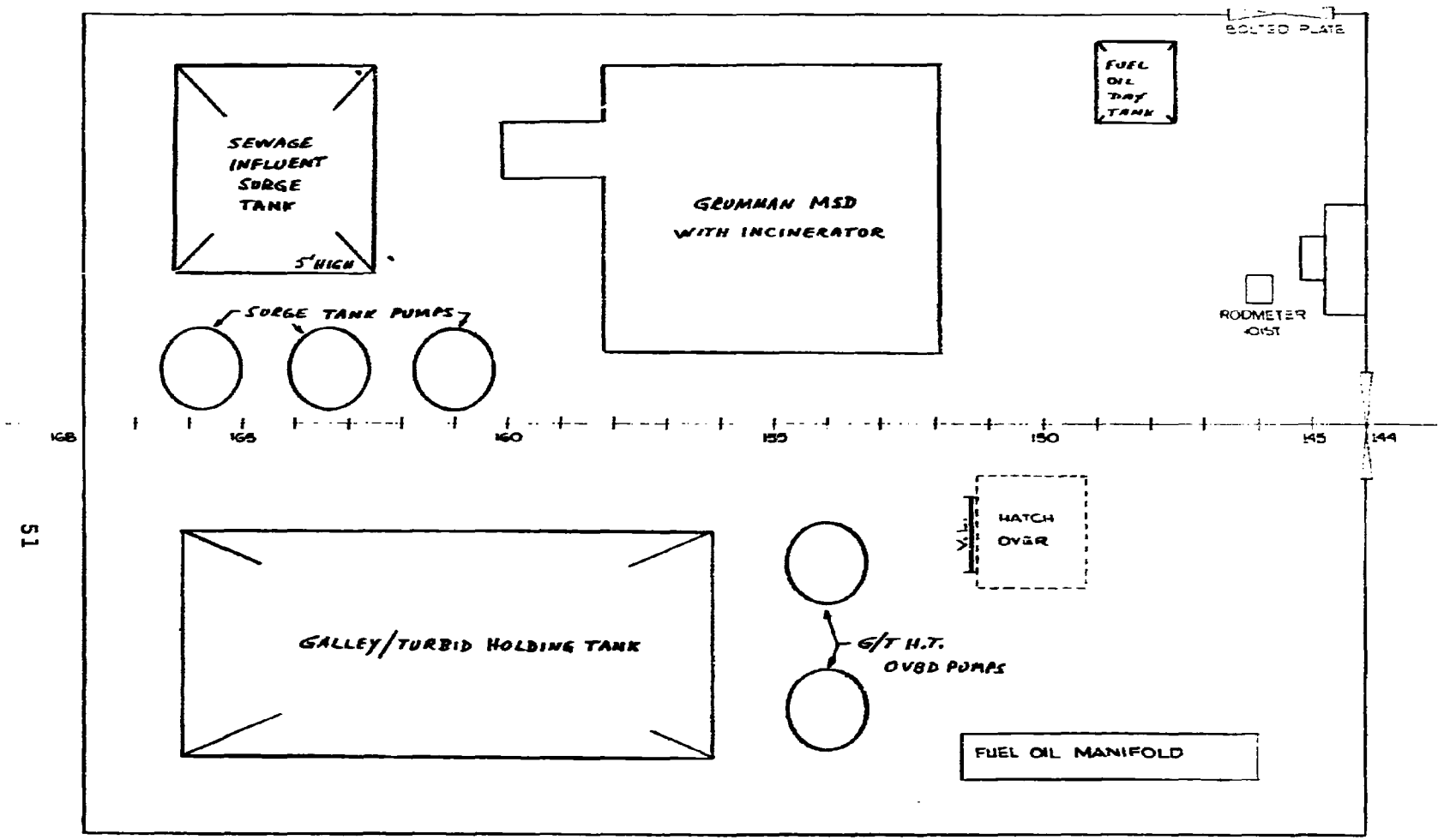
The system is considered to be a viable candidate.

The system is similar to System No. 4 except that an incinerator is being substituted for the sludge holding tank. The incinerators would be located with the Grumman units.

Accordingly the discussion and remarks for System No. 4 would apply. In addition, the possible incinerator stack runs are as in System No. 3.

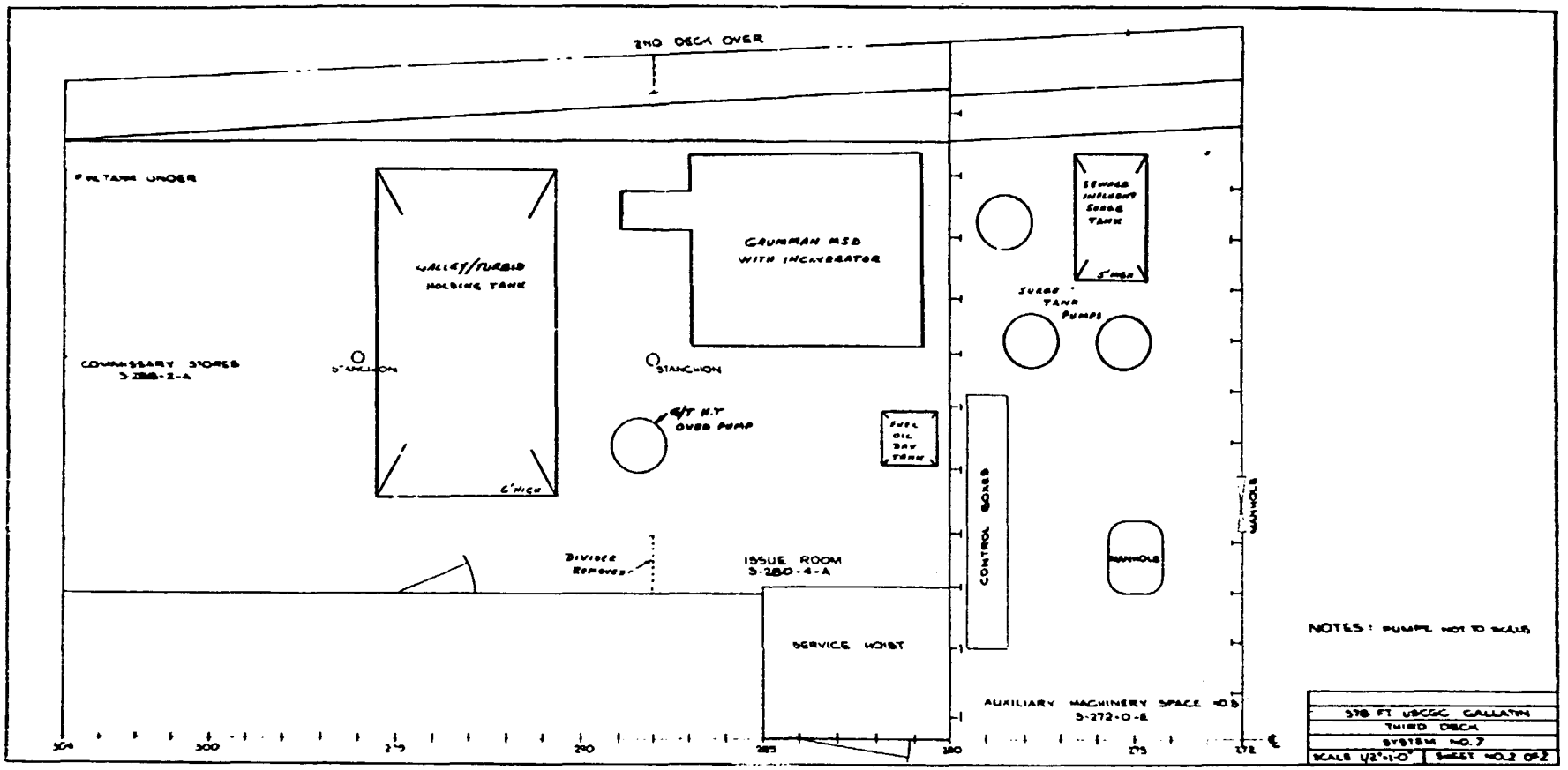
Installation of an incinerator may require additional fire protection equipment and modification of the ventilations system for the space.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-Q
SYSTEM NO. 7
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
F.W. TANK UNDER
GALLEY/TURBID HOLDING TANK
GRUMMAN MSD WITH INCINERATOR
SEWAGE INFLUENT SEWAGE TANK
SURGE TANK PUMPS
COMMISSARY STORES S-288-2-A
STANCHION
STANCHION
S/T H.T OVBD PUMP
FUEL OIL DAY TANK
CONTROL BOARD
MANHOLE
DIVIDER REMOVED
ISSUE ROOM S-280-4-A
SERVICE HOIST
AUXILIARY MACHINERY SPACE S-272-0-E
NOTES: PUMPS NOT TO SCALE
378 FT USCGC GALLATIN
THIRD DECK
SYSTEM NO. 7
SCALE 1/2"=1'-0"
SHEET NO.2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	11,430 [2]	51,435
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	8,995 [4]	4,948
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	5,720 [5]	5,263
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,525	3,050
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	75	1,125
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	195	1,170
Removals	Cutting	Hours	$50.00/Hr. [6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					69,056

(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: GALLATIN (378')

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	3,128 gal. (418 cu. ft.)
Fuel Oil Day Tank	25 gal. (3.3 cu. ft.)
Grumman Units with Incineratora	Five (5) with Five (5) Thiokol Incinerators
Influent Surge Tank Pump	Five (5)
Influent Surge Tank Overboard Pump	Two (2) per tank

Discussion

The system is not a viable candidate.

There is not sufficient space available in each zone for the equipment required for a functional arrangement, especially the Grumman units.

Vessel: GALLATIN (378')

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

	Required
Vacuum Collection Tank Ass'y	One (1) 200 gal. & One (1) 120 gal.
Sewage Holding Tank	2,300 gal. (307 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sanitary Holding Tank Overboard Pump	Two (2) per tank
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system is considered to be a viable candidate subject to certain considerations.

Reuse of existing piping arrangements would have to be considered.

A fresh water sanitary flushing system will be required.

Location of Equipment

(a) Forward of Frame 192

The following equipment for the forward zone would be located in the Sewage Sump and Ejector Room:

Vacuum Collection Tank Ass'y	200 gal.	
Sewage Holding Tank	1533 gal.	7' L x 5' W x 6' H
Galley/Turbid Holding Tank	2244 gal.	10' L x 5' W x 6' H

(b) Aft of Frame 192

The equipment for the aft zone would be located as follows:

Issue Room

Vacuum Collection Tank Ass'y	120 gal.	
Sewage Holding Tank	763 gal.	4'-4" L x 4'-4" W x 5'-6" H

System No. 9 (Cont'd)

Commissary Stores

Galley/Turbid Holding Tank 2424 gal. 6' L x 9' W x 6' H

(c) The associated pumps would be located near the equipment served, in the Sewage Sump and Ejector Room and in Auxiliary Machinery Space No. 3.

Drainages

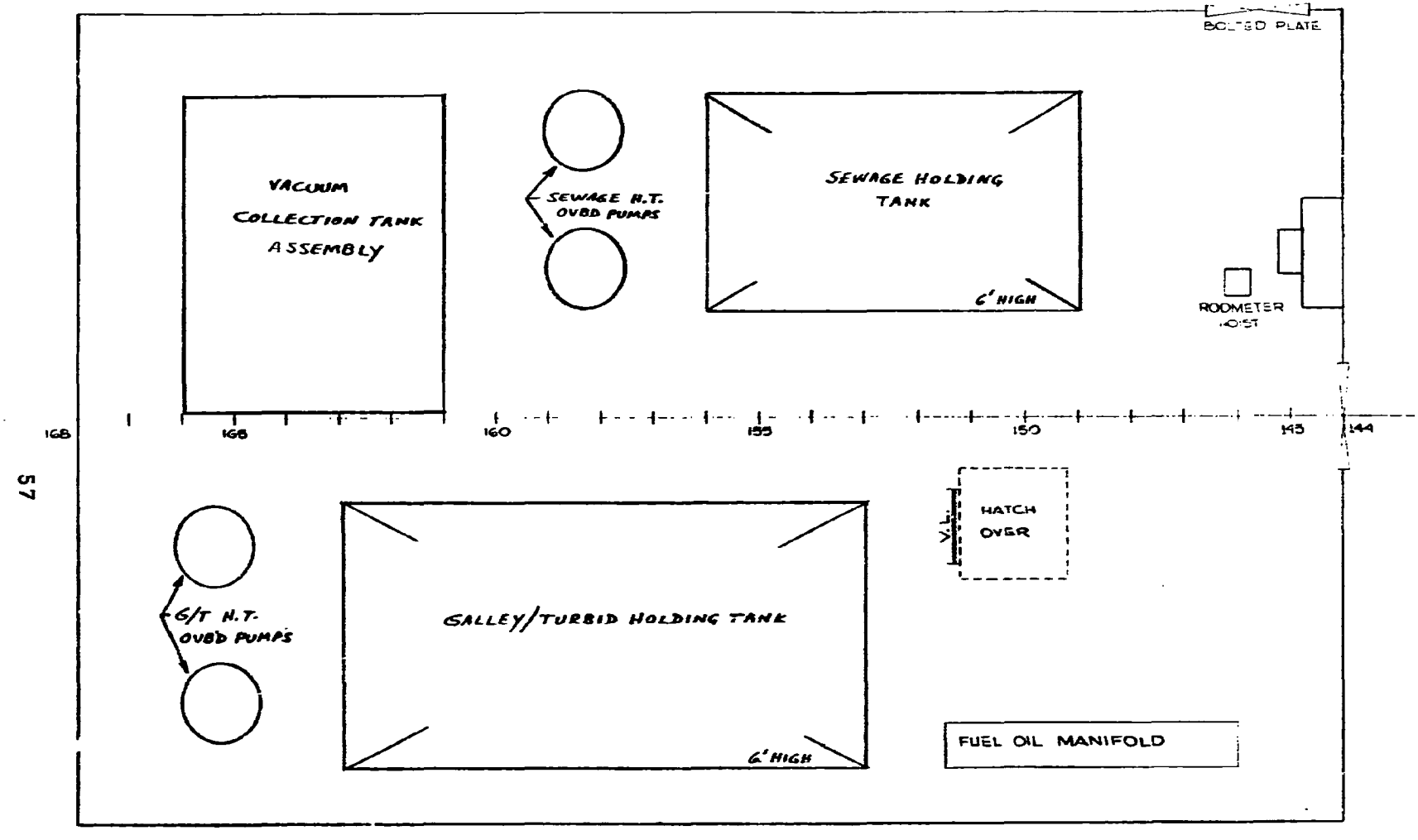
Sewage would collect by vacuum in the vacuum collection tanks for transferral to the sewage holding tanks for discharge overboard or pierside according to prvailing restrictions.

