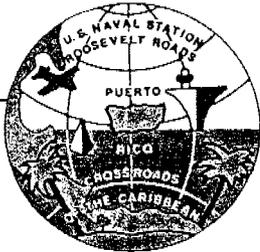


# FINAL REPORT

## **Wastewater Pretreatment Units Evaluation** (WWTP Pretreatments Units, Oil/Water Separators, and Grease Traps)



*for*

**U.S. Naval Station Roosevelt Roads  
Puerto Rico**



*and*

**Atlantic Division Naval Facilities  
Engineering Command  
Norfolk, VA**

*prepared by*



**CH2MHILL**

**SEPTEMBER 2002**

# Executive Summary for Pretreatment Units Evaluation at U.S Naval Station Roosevelt Roads

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DATE: September 27, 2002

## 1 Executive Summary

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### 1.1 Background

The U.S. Naval Station, Roosevelt Roads operates three (3) advanced biological wastewater treatment plants (WWTPs). They are known as the Bundy, Capehart and Forrestal WWTPs. The three WWTPs differ in design, configuration of process equipment and specific equipment used.

The Bundy WWTP consists of secondary biological treatment followed by chemical denitrification. The plant is permitted to treat a maximum day flow of 0.669 million gallons per day (MGD). The secondary biological treatment is provided by means of trickling filters. It receives sewage primarily from the Bundy housing area, officer's quarters, enlisted personnel barracks, and military messes.

The Capehart WWTP is permitted to treat a maximum day flow of 1.13 MGD and is an activated sludge extended aeration plant followed by chemical denitrification. It receives sewage almost exclusively from the Capehart housing area. Other facilities that discharge to the treatment plant include an elementary school, a high school, a television studio, the Air Force Range Operation Center, and the Station Communication Center.

The Forrestal WWTP is hydraulically designed to treat a maximum day flow of 1.01 MGD. Its secondary biological treatment system is followed by chemical denitrification. The secondary treatment is provided by means of trickling filter units, preceded by a one (1) MG equalization lagoon. The Forrestal WWTP has oil spill recovery equipment located on the lagoon for pretreatment as well. Major facilities which discharge to this system include an airfield and its numerous support facilities, a 600-bed hospital, a veterinary clinic, vehicle maintenance garages, auto hobby shops, the Public Works Department, numerous storage facilities, enlisted personnel barracks, officer's quarters, three ship piers, weapons facilities, two pesticide control facilities, and a marina.

There are also a number of pretreatment devices at various locations at the base including 17 grease traps and 29 concrete Oil-Water Separators (OWSs). These facilities pretreat wastewater which is then discharged to one of the three WWTPs.

## 1.2 Objectives and Approach

The objective of this study was to evaluate the wastewater pretreatment units (i.e. screening, grit removal equipment, oil spill recovery equipment, grease traps, washracks/OWSs) located in the Forrestal, Capehart and Bundy wastewater collection systems service areas. Project Documentation Design Packages (form 1391 with associated information) were prepared for improvements that were recommended by CH2M HILL and that were endorsed by the Navy.

To accomplish this work, two person teams evaluated the pretreatment equipment at the WWTPs, the OWSs, and the grease traps. Manufacturer representatives were contacted with respect to the grit equipment to help troubleshoot problems and suggest possible remedies. The field teams also inspected each OWS and its associated wash rack in order to determine if it was receiving excessive drainage, whether it was properly sized, whether it discharged to a sanitary sewer, and to identify by visual inspection any deterioration of the concrete on the interiors of the OWSs. Grease traps were also inspected to assess their condition and whether they were adequately sized. An evaluation was also conducted to determine the preferred method of grease disposal.

## 1.3 Report Organization

The report is organized as a collection of stand-alone technical memorandums which assess the following area:

- Section 1 – Executive Summary
- Section 2 – Evaluation of Forrestal Lagoon (Oil recovery system)
- Section 3 – Evaluation of Forrestal Grit System
- Section 4 – Evaluation of Bundy Grit System
- Section 5 – Evaluation of Capehart Grit System (and screenings)
- Section 6 – Evaluation of Oil-Water Separators
- Section 7 – Evaluation of Grease Traps
- Section 8 – Evaluation of Grease Disposal Alternatives

Additional information for each section is contained in the appendixes at the end of this report.