Galley/turbid drains would gravitate for disposition as described for System No. 1.

Special Remarks

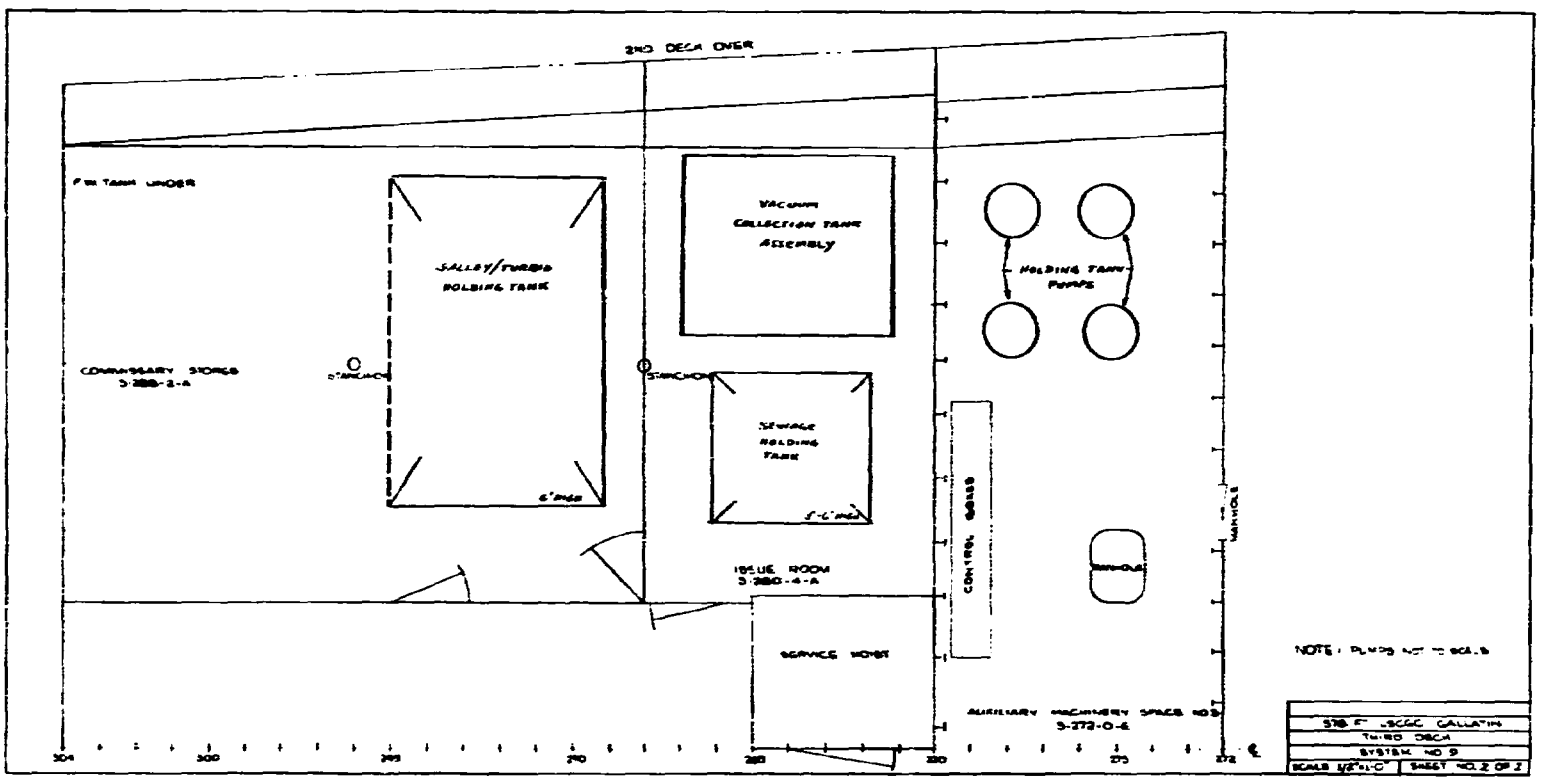
In order to satisfy the requirements of a two-zone ship a VCT is recommended for each zone. If only one is fitted as originally considered, an undesirable and impracticable piping arrangement would have to be fitted between the two zones; that is with the VCT in the forward space all collection piping would have to be routed to that space. Then the VCT would have to discharge back to the aft zone sewage holding tank for disposal. Piping would have to run through berthing areas, shops, engine room, fuel tanks, flume tanks, etc. to interconnect the two zones. By adding the VCT aft the situation is simplified and the two zone separation is maintained with no intervening piping.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-Q
SYSTEM NO. 9
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
FW TANK UNDER
SALLEY/TURBO
BOILING TANK
VACUUM
COLLECTION TANK
ASSEMBLY
HOLDING TANK
PUMPS
COMMISSARY STORES
SEWAGE
HOLDING
TANK
ISSUE ROOM
SERVICE HOIST
CONTROL BOARD
MANHOLE
AUXILIARY MACHINERY SPACE NO 3
304
300
295
290
285
280
275
272

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	6,120 [2]	27,540
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	12,165 [4]	6,691
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	7,605 [5]	6,997
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,375	2,750
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	65	975
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	215	1,290
Removals	Cutting	Hours	$50.00/Hr. [6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					48,308

(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.

Vessel: GALLATIN (378')

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

	Required
Vacuum Collection Tank Assembly	One (1) 200 gal. & One (1) 120 gal.
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Fuel Oil Day Tank	154 gal. (20.6 cu. ft.)
Incinerator	Two (2) Jered
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system is considered to be a viable candidate subject to certain considerations.

Reuse of existing piping arrangements would have to be considered.

A fresh water sanitary flushing system will be required.

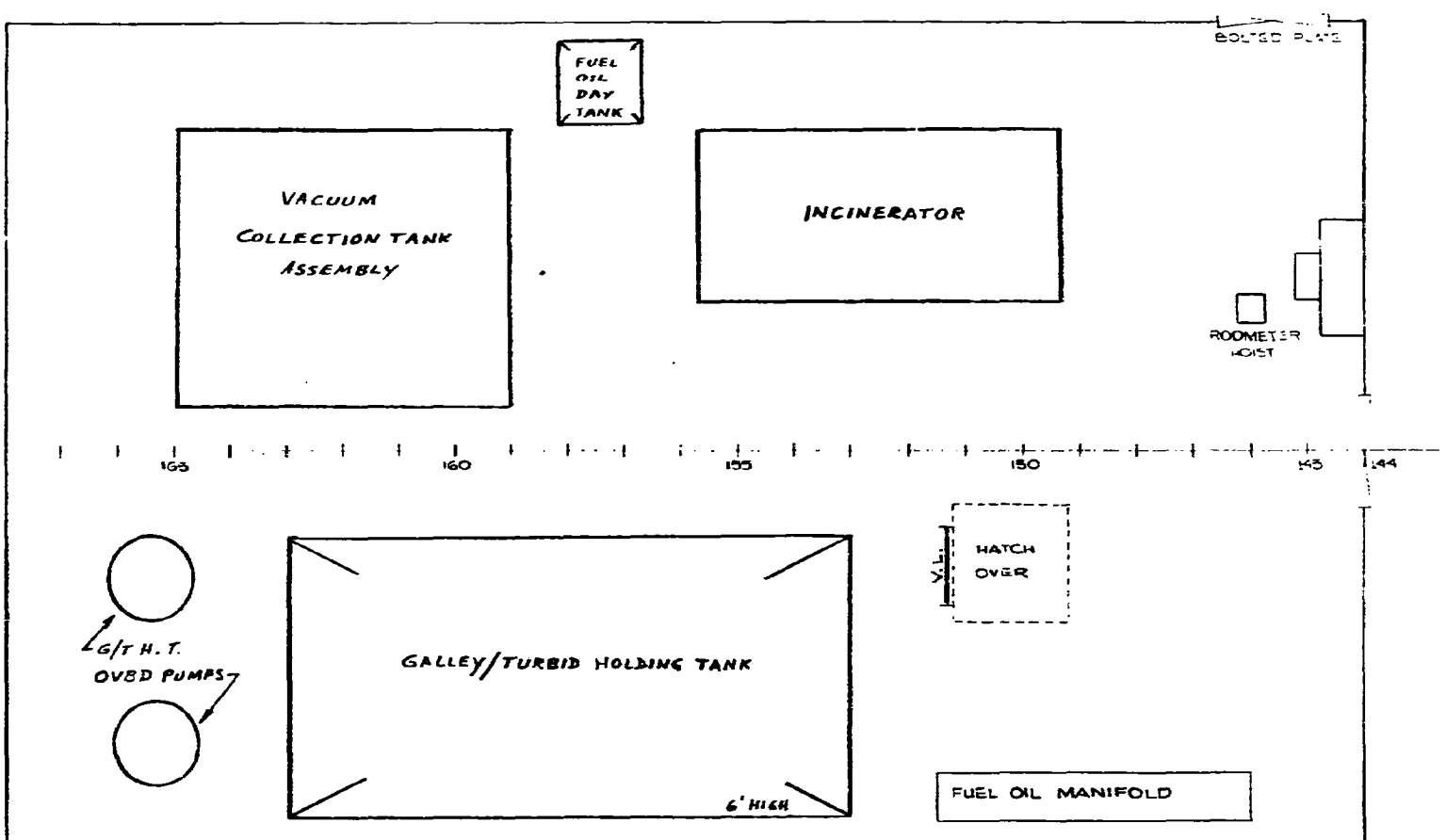
This system is similar to System No. 9 except that the sewage holding tank is being replaced with an incinerator. The same philosophy of maintaning two independent zones applies also to this system regarding a VCT in each zone.

The incinerator for the aft zone would be located in Auxiliary Machinery Room No. 3. The pumps associated with the aft zone would be located in the Issue Room with the VCT. Equipment for the forward zone would be located as in System No. 9. Tank sizes would also be the same as System No. 9.

Incinerator stack runs would be as described under System No. 3.

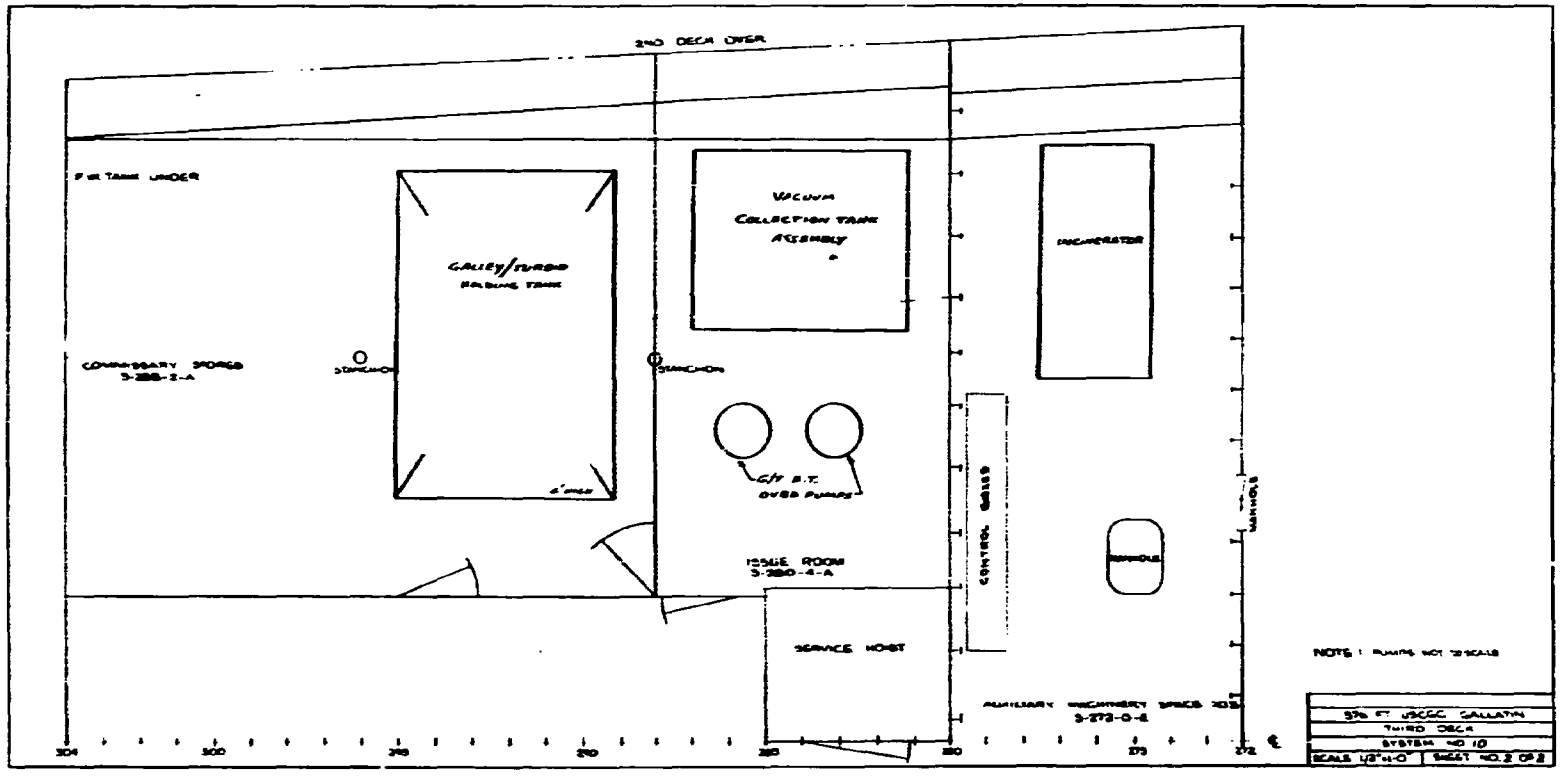
Installation of an incinerator may require additional fire protection equipment and modification of the ventilation system for the space.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-G
SYSTEM NO. 10
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
F.W. TANK UNDER
GALLEY/GALLEY
FRESH WATER TANK
VACUUM
COLLECTION TANK
ASSEMBLY
INCINERATOR
COMMISSARY STORES
3-288-2-A
STANCHION
STANCHION
G/F S.T.
OVER PUMPS
CONTROL GRILL
MANHOLE
ISSUE ROOM
3-280-4-A
SERVICE HOIST
AUXILIARY MACHINERY SPACE
3-272-0-A
304
300
290
280
285
280
275
272
NOTE : RUNS NOT TO SCALE
378 FT USCGC GALLATIN
THIRD DECK
SYSTEM NO 10
SCALE 1/8"=1'-0"
SHEET NO. 2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	13,515[2]	60,818
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	8,150[4]	4,483
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	5,770[5]	5,309
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	825	1,650
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)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	175	1,050
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					75,900

(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: GALLATIN (378')

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

	Required
Vacuum Collection Tank Assembly	One (1) 200 gal. & One (1) 120 gal.
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Evaporator (GATX)	Six (6) 80 gal.
Catalytic Oxidizer	Six (6)
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system is considered to be viable candidate subject to certain considerations.

Reuse of existing piping arrangements would have to be considered.

A fresh water sanitary flushing system will be required.

Location of Equipment

The same philosophy of maintaining two separate zones as discussed under System No. 9 applied for this system regarding the inclusion of a VCT in each zone.

(a) Forward of Frame 192

The following equipment for the forward zone would be located in the Sewage Sump and Ejector Room:

Vacuum Collection Tank Ass'y	200 gal.
Galley/Turbid Holding Tank	1346 gal. 6' L x 5' W x 6' H
Four (4) Evaporators with their Catalytic Oxidizers	

System No. 11 (Cont'd)

(b) Aft of Frame 192

The equipment for the aft zone would be located as follows:

Issue Room: Vacuum Collection Tank Ass'y 120 gal.
In Auxiliary Machinery Room No. 3: Two (2) Evaporators with their Catalytic Oxidizers
In Commissary Stores: Galley/Turbid Holding Tank 2424 gal. 6' L x 9' W x 6' H

(c) The associated pumps would be located near the equipment served, in the Sewage Sump and Ejector Room and in the Issue Room.

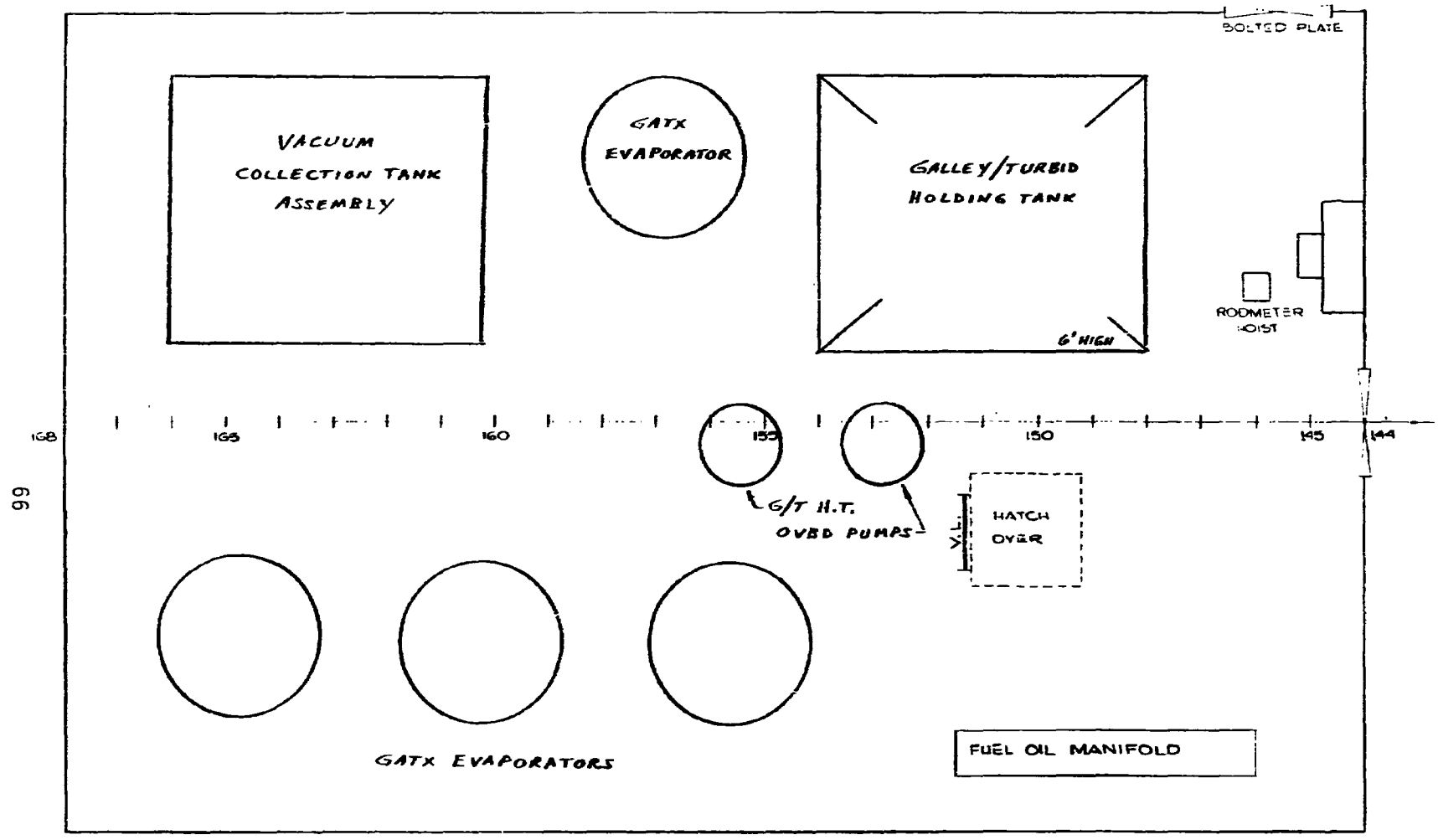
(d) The evaporator installation in the Issue Room aft could be a little tight and would require special consideration in view of all the piping required.

Drainages

Sewage would be collected from the various zone spaces in the VCT for that zone from which it would be transferred to the evaporators.

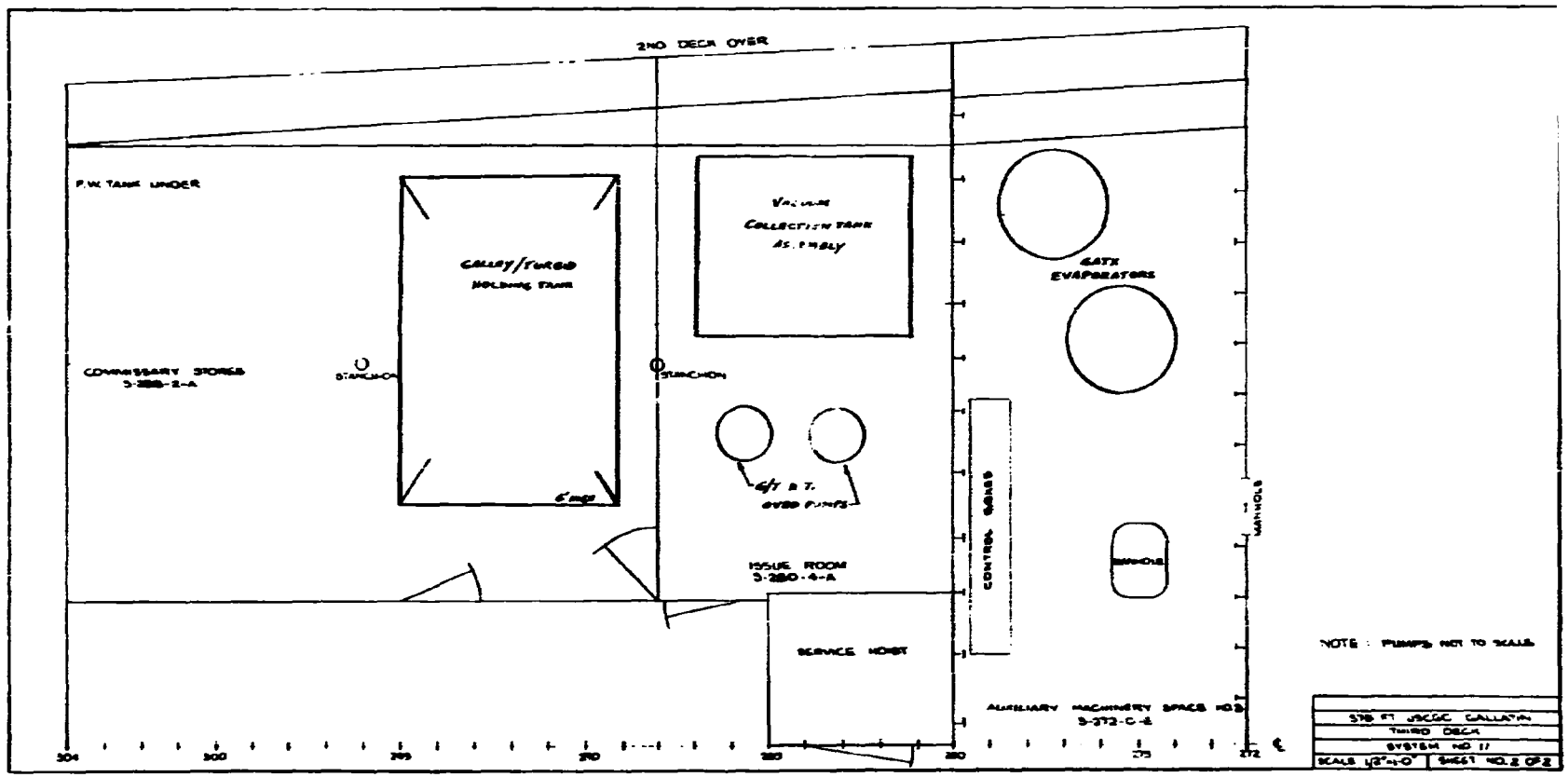
All galley/turbid drains, except those from the Third Deck forward of Frame 192, would gravitate overboard in unrestricted waters. Third Deck drains would gravitate to the galley/turbid holding tank for discharge overboard. In restricted waters and pierside all G/T drains would drain to the respective G/T holding tanks in the zones forward and aft of Frame 192.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-Q
SYSTEM NO. 11
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
F.W. TANK UNDER
COMMISSARY STORES
3-288-2-A
STANCHION
STANCHION
GALLEY/TURBO
HOLDING TANK
6 cmpt
VACUUM
COLLECTION TANK
ASSEMBLY
GATX
EVAPORATORS
CONTROL BOARD
MANHOLE
ISSUE ROOM
3-280-4-A
SERVICE HOIST
AUXILIARY MACHINERY SPACE NO.2
3-272-C-E
NOTE : PUMPS NOT TO SCALE
378 FT JSCGC GALLATIN
THIRD DECK
SYSTEM NO 11
SCALE 1/8"=1'-0"
SHEET NO. 2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	7,495 [2]	33,728
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	6,390 [4]	3,515
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	5,290 [5]	4,867
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	825	1,650
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)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	165	990
Removals	Cutting	Hours	$50.00/Hr. [6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					47,340

(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: CALIATIN (378')

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	2,335 gal. (312 cu. ft.)
Sludge Holding	1,853 gal. (248 cu. ft.)
Vacuum Collection Tank Assembly	One (1) 200 gal. and One (1) 120 gal.
Sewage Holding Tank	2,300 gal. (307 cu. ft.)
Grumman Unit without Incinerator	Four (4)
Influent Surge Tank Pump	Four (4)
Sewage Holding Tank Overboard Pump	Two (2) per tank
Sludge Holding Tank Transfer Pump	One (1) per tank

Discussion

The system is not considered to be a viable candidate.

The available spaces fore and aft (i.e. the Sewage Sump and Ejector Room fwd and Auxiliary Machinery Space No. 3 and the Issue Room and Commissary Stores aft) appear to be inadequate for all the equipment needed.

The spaces would have to accommodate a vacuum collection tank, a sewage holding tank, galley/turbid influent surge tank, two Grumman units, sludge holding tanks, a galley/turbid holding tank and the various pumps associated with the tanks.

All this equipment cannot be arranged functionally and accessibly in the limited space available.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: GALLATIN (378')

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 Influent Surge Tank	2,335 gal. (312 cu. ft.)
Vacuum Collection Tank Assembly	One (1) 200 gal. and One (1) 120 gal.
Fuel Oil Day Tank	285 gal. (38.1 cu. ft.)
Grumman Unit with Incinerators	Four (4) with Eight (8) Thiokol Incinerators
Vacuum Collection Tank Transfer Pumps	Four (4)
Influent Surge Tank Pumps	Four (4)
G/T Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system is not considered to be a viable candidate.