## 1.4 Results of Grit Systems and Oil Recovery Unit at WWTPs

The grit removal systems at Forrestal, Bundy, and Capehart WWTPs were evaluated. Findings and recommendations can be summarized as follows:

- Forrestal grit system is working well since it has been refurbished except that the dewatering screen is receiving excess flow. This is most probably due to malfunctioning of the grit concentrator. The concentrator should be inspected and repaired as needed. Additionally, there is the potential for the headworks at Forrestal to flood with raw wastewater if the Influent Pump Station should fail (due to a pump failure or a power failure). This can be addressed by installation of a float switch located at the headworks area which will activate an alarm if the wastewater level rises above the influent channel. The alarm will permit operators to investigate the problem and appropriately address the situation.
- Bundy grit system is under contract to be refurbished and the refurbishment should address the problems associated with this system.
- Capehart grit system has been inoperable several years and should be replaced. CH2M HILL recommends that a new grit and screenings facility be installed similar to that at Bundy WWTP. Estimated cost for new headworks at Capehart including grit and screenings facilities is \$546,000 (not including engineering costs).

Additionally, the oil recovery system at the Forrestal Lagoon was evaluated. With respect to this system, CH2M HILL recommends that a small area be enclosed by a floating baffle wall at the east influent to the lagoon. This area will permit the capture of oil spills as they enter the lagoon. The existing skimming equipment (or a new skimming unit) can then be used to remove any oil. Additionally, the lagoon liner is in poor condition and should be replaced when the above modifications are installed. Estimated cost of modifying the oil recovery system and re-lining the lagoon is \$438,000.

## 1.5 Evaluation of Oil/Water Separators

Twenty-nine concrete OWSs were surveyed and evaluated. Four OWSs (OWS-382, OWS-860, OWS-2311, and OWS-3152) were found to have some degree of concrete deterioration on the interiors of the OWSs. Six OWSs (OWS-31, OWS-2339-2, OWS-2345, OWS-2431, and OWS-3137) were found to have drainage problems. Three OWSs (OWS-212, OWS-382, and OWS-443) discharge to the stormwater system, however, these appear to be part of an approved Spill Prevention Control and Countermeasure (SPCC) plan. All OWSs were capable of accepting process wastewater flows, however, eight OWSs (OWS-31, OWS-200, OWS-792, OWS-2011, OWS-2036, OWS-2311, OWS-2345, and OWS-3152) were found to be inadequately sized to accept estimated stormwater flows. In particular, one OWS (OWS-2311) was found to have structural, drainage, and capacity problems. CH2M HILL recommends that this OWS be abandoned or replaced. Other OWSs can be modified to help them adequately perform.

With respect to the eight OWSs that are capacity limited, CH2M HILL recommends the following:

- Installation of flow-limiting devices on six of the OWSs (OWS-31, 200, 2011, 2036, 2345, and 3152) which will prevent excessive stormwater from entering the OWSs during storm events. If the stormwater flow is exceptionally high, the excess flow will drain to the adjacent stormwater system. The flow-limiting device is essentially a plate fitted over a drainage grate which prevent excessive stormwater from entering the OWS by limiting the maximum drainage into the grated inlet. Estimated cost for these devices range from \$2,000 to \$8,000 for each OWS.
- Do not use OWS-792 for activities requiring an OWS. This area may continue to be used as a washdown area for small boats.
- Abandonment of one OWS (OWS-2311) which was found to have deteriorated concrete, excessive drainage area, and is too small to handle the flows from the wash area that it serves. The OWS should be abandoned and its flow be re-routed to an adjacent OWS (OWS-2364). Installation of two flow limiting devices and a small grit chamber will permit the additional flow to be routed to OWS-2364 without adversely impacting its operation. Estimated cost is approximately \$45,000.

Specific recommendations for each OWS that was found to have problems are discussed in the OWS technical memorandum.

## 1.6 Evaluation of Grease Traps

Seventeen grease traps were evaluated. Most of the traps were less than 100 gallons in size, however, three traps were over 1000 gallons in size. Five grease traps were not operational and not needed due to facility relocation or new construction. All grease traps were sized properly to handle process flows, however, three grease traps required cleaning more frequently than the scheduled monthly cleaning.