The system is similar to a large extent to System No. 12, except that sewage holding tankage has been deleted but eight incinerators have been added. Therefore, the same over-crowded conditions are apparent, complicated by the requirement of fitting a large quantity of incinerators and running their stacks to the weather. Space aboard the vessel is very much at a premium.

DISCUSSION OF INSTALLATION BASED ON SHIPCHECKS

Vessel: GALLATIN (378')

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

	Required
Sewage Holding Tank	2,501 gal. (334 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sewage Holding Tank Overboard Pump	Two (2) per tank
G/T Holding Tank Overboard Pump	Tow (2) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

The system is considered to be a viable candidate subject to certain considerations.

A fresh water sanitary flushing system will be required.

The system is essentially the same as System No. 1, except that sewage collection has been changed from gravity to pump means. Therefore, with that exception, drainages would be the same as discussed for System No. 1.

Equipment would be located as follows:

(a) Forward of Frame 192

In Sewage Sump and Ejector Room:

Sewage Holding Tank	1668 gal.	9' L x 5' W x 5' H
Galley/Turbid Holding Tank	2693 gal.	12' L x 5' W x 6' H

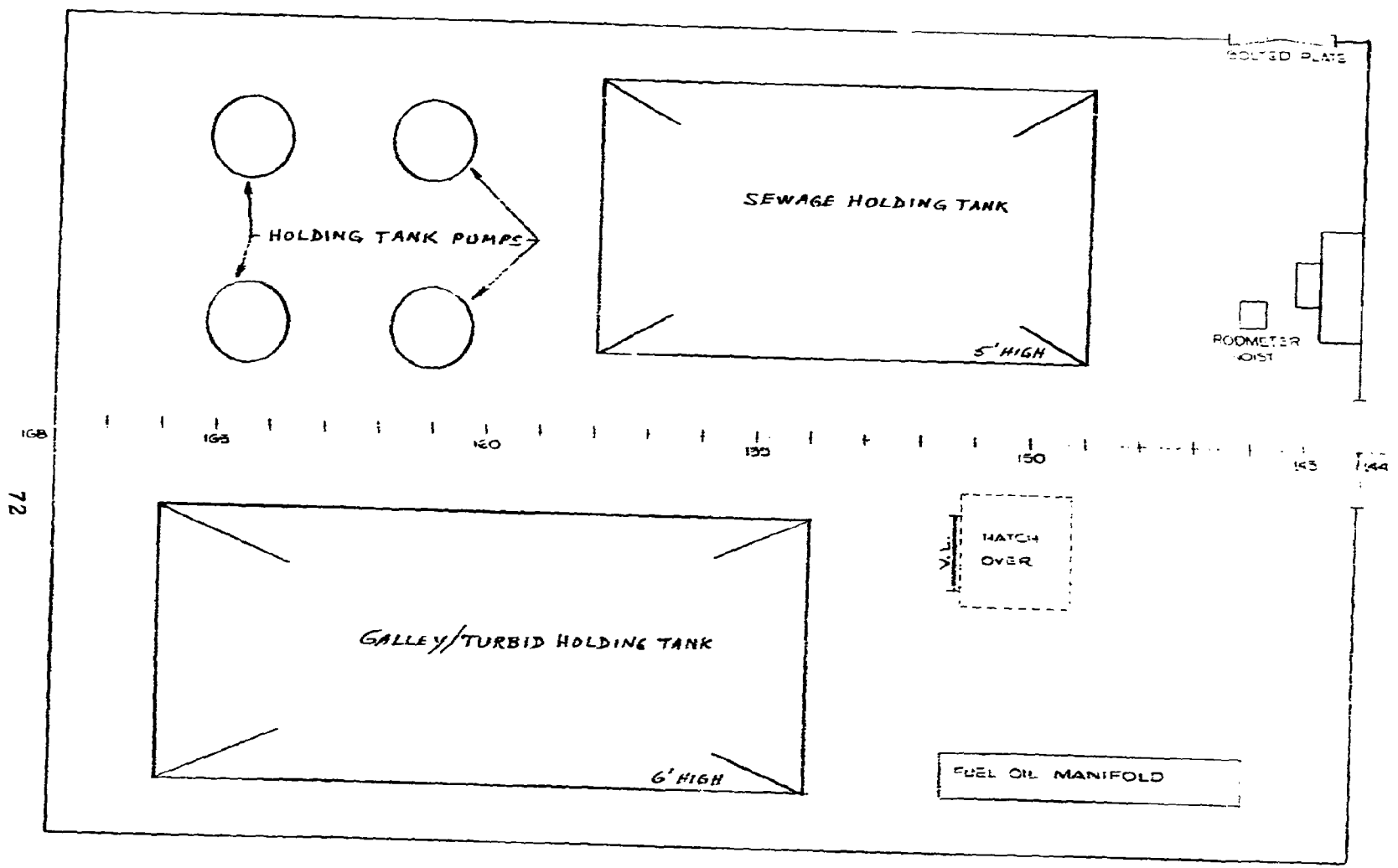
(b) Aft of Frame 192

In Auxiliary Machinery Room No. 3-Sewage Holding Tank 830 gal., 4' L x 5'-6" W x 6' H.

In Issue Room and Commissary Stores-Galley/Turbid Holding Tank 3994 gal., Ell Shaped, 13' L x 9' W x 6' H.

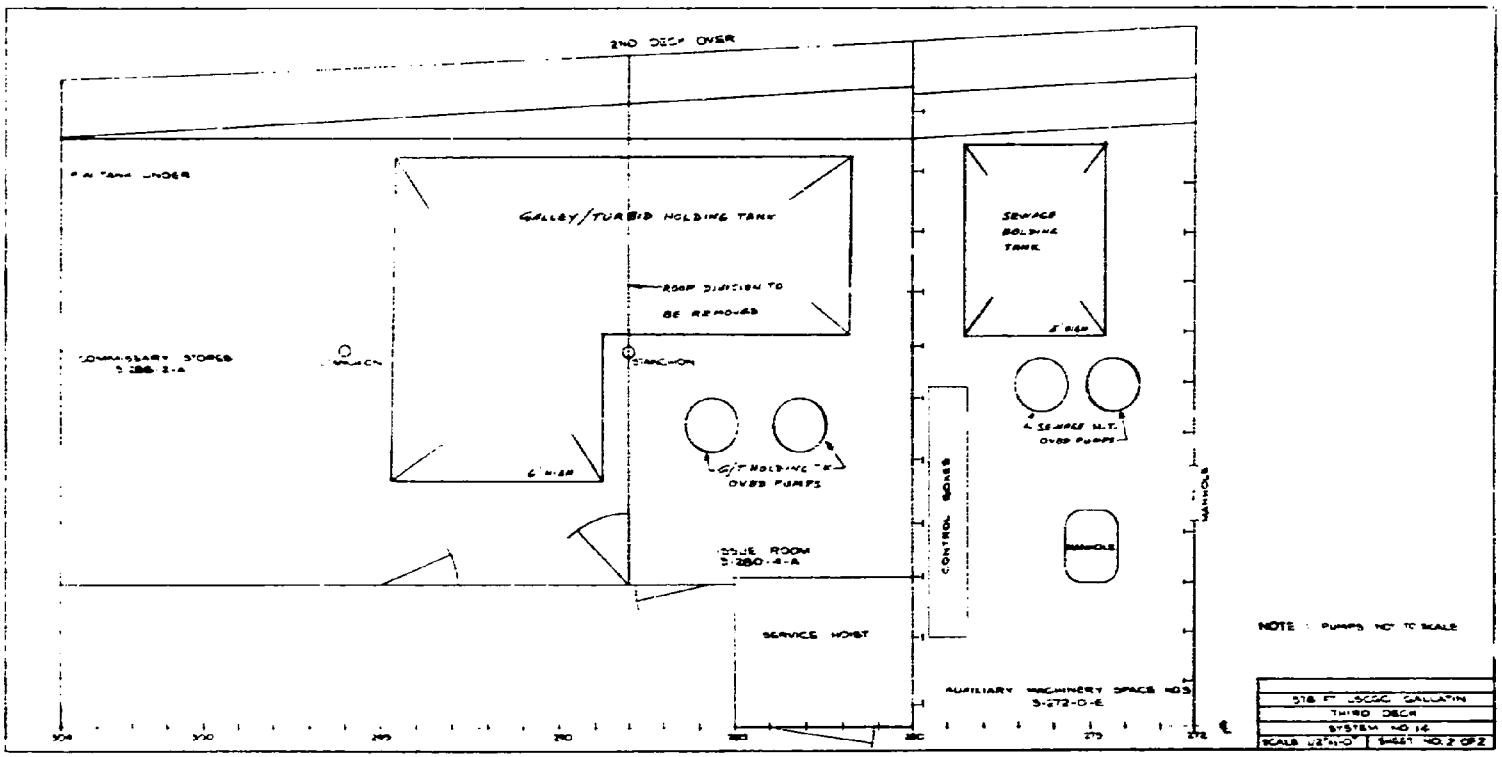
(c) Pumps would be located near their respective tanks.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-Q
SYSTEM NO. 14
SCALE 1/2"=1-0 SHEET NO. 1 OF 2


2ND DECK OVER
GALLEY/TURBID HOLDING TANK
ROOF DIVISION TO BE REMOVED
SEWAGE HOLDING TANK
STANCHION
COMMISSARY STORES
S-280-2-A
G/T HOLDING "E" OVBD PUMPS
4 SEWAGE H.T. OVBD PUMPS
ISSUE ROOM
S-280-4-A
CONTROL BOXES
MANHOLE
SERVICE HOIST
AUXILIARY MACHINERY SPACE NO 3
S-272-0-E
NOTE : PUMPS NOT TO SCALE
578 FT SCOC GALLATIN
THIRD DECK
SYSTEM NO 16
SCALE 1/2"=1'-0"
SHEET NO 2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	5,600 [2]	25,200
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	14,100 [4]	7,755
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	9,260 [5]	8,520
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,100	2,200
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)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	240	1,440
Removals	Cutting	Hours	$50.00/Hr. [6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					47,705

(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: GALLATIN (378')

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

	Required
Incinerator Feed Tank	300 gal. (40 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Fuel Oil Day Tank	155 gal. (20.7 cu. ft.)
Incinerator	Two (2) Jered
Incinerator Feed Pump	Two (2)
Incinerator Feed Tank Overboard Pump	Two (2)
G/T Holding Tank Overboard Pump	Two (2) per tank
Macerator/Transfer Pump	Eighteen (18)

Discission

The system is considered to be a viable candidate subject to certain considerations.

A fresh water sanitary flushing system would be required.

Location of Equipment

For the reasons given in the "Special Remarks" under System No. 9, two independent zones have been suggested for this system. Therefore, an incinerator and its feed tank and pumps have been allocated for each zone, in lieu of the original concept of only one of each piece of equipment. Therefore equipment and locations would be as follows:

(a) Forward of Frame 192

In Sewage Sump and Ejector Room:

Incinerator Feed Tank	300 gal.,	3' L x 3' W x 4'-6" H
Incinerator		
Galley/Turbid Holding Tank	2693 gal.,	12' L x 5' W x 6' H

System No. 15 (Cont'd)

(b) Aft of Frame 192
In Auxiliary Machinery Room No. 3-Incinerator
In Issue Room and Commissary Stores

Incinerator Feed Tank	150 gal.	2' L x 2' W x 5' H
Galley/Turbid Holding Tank	4668 gal.	13' L x 8' W x 6' H

(c) Pumps would be located near the tanks served.

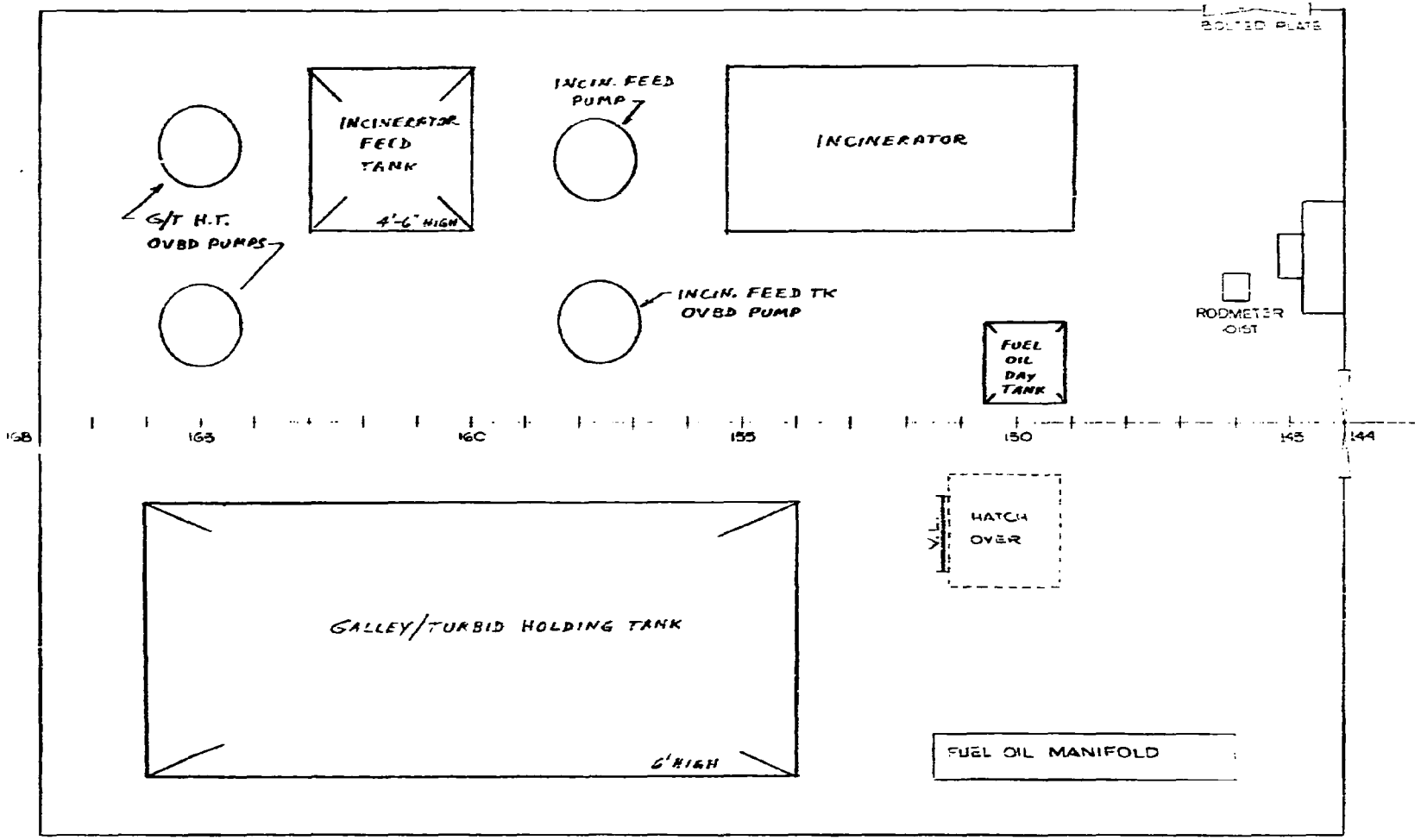
Installation of an incinerator may require additional fire protection equipment and modification of the ventilation system for the space.

Drainages

All sewage would be collected by macerator/transfer pumps for discharge to the respective incinerator feed tank and disposition in the incinerator. The incinerator feed tank would be pumped overboard or to pierside according to the prevailing restrictions.

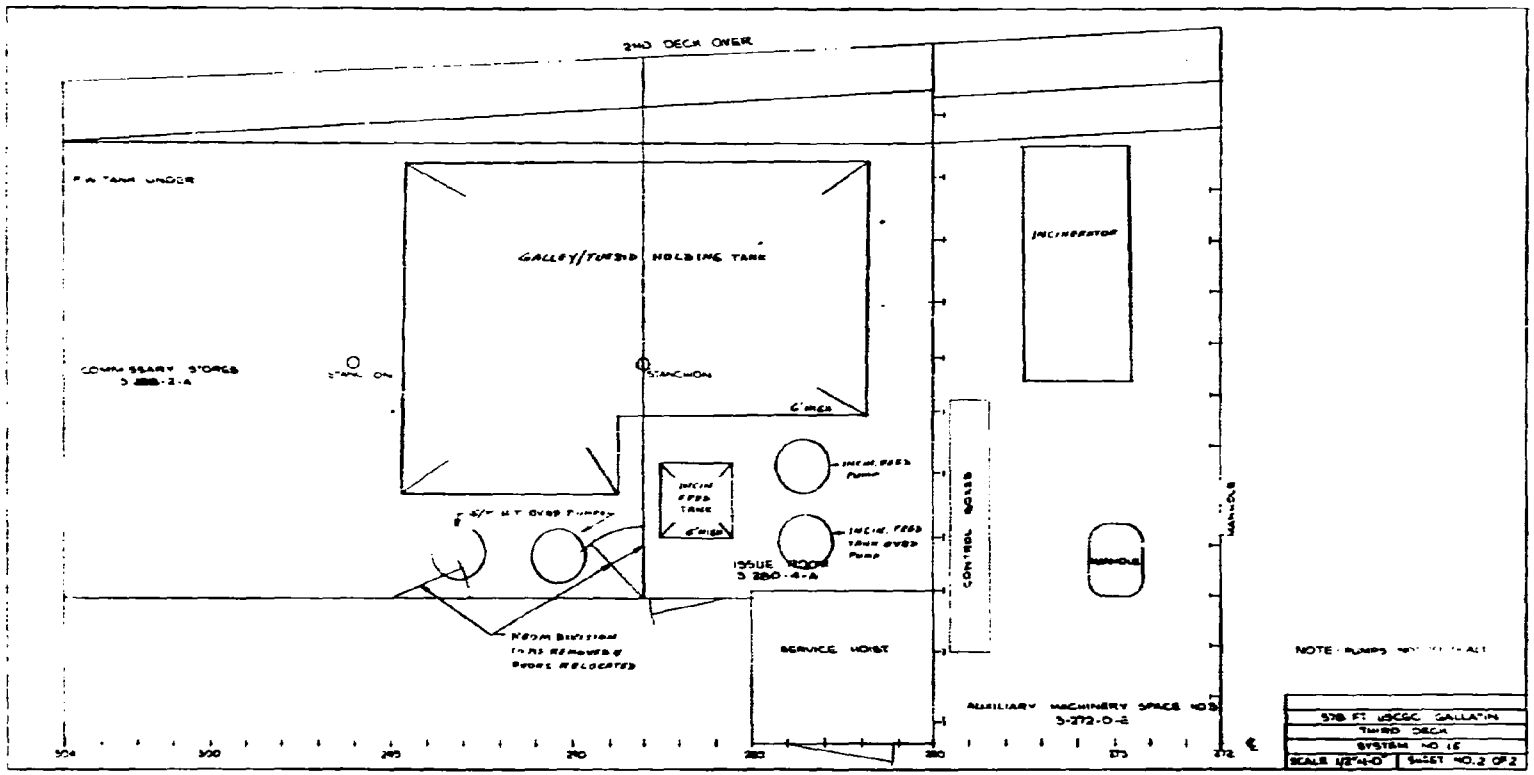
Galley/turbid drains would gravitate for collection and disposition as discussed for System No. 1.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-G
SYSTEM NO. 15
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
F.W. TANK UNDER
GALLEY/TURBID HOLDING TANK
INCINERATOR
COMMISSARY STORES
STANCHION
6"RISER
INCIN. FEED TANK
6"RISER
INCIN. FEED Pump
INCIN. FEED TANK OVBD Pump
ISSUE ROOM
CONTROL BOARD
MANHOLE
SERVICE HOIST
AUXILIARY MACHINERY SPACE NO.3
378 FT. USCGC GALLATIN
THIRD DECK
SYSTEM NO. 15
SCALE 1/2"=1'-0"
SHEET NO. 2 OF 2

WMS INSTALLATION COST ESTIMATES

Vessel GALLATIN (378')

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)	12,505[2]	56,273
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	12,760[4]	7,018
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	8,455[5]	7,779
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,375	2,750
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	65	975
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	210	1,260
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					78,120

(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: GALLATIN (378')

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	22,230 gal. (2972 cu. ft.)
Evaporator Feed Tank	300 gal. (40.1 cu. ft.)
Evaporator (GATX)	Six (6) 80 gal.
Catalytic Oxidizer	Six (6)
Evaporator Feed Pump	Two (2) per set of evaps.
Evaporator Feed Tank Overboard Pump	One (1) per tank
G/T Holding Tank Overobard Pump	Two (2) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

The system is considered to be a viable candidate subject to certain conditions.

A fresh water sanitary flushing system will be required.

Location of Equipment

Equipment would be located as follows:

(a) Forward of Frame 192

In Sewage Sump and Ejector Room
Evaporator Feed Tank 200 gal., 3' L x 3' W x 3' H
Galley/Turbid Holding Tank 1346 gal., 6' L x 5' W x 6' H
Evaporators, Four(4) with Catalytic Oxidizers

(b) Aft of Frame 192

In Auxiliary Machinery Room No. 3: Evaporator Feed Tank- 100 gal., 2' L x 2' W x 3'-6" H
In Issue Room: Evaporators-Two (2) with Catalytic Oxidizers
In Commissary Stores: Galley/Turbid Holding Tank- 2424 gal., 6' L x 9' W x 6' H

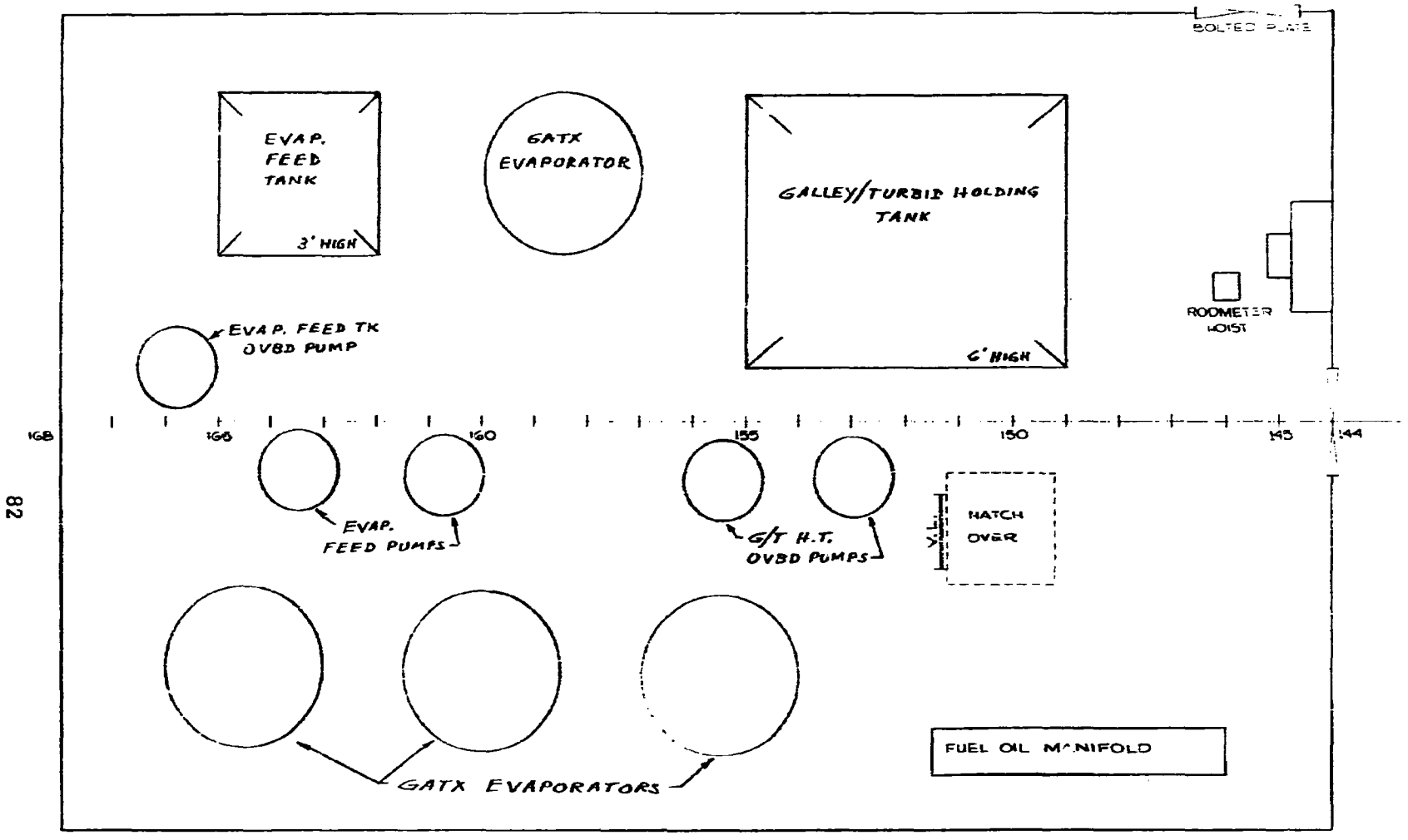
(c) Pumps would be located near the equipment served.

Drainages

Sewage would be collected in the evaporator feed tank via macerator/transfer pumps and would be transferred to the evaporators. The evaporator feed tank would be pumped overboard or pierside by its overboard discharge pumps according to prevailing restrictions.

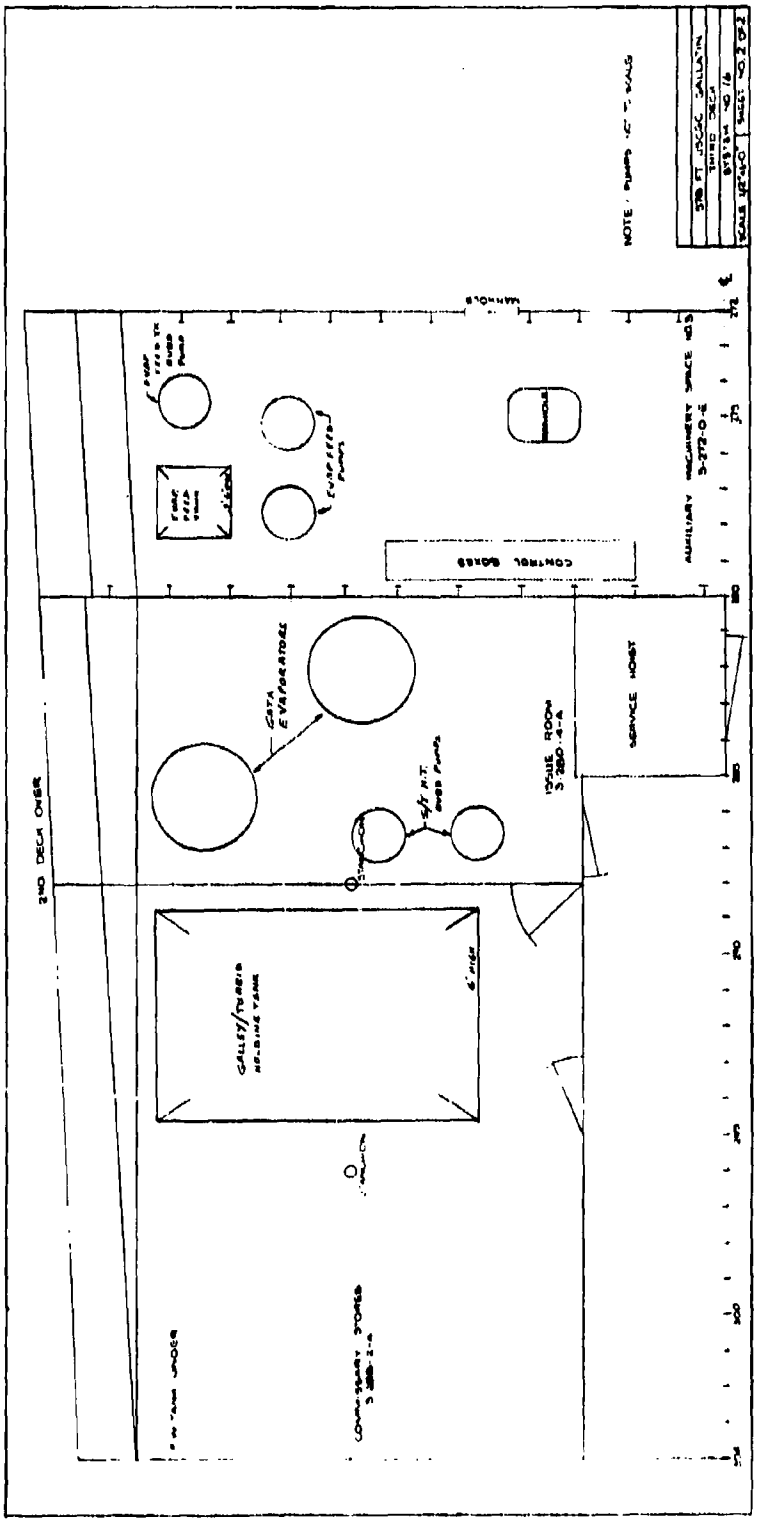
Galley/turbid drains would gravitate overboard and to the holding tanks for pumping overboard/pierside as described for System No. 1.