Disposal of grease was also evaluated. It was found that grease is currently being disposed of in the wet well of a pump station instead of being disposed of in the landfill. The grease was not being disposed of at the landfill due to difficulty in dewatering the grease. CH2M HILL evaluated disposal of the grease at the landfill and at one of the WWTPs (where it would be pumped to a digester). CH2M HILL recommends disposal at a WWTP. To address concerns with dewatering of grease, we recommend that a new grease unloading and receiving facility be constructed at Forrestal WWTP. A new grease unloading and receiving station at the is estimated to cost approximately \$131,000.

## 1.7 Estimates for Recommended Improvements

Estimates for each of the recommended improvements are contained in the appendixes for the 1391 forms.

# Evaluation of Washracks/Oil-Water Separators at U.S Naval Station Roosevelt Roads

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DATE: September 27, 2002

## 1. Summary

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U.S. Naval Station Roosevelt Roads has 29 concrete Oil-Water Separators (OWSs) and the washracks they service. These OWS were evaluated to determine if there were problems in the following areas:

- Drainage problems, such as, piping blockage or failure (OWSs that have inadequate capacity to accept the stormwater generated are discussed under inadequate treatment capacity)
- Visual inspection of the interior of the OWSs to locate any visible structural deterioration
- Discharge to other than the Sanitary Sewer System
- Inadequate treatment capacity (including inadequate capacity to treat stormwater generated)

A location diagram of the OWS is shown in Figure 1. Figure 1 also includes a detailed chart identifying OWSs that were found to have problems. A more comprehensive OWS listing is also included as Table 1.

Three OWSs (OWS-2345, OWS-2431, and OWS-3137) had blocked drainage lines from the drainage apron to the OWS. One OWS (OWS-2339-2) was found to receive sanitary waste from a nearby bathroom. CH2M HILL recommends that the blockages be removed from the three OWSs and that the sanitary flow routed to one OWS be separated and connected directly to a sanitary sewer.

Four OWSs (OWS-382, OWS-860, OWS-2311, and OWS-3152) had visible structural deterioration. One of these OWSs also has capacity problems (with respect to stormwater flows) and CH2M HILL recommends that this OWS be replaced or that it be decommissioned and its flow be rerouted to an adjacent OWS.

Three OWSs (OWS-212, OWS-382, and OWS-443) were found to discharge to the stormwater system. All of these OWSs were at fuel depots, had effluent discharge valves, and appeared to be part of the SPCC (Spill Prevention Control and Countermeasure) program at the base. If they are part of an approved SPCC plan, no further action is required.

All OWSs receiving process wastewater flow were adequately sized. There were also eight OWSs handling stormwater inflow that did not have adequate capacity. CH2M HILL recommends that flow-limiting devices be installed on six of these OWSs and that the other two OWS be abandoned and their flows routed elsewhere.

The results of the surveys are included in the appendix of this report. The surveys include photos of the OWSs and calculations to determine their adequacy to accept process and stormwater flows.

## 2. Field Survey Results

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Field surveys were conducted for each OWS and their associated washrack in November of 2001 and January and February of 2002. A two person team surveyed each washrack and OWS. Sources of washdown water were identified and drainage areas for stormwater were delineated and measured. Each OWS was emptied and cleaned and a person measured the dimensions of each OWS and performed a visual inspection of the concrete interior. Deteriorated concrete was identified and is summarized in this report. Further inspection and testing may be required to determine the extent of concrete deterioration. The OWSs were also inspected to determine if they were connected to the sanitary sewer. In addition to conducting a visual inspection to determine if an OWS were connected to a sanitary sewer, existing drawings of the OWSs and the sanitary sewer collection system were also consulted to determine where each OWS discharged.