PROPOSED WMS EQUIPMENT ARRANGEMENT



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

378 FT. USCGC GALLATIN
SEWAGE PUMP & EJECTOR ROOM 5-144-0-G
SYSTEM NO. 16
SCALE 1/2"-1'-0" SHEET NO. 1 OF 2


2ND DECK OVER
SERVICE HOIST
ISSUE ROOM
CONTROL BOXES
AUXILIARY MACHINERY SPACE NO.2
MANHOLE
NOTE

Vessel GALLATIN (378')

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)	5,710[2]	25,695
Tank Steel[3]		Pounds	$ .55/Lb. (Materials and Labor)	6,390[4]	3,515
Foundations		Pounds	$ .92/Lb. (Materials and Labor)	5,250[5]	4,830
Electric Cables		Feet	$ 2.00/Ft. (Materials and Labor)	1,650	3,300
Miscellaneous Installations (pumps, motors, skid-mounted components, etc.)		Man-Hours	$15.00/MH (Labor)	80	1,200
Access Cuts (in hull, deck plating or bulkhead to provide passageway)		Feet	$ 1.00/Ft. (Labor)	115	115
Welding		Feet	$ 6.00/Ft. (Materials and Labor)	185	1,110
Removals	Cutting	Hours	$50.00/Hr.[6] (Labor)	30	1,500
	Other (miscellaneous handling)	Man-Hours	$15.00/MH (Labor)	30	450
Total Installation Cost ($)					41,715

(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: CALLATIN (378')

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	2,501 gal. (334 cu. ft.)
Galley/Turbid Influent Surge Tank	2,335 gal. (312 cu. ft.)
Sludge Holding Tank	1,853 gal. (248 cu. ft.)
Grumman Unit without Incinerator	Four (4)
Sewage Holding Tank Overboard Pump	Two (2) per tank
G/T Influent Surge Tank Pump	Four (4)
G/T Influent Surge Tank Transfer Pump	One (1) per tank
Sludge Holding Tank Transfer Pump	One (1) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

The system is not considered to be a viable candidate.

There does not appear to be sufficient space forward or aft to permit a practicable and functional arrangement of equipment required for each zone.

Vessel: GALLATIN (378')

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	308 gal. (41 cu. ft.)
Galley/Turbid Surge Tank	2,335 gal. (312 cu. ft.)
Fuel Oil Day Tank	285 gal. (38.1 cu. ft.)
Grumman Unit with Incinerators	Four (4) with Eight (8) Thiokol Incinerators
Sewage Surge Tank Transfer Pump	Two (2) per tank
Sewage Surge Tank Overboard Pump	One (1) per tank
G/T Surge Tank Pump	Two (2) per tank
G/T Surge Tank Overboard Pump	One (1) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

The system is not considered to be a viable candidate.

For the spaces available, it appears impossible to locate all the equipment required in an arrangement which would be satisfactory functionally and accessible for operation, maintenance, and repair. The addition of pumps and eight incinerators presents special complications.

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel GALLATIN (378')

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	N/A	N/A	a	N/A	a	a	a	N/A	N/A	a	a	a	N/A	N/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	c	c	c	c	N/A	N/A	c	N/A	c	c	c	N/A	N/A	c	c	c	N/A	N/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: . 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.

(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	N/A	N/A	b	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

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	N/A	N/A	a	N/A	c	c	c	N/A	N/A	e	e	e	N/A	N/A

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	N/A	N/A	a	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

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	N/A	N/A	a	N/A	c	c	c	N/A	N/A	d	d	d	N/A	N/A

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	N/A	N/A	a	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

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

Factor/Subfactor Ident. No.

INSTALLATION CHARACTERISTIC

233 Space requirements for WMS Collection/Transport subsystem installation.

(a) No additional space required.(1)
(b) Some additional space required.(2)
(c) Large amount of additional space required.

(1) E.g., M/T pumps in GATX; or small influent surge tank.
(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	b	N/A	N/A	b	N/A	b	b	b	N/A	N/A	a	a	a	N/A	N/A

234 Modularity of WMS Collection/Transport subsystem (as it affects installation)(1)

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

(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	N/A	N/A	a	N/A	a	a	a	N/A	N/A	a	a	a	N/A	N/A

235 Vent requirements for WMS Collection/Transport subsystem installation

(a) No vents are required other than the existing vents.
(b) Few vents are required in addition to the existing vents.
(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	b	b	b	b	N/A	N/A	b	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

241 Space requirements for WMS waste Treatment/Disposal subsystem installation

(a) Volume required is minimal and dimensions(1) of equipment present no problems in fitting equipment into available compartment space.
(b) Volume required is moderate and dimensions(1) of equipment present no problems in fitting equipment into available compartment space.
(c) Volume and dimension(1) of equipment do present problem in fitting equipment into available compartment space.
(d) Large volume required and dimension(1) of equipment do present problem in fitting equipment into available compartment space.

(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	b	b	b	b	N/A	N/A	b	N/A	b	b	d	N/A	N/A	b	b	c	N/A.	N/A

Factor/Subfactor Ident. No.

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

INSTALLATION CHARACTERISTIC

242 Hookup requirements[1] for WMS waste Treatment/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	N/A	N/A	b	N/A	b	b	c	N/A	N/A	b	b	c	N/A	N/A

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	b	N/A	N/A	b	N/A	b	b	b	N/A	N/A	a	b	b	N/A	N/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	N/A	N/A	b	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

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 <u>can</u> be run via existing ship's stack enclosure (fiddley).
(c) Exhaust required, size of stack relatively large and stack <u>can</u> be run via existing ship's stack enclosure.
(d) Exhaust required, size of stack relatively small and stack <u>cannot</u> be run via existing ship's stack enclosure.
(e) Exhaust required, size of stack relatively large and stack <u>cannot</u> 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	e	a	N/A	N/A	e	N/A	a	e	a	N/A	N/A	a	e	a	N/A	N/A

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel GALLATIN (378') Sheet 5 of 10

Factor/Subfactor Ident. No.

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

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	N/A	N/A	b	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

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	b	b	b	c	N/A	N/A	c	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/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	b	b	c	N/A	N/A	c	N/A	b	b	c	N/A	N/A	b	b	c	N/A	N/A

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	c	c	c	d	N/A	N/A	d	N/A	c	c	c	N/A	N/A	c	c	c	N/A	N/A

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel GALLATIN (378')

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

Factor/Subfactor Ident. No.	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	N/A	N/A	a	N/A	a	a	a	N/A	N/A	a	a	a	N/A	N/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	a	N/A	N/A	a	N/A	a	a	a	N/A	N/A	a	a	a	N/A	N/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 Sheets -																	

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	b	b	b	b	N/A	N/A	b	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/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	1040	657	591	634	N/A	N/A	662	N/A	695	682	596	N/A	N/A	858	867	558	N/A	N/A

M/E II - PERFORMANCE (Cont'd)

Factor/Subfactor Ident. No. / 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	29.0	29.8	31.5	29.5	N/A	N/A	27.7	N/A	28.8	29.1	29.5	N/A	N/A	29.3	31.1	29.0	N/A	N/A

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	N/A	N/A	100	N/A	100	100	100	N/A	N/A	100	100	100	N/A	N/A

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	19	18	13	17	N/A	N/A	17	N/A	21	21	17	N/A	N/A	30	33	17	N/A	N/A

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	N/A	N/A	100	N/A	--	--	--	N/A	N/A	--	--	--	N/A	N/A

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	--	--	--	--	N/A	N/A	--	N/A	--	--	--	N/A	N/A	--	--	--	N/A	N/A

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	N/A	N/A	--	N/A	100	--	--	N/A	N/A	100	--	--	N/A	N/A

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel GALLATIN (378')

Factor/Subfactor Identif. No.

M/E II - PERFORMANCE (Cont'd)

PERFORMANCE CHARACTERISTIC

332 Ability of gray water portion of WMS to handle additional personnel (on a long term basis)
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	10	18	13	17	N/A	N/A	17	N/A	21	21	17	N/A	N/A	30	33	17	N/A	N/A

M/E IV - PERSONNEL SAFETY

SAFETY CHARACTERISTIC

21 Hazard of explosive potential for operator/maintainer due to inherent WMS design.

I - Installation Index (for personnel safety)

(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.
(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.
(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	b	a	N/A	N/A	b	N/A	a	b	a	N/A	N/A	a	b	a	N/A	N/A

22 Hazard of explosive potential for operator/maintainer due to procedural error/equipment failures of WMS.

I - Installation Index (for personnel safety)

(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.
(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.
(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	b	a	N/A	N/A	b	N/A	a	b	a	N/A	N/A	a	b	a	N/A	N/A

31 Hazard of fire ignition potential due to inherent WMS design

I - Installation Index (for personnel safety)

(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.
(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.
(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	b	a	N/A	N/A	b	N/A	a	b	a	N/A	N/A	a	b	a	N/A	N/A

32 Hazard of fire ignition potential due to procedural errors/equipment failures of WMS.

I - Installation Index (for personnel safety)

(a) Likelihood of hazardous situation is not increased due to location of any portion of WMS.
(b) Likelihood of hazardous situation is increased due to proximity of any portion of WMS to working or berthing area.
(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	b	a	N/A	N/A	b	N/A	a	b	a	N/A	N/A	a	b	a	N/A	N/A

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel GALLATIN (378')

M/E V - HABITABILITY

Factor/Subfactor Ident. No.

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	N/A	N/A	b	N/A	a	b	a	N/A	N/A	a	b	a	N/A	N/A

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	N/A	N/A	b	N/A	a	b	a	N/A	N/A	a	b	a	N/A	N/A

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	N/A	N/A	a	N/A	a	a	a	N/A	N/A	a	a	a	N/A	N/A

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	N/A	N/A	a	N/A	a	a	a	N/A	N/A	a	a	a	N/A	N/A

WMS INSTALLATION EFFECTIVENESS ATTRIBUTE DATA

Vessel GALLATIN (378')

Factor/Subfactor Ident. No.																		
M/E VI - RELIABILITY																		
RELIABILITY CHARACTERISTIC																		
22	Extent of WMS configuration redundancy 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 Requirement Data Form -													
M/E VII - MAINTAINABILITY																		
MAINTAINABILITY CHARACTERISTIC																		
131	Accessibility of replaceable WMS components I - Installation Index (for accessibility) (a) High degree of physical clearance around WMS equipment. (b) Moderate degree of clearance around WMS equipment. (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	b	b	b	b	N/A	N/A	b	N/A	b	b	b	N/A	N/A	b	b	b	N/A	N/A

CONCLUDING REMARKS

The following are points of consideration and observations 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 fitted with two separate zones for waste collection due to its large size and general arrangement. Each system is of the CHT type. Space is at a premium on this modern vessel and the WMS equipment compartments are located on the Fifth Deck (Sewage Sump and Ejector Room 5-144-0-Q) for the forward zone and on the Third Deck (Auxiliary Machinery Space No. 3, 3-272-0-E) for the aft zone. These spaces are quite small and do not lend themselves to much rearrangement. This is especially true of the aft arrangement. This is the reason why it is necessary to suggest allocating part of the Commissary Stores adjacent to Auxiliary Machinery Space No. 3 for some of the candidate WMS equipment. Because no additional space was apparent for relocation of the commissary stores, only part was taken in the study. Thus the limitation on the tank sizes in this area. The adequacy of the remaining stores space would have to be assessed.

(b) The interior of the vessel represents the latest in marine joiner work and because of this it is not possible to realize the possible piping runs or interferences due to hidden pipe, duct or wireways. Especially is this a detriment in trying to estimate how incinerator stacks can be run to the weather.

(c) For the most part the existing piping systems separate the black and gray water. In some cases it will be necessary to reroute short runs to conform to the guidelines of what is considered black and what is considered gray water. Where smaller size piping is required for a candidate WMS, the existing piping would have to be replaced.

(d) Although the vessel is fitted with extensive support systems, it would require a fresh water flushing system for some of the candidate WMS configurations. In addition the fire protection and ventilation systems would probably require modification to suit the systems employing incinerating and other heat producing equipment.

(e) There is no ballast system per se. Fuel tanks are ballasted as they become depleted. Reportedly the vessel is considered to be "tender" as far as ship's motions are concerned. Therefore, any weight compensation requirements would have to be analyzed critically as to how they could be made. There is a flume stabilization tank aboard to help dampen ship's rolling motion. However, as indicated in the shipcheck observations, there reportedly are two shipalts pending which will delete the flume stabilization tank in favor of bilge keels. If this is accomplished, the compartmentation made available would change the aft zone arrangement considerations.