The results of the field surveys are summarized in Table 1. The results can be summarized as follows:

- **Drainage into the OWSs** – Six OWS had drainage problems with respect to flow entering the OWSs. Three OWSs, OWS-2345, OWS-2431, and OWS-3137 had plugged drains that prevented flow from the drainage area from entering the OWSs. Two OWSs (OWS-31 and OWS-2311) had excessive drainage. Due to the cost of separating the storm drainage, it may be less expensive to limit the amount of stormwater entering OWS-31. OWS-2311 would not have capacity even if the area of excessive drainage was removed (i.e., it is not adequately sized for the washdown area it serves). OWS-31 and OWS-2311 are discussed further under the evaluation of capacity for each OWS. Additionally, it was noted that one OWS (OWS-2339-2) was receiving sanitary waste from the bathroom of the service station it served.
- **Structural Deterioration** – Four OWSs (OWS-382, OWS-860, OWS-2311, and OWS-3152) had visible structural problems. Structural inspection and testing may be necessary to

determine the extent of the deterioration. Refer to Section 3 of this memo for a description of observations.

- **Discharge to Other than the Sanitary Sewer** – Three OWSs (OWS-212, OWS-382, and OWS-443) did not discharge to the sanitary sewer. However, it appears that these OWSs have effluent valves and may be covered as part of an approved SPCC plan.
- **Treatment Capacity** – All OWSs receiving process wastewater flow were adequately sized. There were also eight OWSs (OWS-31, OWS-200, OWS-792, OWS-2011, OWS-2036, OWS-2311, OWS-2345, and OWS-3152) handling stormwater inflow that did not have adequate capacity. This is discussed in more detail in the following section.

Field notes for each OWS are contained in the appendix of this report.

### Discussion of Treatment Capacity Evaluation

Several different criteria were used to evaluate the treatment capacity of the OWSs. One criteria used frequently is to estimate 0.1 gpm of treatment for every gallon of capacity. Another criteria is to permit a maximum flow of 1,000 to 2,000 gpd/ sf of surface area of the OWS. These two criteria can provide very different sizing data. Additionally, OWSs generally need to be sized to accommodate stormwater flows as well as process flows.

For the purpose of this study, the following criteria were used to evaluate the existing OWSs:

- Capacity assuming 0.1 gpm for every gallon of capacity, and,
- Capacity assuming 2000 gpd/sf of surface area of the OWS
- Process wastewater flows were based on the size of fixtures used that generated the wastewater discharged to the OWS assuming a pipe velocity of 5 fps
- Stormwater flows were based on a 1-hour, 5-year storm event (per 1997 DOD OWS Guidance Manual) of 5-inches (San Juan's 1-hr, 5-yr storm event is 4-inches. This factor was increase by 25% to 5-inches for our evaluation at Roosevelt Roads to account for heavier rains that may be experienced on the east coast of Puerto Rico. It should be noted that this increase did not significantly affect whether an OWS was adequately sized or not).

Using the above criteria, all OWSs had the capacity to accept process wastewater flows. However, eight OWSs (OWS-31, OWS-200, OWS-792, OWS-2011, OWS-2036, OWS-2311, OWS-2345, and OWS-3152) do not appear to be adequately sized for the 1-hour, 5-year stormwater flows. Each of these OWSs is discussed in more detail below.

Several different options were considered to remedy problems caused by excessive stormwater flows. If the drainage area was excessive, limiting the drainage area was generally considered the preferred option. However, the majority of OWSs did not have excessive drainage areas. For these OWSs, alternatives included replacement of the OWSs or installation of flow-limiting devices to prevent high flows. A flow-limiting device would most likely consist of a drainage grating specifically modified to only accept a given flow

rate (for example, a checkered metal plate with the appropriate holes drilled to accept the design flow). Covering of the drainage areas was also considered but was not considered economically practicable for any of the OWSs (covering also restricts the height of vehicles that can be serviced). The alternatives are discussed in further detail below.

- **OWS-31** – This OWS has an excessive drainage area with two stormwater inlets tying into the OWS. This can be remedied by installation of a flow-limiting devices on these two inlets. Another alternative is to separate the storm drainage and connect it to the stormwater system and route only the process wastewater to the OWS.
- **OWS-200** – Although this OWS does not have an excessive drainage area (it collects drainage from a large aircraft washdown area), it has the capacity to treat only 10% of the stormwater generated by the design event. The influent to this OWS is equipped with valves that permit entering flows to be throttled. If these valves are working adequately, no further action is required. However, if the flow is not being adequately throttled, consideration should be given to installation of another type of flow-limiting device.
- **OWS-792** – Although this OWS does not have an excessive drainage area, it has the capacity to treat approximately 20% of the stormwater generated by the design storm. It serves an area used to wash down small boats. This OWS is in a paved road that is bounded by buildings on either side. Installation of a flow-limiting device is a possibility, however, it could cause flooding in the adjacent buildings. Another possibility is to abandon the OWS and relocate this activity to another washdown area. Also, the Activity may want to investigate if an OWS is necessary for washing down small boats (this activity will not generate much oil and if detergent is used then the oil will be emulsified and not trapped by an OWS). Installation of a larger OWS is also a possibility, however, due to its location under a road, it would be very expensive.
- **OWS-2011** – Although this OWS does not have an excessive drainage area, it only has the capacity to treat approximately 15% of the stormwater generated by the design storm. This OWS serves an aircraft wahrack. Installation of a flow-limiting device is a possibility and there are no surrounding structures that would be impacted by this. Installation of a larger OWS is also a possibility, however, this would be expensive.
- **OWS-2036** – Although this OWS does not have an excessive drainage area, it only has the capacity to treat approximately 65% of the stormwater generated by the design storm. This OWS serves the oil spill compound. Installation of a flow-limiting device is a possibility and the existing curb surrounding the washdown area would prevent flooding of adjacent areas. Installation of a larger OWS is also a possibility, however, this would be expensive.
- **OWS-2311** – this OWS has numerous problems. It appears to have significant structural problems. It also has an excessive drainage area (the adjacent grassed area is significantly higher than the OWS and flows into it during rain events. Even if the excessive drainage area is excluded, the OWS only has the capacity to treat approximately 35% of the stormwater generated by the design storm. This OWS serves

the vehicle washdown area adjacent to Pier 3. Abandoning the OWS and routing its flow to an adjacent OWS (OWS-2364) is an option, however, this would also include installing a flow-limiting device to prevent the OWS-2364 from exceeding its capacity. Installation of a larger OWS is also a possibility, however, due to the large size required this would be very expensive.

- **OWS-2345** – Although this OWS does not have an excessive drainage area, it only has the capacity to treat approximately 65% of the stormwater generated by the design storm. This OWS serves the garbage truck wash rack. Installation of a flow-limiting device is a possibility and there are no nearby adjacent building that would be flooded by the restricted flow. Installation of a larger OWS is also a possibility, however, this would be expensive.
- **OWS-3152** – although this OWS does not have an excessive drainage area, it only has the capacity to treat approximately 50% of the stormwater generated by the design storm. This OWS is at Sea Bee Camp Bravo. Installation of a flow-limiting device is a possibility and the curb surrounding the washdown area are would prevent flooding of adjacent areas. Installation of a larger OWS is also a possibility and given the poor condition of this OWS, it may be the best alternative.

### **3. Recommended Improvements**

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The following improvements are recommended to resolve the problems identified by the field surveys:

- **Drainage Problems** -- OWS-2339-2, OWS-2345, OWS-2431, OWS-3137
  - **OWS-2339-2** – This OWS had sanitary waste entering it from a toilet in the service station. The toilet waste needs to be rerouted to another sanitary sewer so that it does not enter the OWS.
  - **OWS-2345** – No drainage to this OWS was observed due to plugging of the line from the drainage apron to the OWS. This problem could be remedied by cleaning this line.
  - **OWS-2431** – No drainage to this OWS was observed due to plugging of the line from the drainage apron to the OWS. This problem could be remedied by cleaning this line.
  - **OWS-3137** – no drainage to this OWS was observed due to plugging of the line from the drainage apron to the OWS. This problem could be remedied by cleaning this line.