(f) For access to ship equipment and material into the WMS compartments, the only apparent way is to cut into the ship's side.

APPENDIX A

PRELIMINARY INSTALLATION ANALYSIS

GALLATIN (378')

Vessel Characteristic	Data
Class	WHEC - 721 Hamilton (378') Class
Type	High Endurance Cutter
Crew Size	152
Home Port	Governor's Island, New York

SUMMARY OF PRELIMINARY INSTALLATION ANALYSIS RESULTS

GALLATIN (378')

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. (Chrysler)	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		No
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		No
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	No
13		Incinerator	Grum Flow Thru + Incin.	No
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.	No

(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).

GALLATIN (378')

Crew: 152 men

Waste Sources

Deck	W. C.'s	Urinals	Showers	Lavatories
02 Level	3	-	2	3
01 Level	2	-	2	2
Main Deck	5	-	4	9
Second Deck	15	7	16	11
Third Deck	3	3	4	3
Total	28	10	28	28

Existing Arrangement

The ship's waste sources are grouped in two zones; viz. one forward of Frame No. 192 (approx.) and one aft. All drains, whether black water or gray water, collect by gravity. Each zone is fitted with a holding tank and two pumps which discharge a mixture of black and gray water directly overboard and, in port, to shore connections on deck, port and stbd, for off-loading to a pierside facility.

The forward zone holding tank (approx. 1130 gallons capacity) and its off-loading pumps are located low in the ship, on the Fifth Deck, in the Sewage Sump and Ejector Room (5-144-O-Q). All sewage drains in the zone and all galley/turbid drains on the Third Deck of the zone gravitate to this tank. All turbid drains above the Third Deck gravitate directly overboard.

The aft zone holding tank (approx. 450 gallons capacity) and its off-loading pumps are located on the Third Deck, in Auxiliary Machinery Space No. 3 (3-272-O-E). All galley and sewage drains in the zone gravitate to this tank. Turbid drains in the zone gravitate directly overboard.

The two compartments containing the holding tanks are separated by a comparatively long distance in which are located the engine room, diesel oil fuel storage tanks, fresh water storage tanks and the flume stabilization tank (for controlling the ship's stability when rolling).

GALLATIN (378')

Special Remarks

From an analysis of the vessel's drawings and available data, it appears that where gravity drainage is required the most practicable approach would be to retain the existing two-zone concept. There are too many complications and restrictions which will rule out trying to route piping through the aforementioned spaces between the two holding tank compartments in an attempt to consolidate the system arrangements. It also appears that the distribution of personnel berthing and sanitary facilities is greater in the forward zone than the aft zone. It is estimated that personnel distribution is approximately twice as many forward as aft, and the sanitary facilities installed show sewage sources also approximately two to one and turbid sources almost three to one. These factors will be taken into account when analyzing locations and space requirements for waste water management system components.

In this investigation it has been established that all tankages will be free-standing, with proper exterior strengthening, in contrast to those built into the ship's structure with attendant structural shapes (beams, girders etc.) being inside the tanks. While the latter approach usually yields more available tankage it is not as desirable from a fabrication and maintenance point of view, and appears to be in conflict with the study guidelines for holding tank design specifications.

The vessel arrangement drawings indicate that all space has been allocated for the many functions for a ship of this type and that there will be very little, if any, actual space available for reassignment. This will be verified in the shipcheck.

Where waste collection is via vacuum or by macerator transfer pumps, new and smaller piping will have to be installed. Since the wastes can be motivated in any direction and do not have the limitation imposed by gravity, it is possible to take a different approach for equipment locations; that is, equipment can be located more or less where there is space, since the new piping can usually be run to suit. This has the effect of linking, in part, spaces in the forward zone (Forward of Fr. 192) with those in the aft zone as necessary for proper loading of the equipment. In this way the equipment does not have to be placed to suit the piping as in the case of gravity drainage.

PRELIMINARY INSTALLATION ANALYSIS OF INDIVIDUAL CANDIDATE SYSTEMS

Vessel: GALLATIN (378')

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

	Required
Sewage Holding Tank	7,781 gal. (1040 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sewage Holding Tank Overboard Pump	Two (2)
G/T Holding Tank Overboard Pump	Two (2)

Discussion

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

Location of Equipment

(a) Forward of Frame 192

Based on the discussion in the introductory remarks regarding this system, it appears that the sewage holding tank capacity required for the zone (approx. 5184 gal./693 cu. ft.) can be installed in the Sewage Sump and Ejector Room.

There does not appear to be sufficient space available to fit all the required galley/turbid holding tankage. It is estimated that tankage for approximately 5109 gal. (683 cu. ft.) can be fitted alongside the sewage holding tank.

(b) Aft of Frame 192

It appears that room in Auxiliary Machinery Space No. 3 will have to be supplemented by some from the Issue Room and Commissary Stores just aft of it to accommodate the tankages. Room in the latter spaces would accommodate the estimated sewage holding tank requirement of approximately 2595 gal. (347 cu. ft.).

There is insufficient space available to fit all the required galley/turbid holding tankage. Remaining space in the Issue Room and Commissary Stores plus the Auxiliary Machinery Room No. 3 can apparently accommodate approximately 4174 gal. (558 cu. ft.).

System No. 1 (cont'd.)

The sewage holding tank overboard discharge pumps could fit in Auxiliary Machinery Space No. 3, while the galley/turbid holding tank overboard discharge pumps would be located in Passage 3-280-O-L just aft of the Service Hoist.

(c) It is anticipated that some existing equipment will have to be relocated to accommodate the installations.

Drainages

(a) Forward of Frame 192

All sewage would gravitate to the holding tank for pumping overboard or pierside according to prevailing restrictions.

Galley/turbid drains from the Third Deck would have to drain to the G/T holding tank since they are below the waterline and cannot gravitate overboard. They would be pumped overboard/pierside according to prevailing restrictions. Galley/turbid drains above the Third Deck would gravitate overboard in unrestricted waters and to the G/T holding tank in restricted waters for pump discharge according to prevailing restrictions.

(b) Aft of Frame 192

All sewage would gravitate to the sewage holding tank for pumping overboard or pierside according to prevailing restrictions.

All galley/turbid drains would gravitate overboard in unrestricted waters and otherwise to the G/T holding tank for discharge according to prevailing restrictions.

Vessel: GALLATIN (378')

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	1,452 gal. (194 cu. ft.)	
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)	
Chrysler Model and Quantity	Option A	Option B
Separation Tank	One (1) - B	Three (3) - A/B
Fluid Maintenance Module	One (1) - B	
Pump Package	One (1) - B	
Oil Accumulator	One (1) - 46.8 cu. ft.	
Fluid Maintenance and Pump Package		Three (3) - A
Sewage Holding Tank Overboard Pump	Two (2)	
G/T Holding Tank Overboard Pump	Two (2)	

Discussion

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

Location of Equipment

(a) Forward of Frame 192

Based on the zoning allocations previously discussed, it appears that all of the required sewage holding tankage (approx. 957 gal./128 cu. ft.) can be installed in the Sewage Sump and Ejector Room.

There is insufficient space available for all required galley/ turbid holding tankage. It is estimated that tankage for approximately 7330 gal./980 cu. ft. can be fitted alongside the sewage holding tank.

The tank overboard discharge pumps would be located near the tanks served.

System No. 2 (cont'd.)

Chrysler equipment Option A would be impractical for a two zone ship with restrictions like the subject vessel, since it calls for only 1 set. Therefore, Option B is better adaptable, since two of the three required shipsets would be located in the Sewage Sump and Ejector Room.

(b) Aft of Frame 192

The estimated required sewage holding tank capacity can be met by installing the tank (approx. 486 gal./65 cu. ft.) in Auxiliary Machinery Room No. 3.

The estimated required galley/turbid tankage of approximately 5558 gal. (743 cu. ft.) could be installed in the Issue Room and Commissary Stores spaces.

The remaining Chrysler set could be installed in Auxiliary Machinery Room No. 3, along with the sewage tank overboard discharge pumps. The G/T holding tank overboard pumps would be located near the tank as in System No. 1.

Drainage

(a) Forward of Frame 192

All sewage would gravitate to the Chrysler separation tanks for transfer to the sewage holding tank for off-loading overboard or to pierside according to prevailing restrictions.

Galley/turbid drainage would be the same as in System No. 1.

(b) Aft of Frame 192

All sewage would be handled the same way as for spaces forward of Frame 192.

Galley/turbid drainage would be the same as in System No. 1.

Vessel: GALLATIN (378')

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	22,230 gal. (2972 cu. ft.)	
Sludge Holding Tank	One (1) - Model C	
Incinerator Model and Quantity	Two (2) - Model C	
Chrysler Model and Quantity	Option A	Option B
Separation Tank	One (1) - B	Three (3)-A/B
Oil Accumulator	One (1) 46.8 cu. ft.	
Fluid Maintenance and Pump Package		Three (3) - A
Pump Package	One (1) - B	
Fluid Maintenance Module	One (1) - B	
Sludge Holding Tank		
Transfer Pump	One (1) per tank	
Overboard Pump	One (1) per tank	
Galley/Turbid Holding Tank		
Overboard Pump	Two (2)	

Discussion

The system installation appears to be acceptable but requires certain considerations and reservations.

This system is essentially the same as System No. 2 except that in place of a sewage holding tank, an incinerator with a sludge holding (surge) tank has been substituted. Therefore the discussion for System No. 2 would apply and an incinerator with its sludge holding (surge) tank would have to be fitted in the Sewage Sump and Ejector Room and in Auxiliary Machinery Space No. 3. The incinerator stack runs are not immediately apparent and will have to be analyzed in the shipcheck.

It should be noted that the requirements call for only one (1) sludge holding tank (Model C) to feed both incinerators. However, due to the required zoning of the vessel only one incinerator can be located forward and one aft, but the one sludge holding tank cannot feed the two incinerators. There would have to be an additional tank. Each would preferably be sized to suit the service of the zone in which located. Further, the incinerator service is unequal since there would be approximately twice the demand for its use forward than aft.

These considerations would have to be taken under advisement and slight changes made to make the system completely acceptable.

Vessel: GALLATIN (378')

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	793 gal. (106 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sludge Holding Tank	648 gal. (87 cu. ft.)
Grumman Unit without Incinerator	Two (2)
Influent Surge Tank Pump	Two (2)
Influent Surge Tank Overboard Pump	Four (4)
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank
Sludge Holding Tank Transfer Pump	Two (2)

Discussion

The system installation appears to be acceptable, but requires certain considerations and reservations.

Location of Equipment

(a) Forward of Frame 192

One of the two Grumman units required for the ship could be located in the Sewage Sump and Ejector Room, together with an influent surge tank and sludge holding tank, each proportioned for the zone being served.

There does not appear to be sufficient room in the Sewage Sump and Ejector Room for all the required galley/turbid holding tankage. However, part of it can and the amount will be determined from the shipcheck.

The associated pumps would be located functionally near equipment served.

(b) Aft of Frame 192

The same arrangement would apply aft as for the forward spaces. The room available in Auxiliary Machinery Room No. 3 and in the Issue Room and Commissary Stores would be considered. It appears that only part of the required galley/turbid holding tankage can be fitted, space being at a premium. The amount and location will be determined from the shipcheck.

Drainages

All sewage in both zones would gravitate to the respective influent surge tanks for transfer to the Grumman units. The surge tanks would be pumped overboard or pierside according to prevailing restrictions.

The galley/turbid drainage for each zone would be as described in System No. 1.

Special Considerations and Reservations

It should be noted that two Grumman units were specified as being required for the ship's needs. However, the requirements are greater in the forward zone than in the aft zone (about 2:1). Therefore, since one unit must be fitted in each zone, the demand will be greater on the forward are and lighter on the aft. It will have to be ascertained whether this disproportionate lo ding is acceptable. If not, the system installation would not be acceptable.

Vessel: GALLATIN (378')

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

	Required
Influent Surge Tank	3,128 gal. (418 cu. ft.)
Sludge Holding Tank	2,501 gal. (334 cu. ft.)
Grumman Unit without Incinerator	Five (5)
Influent Surge Tank Pump	Five (5)
Influent Surge Tank Overboard Pump	Two (2) per tank
Sludge Holding Tank Transfer Pump	Five (5)

Discussion

The system installation appears to be unacceptable.

Due to the zoning requirements for the vessel, the best distribution proportions for the five (5) Grumman units would appear to be three (3) units in the forward zone in the Sewage Sump and Ejector Room and two (2) units in the aft zone, probably in the Issue Room and Commissary Stores spaces.

There does not appear to be sufficient room in the forward space for three Grumman units, an influent surge tank, sludge holding tanks, three (3) surge tank transfer pumps (to feed the Grumman unit), two (2) surge tank overboard discharge pumps and sludge holding tank transfer pump(s).

The situation aft does not appear to be any better.

Both spaces will be shipchecked. It will also have to be determined if the Grumman unit proportional locations will be capable of handling the anticipated zone loadings.

Vessel: GALLATIN (378')

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
G/T Influent Surge Tank	2,335 gal. (312 cu. ft.)
Sewage Holding Tank	7,781 gal. (1040 cu. ft.)
Sludge Holding Tank	1,853 gal. (248 cu. ft.)
Optional Combined Sewage/Sludge Holding Tank	9,633 gal. (1288 cu. ft.)
Grumman Unit without Incinerator	Four (4)
Sewage Holding Tank Overboard Pump	Two (2) per tank
Influent Surge Tank Pump	Four (4)
Influent Surge Tank Transfer Pump	One (1) per tank
Sludge Holding Tank Transfer Pump	One (1) per tank

Discussion

The system installation appears to be acceptable, but requires certain considerations and reservations.