- **Structural problems** – OWS-382, OWS-860, OWS-2311, OWS-3152
  - **OWS-382** – The concrete has deteriorated, such that some reinforcing steel is exposed and aggregate is crumbling. Structural testing and analysis by a qualified structural engineer is required to determine the extent of damage and how to best repair the OWS.
  - **OWS-860** – This OWS had a hole in its side through which groundwater flowed into the OWS. Although this was only occurring in one location, it is quite possible that the concrete has deteriorated at other locations. Structural testing and analysis by a qualified structural engineer is required to determine the extent of damage and how to best repair the OWS.
  - **OWS-2311** – This OWS has significant crumbling aggregate and large cracks. The concrete is not easily repairable. Structural testing and analysis by a qualified structural engineer is required to determine the extent of damage and how to best repair the OWS. CH2M HILL recommends this OWS be abandoned since it also has drainage problems and the flow it receives can be easily routed to an adjacent OWS (OWS-2364).
  - **OWS-3152** – This OWS has significant exposed reinforcing steel and crumbling aggregate. Structural testing and analysis by a qualified structural engineer is required to determine the extent of damage and how to best repair the OWS.
- **Discharge to the Sanitary Sewer** – OWS-212, OWS-382, and OWS-443
  - **OWS-212** – This OWS is used to separate oil from stormwater run-off and acts as containment if there were an oil spill while loading a truck. It has a discharge valve to prevent accidental spill release into the stormwater ditch. If this OWS is part of an approved SPCC plan, no further action needs to be taken.
  - **OWS-382** – This OWS is used to separate oil from stormwater run-off and acts as spill containment if there were an oil spill while loading a truck. It has a discharge valve to prevent accidental spill release into the stormwater ditch. If this OWS is part of an approved SPCC plan, no further action needs to be taken.
  - **OWS-443** – This OWS is used to separate oil from stormwater run-off and acts as spill containment if there were an oil spill while loading a truck. It has a discharge valve to prevent accidental spill release into the stormwater ditch. If this OWS is part of an approved SPCC plan, no further action needs to be taken.
- **Capacity Problems** – no OWSs were found to have capacity problems with respect to process wastewater received. However, eight OWSs (OWS-31, OWS-200, OWS-792, OWS-2011, OWS-2036, OWS-2311, OWS-2345, and OWS-3152) do not appear to be adequately sized to treat stormwater flows. Recommendations for each of these OWS are discussed below.

- **OWS-31** – This OWS has an excessive drainage area. The recommended solution is installation of a flow-limiting-device to limit hydraulic loading on the OWS during a significant rain event.
- **OWS-200** – This OWS is equipped with valves that permit influent to be throttled. If these valves are working adequately, no further action is required. However, if the flow is not being adequately throttled, consideration should be given to installation of another type of flow-limiting device.
- **OWS-792** – The recommended solution is to abandon the OWS (it is currently used to receive flows from washing down boats) and relocate this activity to another washdown area.
- **OWS-2011** – The recommended solution is installation of a flow-limiting-device to limit hydraulic loading on the OWS during a significant rain event.
- **OWS-2036** – The recommended solution is installation of a flow-limiting device to limit hydraulic loading on the OWS during a significant rain event.
- **OWS-2311** – The recommended solution is abandoning the OWS and routing its flow to an adjacent OWS (OWS-2364). A flow-limiting device would also need to be installed to prevent the OWS-2364 from exceeding its capacity.
- **OWS-2345** – The recommended solution is installation of a flow-limiting device to limit hydraulic loading on the OWS during a significant rain event.
- **OWS-3152** – Due to its structural and sizing problems, the recommended solution is installation of a new OWS or abandonment of the OWS.

#### **4. Cost Estimates of Recommended Alternatives**

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Cost estimates were prepared for comparing the recommended alternatives to address capacity issues for the OWSs. The cost figures were calculated on the basis of the stated assumptions and information available at the time of the estimate. Costs are considered representative of an order-of-magnitude level of accuracy for the stated assumptions as defined by the American Association of Cost Engineers. This type of estimate is normally expected to be accurate within +50 and -30 percent.

The cost estimate presented, including the resulting discussion, was prepared to provide guidance for project evaluation and implementation and used information available at this time. The final costs of the project and resulting feasibility will depend on a number of variable factors including actual labor and material costs, competitive market conditions, actual site conditions, final project scope, and implementation schedule. As a result, final project costs will vary from the cost estimate presented. Also, it should be noted that any site remediation (due to contaminated soil, etc.) is specifically excluded in the estimates.

Because of the accuracy of this type of estimate and the variable nature of a number of factors, project feasibility, risks, and funding needs must be carefully reviewed before

making specific financial decisions or establishing project budgets to ensure proper project evaluation and adequate funding.