The required holding tankage for forward and aft zones can apparently be met in the same proportions as given in System No. 1; i.e. 5184 gal./693 cu. ft. forward and 2595 gal./347 cu. ft. aft. Locations would be essentially the same as in System No. 1.

The question arises in the proportionate distribution of the four (4) required Grumman units in two (2) zones. With a service ratio of approximately twice as much needed forward as aft, it would have to be determined if two units forward and two units aft would be functional. It is fairly certain that to consider locating three (3) units forward would be impossible due to lack of space (as discussed in System No. 5), with all the other equipment that is required.

Vessel: GALLATIN (378')

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	22,230 gal. (2972 cu. ft.)
Sewage Influent Surge Tank	793 gal. (106 cu. ft.)
Fuel Oil Day Tank	25 gal. (3.3 cu. ft.)
Grumman Units with Incinerator	Two (2) with Two (2) Thiokol Incinerators
Influent Surge Tank Pump	Two (2)
Influent Surge Tank Overboard Pump	Four (4)
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system installation appears to be acceptable, but requires certain considerations and reservations.

The system is similar to System No. 4 except that an incinerator with its feed tank is being substituted for the sludge holding tank.

Accordingly the discussion and remarks for System No. 4 would apply. Any variations in available tankages will be noted as a result of a shipcheck. In addition, the possible incinerator stack runs are not immediately apparent and will have to be checked aboard ship as in System No. 3.

Vessel: GALLATIN (378')

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

	Required
Influent Surge Tank	3,128 gal. (418 cu. ft.)
Fuel Oil Day Tank	25 gal. (3.3 cu. ft.)
Grumman Units with Incinerators	Five (5) with Five (5) Thiokol Incinerators
Influent Surge Tank Pump	Five (5)
Influent Surge Tank Overboard Pump	Two (2) per tank

Discussion

The system installation appears to be unacceptable.

The system is essentially similar to System No. 7 except that there is no galley/turbid holding tank and all wastes go to the influent surge tank. However, due to the increase in the number of Grumman units, there appears to be room enough only for two units aft in the Issue Room and Commissary Stores but not enough for three units with incinerators, tanks and pumps in the Sewage Sump and Ejector Room. This will be further investigated in the shipcheck along with the possibility of running incinerator stacks to the weather.

Vessel: GALLATIN (378')

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

	Required
Vacuum Collection Tank Ass'y	250 gal. (165 cu. ft.)
Sewage Holding Tank	2,300 gal. (307 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sanitary Holding Tank Overboard Pump	Two (2) per tank
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

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

A fresh water sanitary flushing system will be required.

Location of Equipment

Since only one vacuum collection tank assembly has been specified, it appears that more space is available for it in the forward port of the vessel in the Sewage Sump and Ejector Room. None would, therefore be located aft.

The sewage holding tankage would be proportioned between the forward and aft spaces. One tank could be located in the Sewage Sump and Ejector Room with the VCT, another would have to be located aft in Auxiliary Machinery Space No. 3.

The galley/turbid holding tankage would be proportioned between the forward and aft spaces similar to System No. 1, but the available tankage space could be different than in that system. This will be shipchecked.

Pumps would be located near the tanks served.

Drainages

Sewage would collect by vacuum in the vacuum collection tank for transferral to the sewage holding tanks for discharge overboard or pierside according to prevailing restrictions.

Galley/turbid drains would gravitate for disposition as discribed for System No. 1.

Special Remarks

Since this system has vacuum collection, and since there is only one vacuum collection tank assembly, the collection piping from the sewage waste sources in the two existing waste zones of the vessel will have to be all routed to the one VCT. Further, the effluent from the VCT would have to be proportioned to two sewage holding tanks as mentioned above for adequate holding time.

Vessel: GALLATIN (378')

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

	Required
Vacuum Collection Tank Assembly	250 gal. (165 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Fuel Oil Day Tank	154 gal. (20.6 cu. ft.)
Incinerator	One (1) Jered
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

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

This system is similar to System No. 9 except that the sewage holding tank is being replaced with an incinerator. Since the incinerator will preferably be located with the VCT in the Sewage Sump and Ejector Room and there is no sewage holding tank, there will probably be more tankage space available for galley/turbid holding tankage aft. This will be shipchecked along with the possible routing of theincinerator stack.

Vessel: GALLATIN (378')

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

	Required
Vacuum Collection Tank Assembly	250 gal. (165 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.
Evaporator (GATX)	Six (6) - 80 gal.
Catalytic Oxidizer	Six (6)
Galley/Turbid Holding Tank Overboard Pump	Two (2) per tank

Discussion

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

A fresh water sanitary flushing system will be required.

Location of Equipment

Only one vacuum collection tank assembly is required and it appears that it would be best fitted forward in the Sewage Sump and Ejector Room.

Four of the six evaporators and thier catalytic oxidizers can probably be located also in the Sewage Sump and Ejector Room. The remaining two can be fitted aft in Auxiliary Machinery Space No. 3.

The galley/turbid holding tanks can possibly be fitted in the manner and proportion of System No. 1.

Pumps would be fitted near the tanks served.

Drainages

Sewage would be collected from all spaces in the VCT from which it

would be transferred fore and aft to the six evaporators.

All galley/turbid drains, except those from the Third Deck forward of Frame 192, would gravitate overboard in unrestricted waters. Third Deck drains would gravitate to the galley/turbid holding tank for discharge overboard. In restricted waters and pierside all G/T drains would drain to the respective G/T holding tanks in the zones forward and aft of Frame 192.

Vessel: GALLATIN (378')

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	2,335 gal. (312 cu. ft.)
Sludge Holding	1,853 gal. (248 cu. ft.)
Vacuum Collection Tank Assembly	250 gal. (165 cu. ft.)
Sewage Holding Tank	2,300 gal. (307 cu. ft.)
Grumman Unit without Incinerator	Four (4)
Influent Surge Tank Pump	Four (4)
Sewage Holding Tank Overboard Pump	Two (2) per tank
Sludge Holding Tank Transfer Pump	One (1) per tank

Discussion

The system installation appears to be unacceptable.

The available spaces fore and aft (i.e. the Sewage Sump and Ejector Room fwd and Auxiliary Machinery Space No. 3 and the Issue Room and Commissary Stores aft) appear to be inadequate for all the equipment needed.

The forward space would have to accommodate the vacuum collection tank, the sewage holding tank, galley/turbid influent surge tank, two Grumman units, sludge holding tanks, a galley/turbid holding tank and the various pumps associated with the tanks.

The aft spaces would have to accommodate the galley/turbid influent surge tank, two Grumman units, sludge holding tanks and the pump associated with the tanks.

All this equipment could not be arranged functionally and accessibly in the limited space available.

Vessel: GALLATIN (378')

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 Influent Surge Tank	2,335 gal. (312 cu. ft.)
Vacuum Collection Tank Assembly	250 gal. (165 cu. ft.)
Fuel Oil Day Tank	285 gal. (38.1 cu. ft.)
Grumman Unit with Incinerators	Four (4) with Eight (8) Thiokol Incinerators
Vacuum Collection Tank Transfer Pumps	Four (4)
Influent Surge Tank Pumps	Four (4)
G/T Holding Tank Overboard Pump	Two (2) per tank

Discussion

The system installation appears to be unacceptable.

The system is similar to a large extent to System No. 12, except that sewage holding tankage has been deleted but eight incinerators have been added. Therefore, the same over-crowded conditions are apparent, complicated by the requirement of fitting a large quantity of incinerators and running their stacks to the weather. Space aboard the vessel appears to be at a premium.

Vessel: GALLATIN (378')

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

	Required
Sewage Holding Tank	2,501 gal. (334 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Sewage Holding Tank Overboard Pump	Two (2) per tank
G/T Holding Tank Overboard Pump	Two (2) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

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

A fresh water sanitary flushing system will be required.

The system is essentially the same as System No. 1, except that sewage collection has been changed from gravity to pump means. Therefore, with that exception, equipment locations and drainages would be the same as discussed for System No. 1. The sewage holding tank sizes, of course, would be smaller due to less required capacity.

Vessel: GALLATIN (378')

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

	Required
Incinerator Feed Tank	300 gal. (40 cu. ft.)
Galley/Turbid Holding Tank	22,230 gal. (2972 cu. ft.)
Fuel Oil Day Tank	155 gal. (20.7 cu. ft.)
Incinerator	One (1) Jered
Incinerator Feed Pump	One (1)
Incinerator Feed Tank Overboard Pump	One (1)
G/T Holding Tank Overboard Pump	Two (2) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

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

A fresh water sanitary flushing system would be required.

Location of Equipment

It appears possible to include the following in the forward Sewage Sump and Ejector Room: incinerator feed tank, incinerator, fuel oil day tank, a galley/turbid holding tank as in System No. 1, and the pumps associated with this equipment. Similarly, a galley/turbid holding tank could be fitted aft, preferably in the Issue Room and Commissary Stores spaces because of the tankage size required. The G/T holding tank overboard pumps could be located in Auxiliary Machinery Space No. 3.

Drainages

All sewage would be collected by macerator/transfer pumps for discharge to the incinerator feed tank and disposition in the incinerator. The incinerator feed tank would be pumped overboard or to pierside according to the prevailing restrictions.

Galley/turbid drains would gravitate for collection and disposition as discussed for System No. 1.

Vessel: GALLATIN (378')

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	22,230 gal. (2972 cu. ft.)
Evaporator Feed Tank	300 gal. (40.1 cu. ft.)
Evaporator (GATX)	Six (6) - 80 gal.
Catalytic Oxidizer	Six (6)
Evaporator Feed Pump	Two (2) per set of evaps.
Evaporator Feed Tank Overboard Pump	One (1) per tank
G/T Holding Tank Overboard Pump	Two (2) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

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

A fresh water sanitary flushing system will be required.

Location of Equipment

In the Sewage Sump and Ejector Room forward it appears that the following can be fitted: evaporator feed tank, four (4) evaporators with their catalytic exidizers two (2) evaporator feed pumps (one for standby), evaporator feed tank overboard pump, galley/turbid holding tank (sized for forward drainage zone) and two (2) G/T holding tank overboard discharge pumps.

In the aft spaces - Auxiliary Machinery Room and the Issue Room and Commissary Stores - it appears that the following can be fitted: evaporator feed tank, two (2) evaporators with their catalytic oxidizers, two (2) evaporator feed pumps (one for standby), evaporator feed tank overboard pump, galley/turbid holding tank (sized for aft drainage zone) and two (2) G/T holding tank overboard discharge pumps.

Drainages

Sewage would be collected, via macerator/transfer pumps, in the evaporator feed tank from which it would be transferred to the evaporators. The evaporator feed tank would be pumped overboard or pierside by its overboard discharge pumps according to prevailing restrictions.

Galley/turbid drains would gravitate overboard and to the holding tanks for pumping overboard/pierside as described for System No. 1.

Vessel: GALLATIN (378')

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	2,501 gal. (334 cu. ft.)
Galley/Turbid Influent Surge Tank	2,335 gal. (312 cu. ft.)
Sludge Holding Tank	1,853 gal. (248 cu. ft.)
Grumman Unit without Incinerator	Four (4)
Sewage Holding Tank Overboard Pump	Two (2) per tank
G/T Influent Surge Tank Pump	Four (4)
G/T Influent Surge Tank Transfer Pump	One (1) per tank
Sludge Holding Tank Transfer Pump	One (1) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

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

A fresh water sanitary flushing system will be required.

Location of Equipment

In the Sewage Sump and Ejector Room forward it appears that the following equipment can be fitted: sewage holding tank (sized for the forward zone), two (2) sewage holding tank overboard discharge pumps, galley/turbid influent surge tank (sized for the forward drainage zone), three (3) surge tank pumps (one per Grumman unit), surge tank transfer pump (to sewage holding tank), three (3) Grumman units, sludge holding tank and a sludge holding tank transfer pump (to sewage holding tank).

In the aft spaces - Auxiliary Machinery Room No. 3 and the Issue Room and Commissary Stores - it appears that the following equipment can be fitted: sewage holding tank (sized for the aft zone), two (2) sewage holding tank overboard discharge pumps, galley/turbid influent surge tank (sized for the aft drainage zone), one (1) surge tank pump (to Grumman feed tank), surge

tank transfer pump (to sewage holding tank), one (1) Grumman unit, sludge holding tank and a sludge holding tank transfer pump (to sewage holding tank).

Drainages

Sewage would be collected in the sewage holding tanks via the macerator transfer pumps and the tank would be discharged overboard or pierside via the overboard discharge pumps.

Except for Third Deck drains forward, galley/turbid drains would gravitate overboard in unrestricted waters and to the influent surge tank for transfer to the Grumman feed tanks in restricted waters. Third Deck drains would have to drain to the influent surge tank for transfer to the sewage holding tank for discharge overboard. When pierside, all G/T drains would gravitate to the influent surge tank for transfer to the sewage holding tank for discharge pierside.

The sludge holding tanks would be pumped to the sewage holding tank for disposal.

Vessel: GALLATIN (378')

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	308 gal. (41 cu. ft.)
Galley/Turbid Surge Tank	2,335 gal. (312 cu. ft.)
Fuel Oil Day Tank	285 gal. (38.1 cu. ft.)
Grumman Unit with Incinerators	Four (4) with Eight (8) Thiokol Incinerators
Sewage Surge Tank Transfer Pump	Two (2) per tank
Sewage Surge Tank Overboard Pump	One (1) per tank
G/T Surge Tank Pump	Two (2) per tank
G/T Surge Tank Overboard Pump	One (1) per tank
Macerator/Transfer Pump	Eighteen (18)

Discussion

The system installation appears to be unacceptable.

For the spaces available, it appears impossible to locate all the equipment required in an arrangement which would be satisfactory functionally and accessible for operation, maintenance, and repair. The addition of pumps and eight incinerators presents complications, the solutions to which are not readily apparent. However, the vessel will be checked to determine the status of this proposed system.

* U.S.G.P.O. 727-079/1302-1639