The estimated capital costs for each recommended alternative are listed on the table below:

**Summary of estimated construction costs for recommend improvements for OWSs:**

OWS	Description	Recommended Solution	Estimated Cost
31	PWD-Transportation	Install flow-limiting devices	\$4,000
200	Aircraft Hangar	Install flow-limiting devices	\$8,000
382	Aircraft Fuel Truck Area	Perform structural analysis to determine extent of problem	Cannot be estimated without additional info.
792	NSWU Warehouse - Boat Wash	Abandon OWS	\$5,000
860	Drone Support	Perform structural analysis to determine extent of problem	Cannot be estimated without additional info.
2011	VC-8 Wash Rack	Install flow-limiting devices	\$4,000
2036	Oil Spill Team Compound	Install flow-limiting device	\$2,000
2311	Temporary Wash Rack	Abandon OWS and route flow to OWS-2364	\$45,000
2339-2	Service Station/Mini Mart	Separate Sanitary Waste Line. Line must first be located before cost can be estimated	Cannot be estimated without additional info.
2345	Garbage Truck Wash Rack	Install flow-limiting device	\$2,000
2431	Waste Management Area	Clean plugged line	\$300
3137	SeaBees Camp - Alpha Co.	Clean plugged line	\$300
3152	SeaBees Camp - Bravo Co.	Install flow-limiting device. Perform structural analysis to determine extent of problem	\$2,000 plus cost of structural repairs

Details of these cost estimates are included in the Forrestal 1391 appendix.

# OWS Survey Form

Page 1 of 3

Base: Roosevelt Roads, Puerto Rico

OWS No.: 0031 Number of Stages 1

Date surveyed: 11/28/2001

Surveyors: Bill Cumbie /HRO  
Joe Kenderdine /WDC

Calculated Size of OWS: Stage 1  
935 gallons

Measured dimensions: Stage 1  
Length 10.0 ft  
Width 5.0 ft  
Total Depth 6.0 ft  
Depth of Water 2.5 ft

Water source: Two - 3/4" (No. and size of washwater lines)

Estimated max washdown flow: 17 gpm (wash unit only)

Estimated stormwater flow: 187 gpm (based on 5-in, 1 hr rain event with 90% runoff)

Estimated capacity based on SA: 69 gpm Criteria: 2000 gpd/sf of SA

Cap. assuming 0.1 gpm/gal vol: 94 gpm

Does OWS have sufficient capacity (Y/N)? No

Estimated drainage area: 4000 ft<sup>2</sup>

Excessive drainage area (Y/N): Possibly

If excessive, explain: excessive drainage possible during significant storm events

Connected to sanitary sewer: Yes

If yes, no. of nearest manhole: F-231

Check here if additional sheets are attached and provide description

(note: the second sheet of this form does not constitute a new sheet)

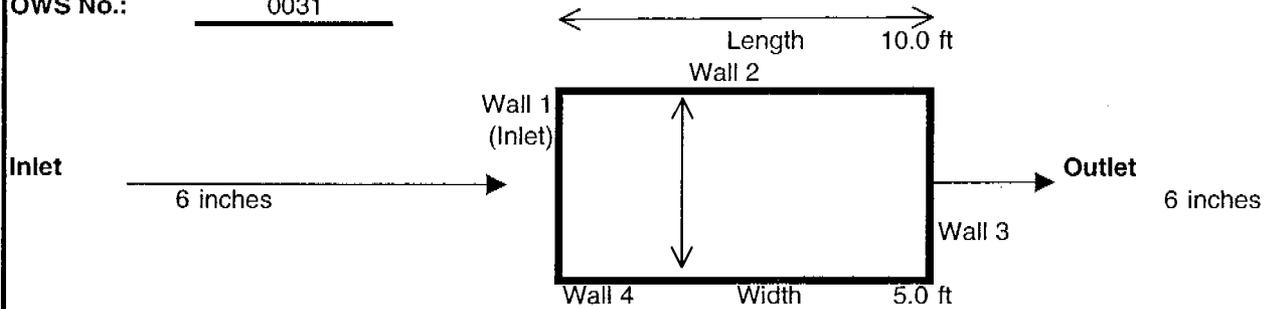
## Description of additional sheets

Sheet no.	Description
1	Drainage area sketch with possible solution

**OWS Survey Form**

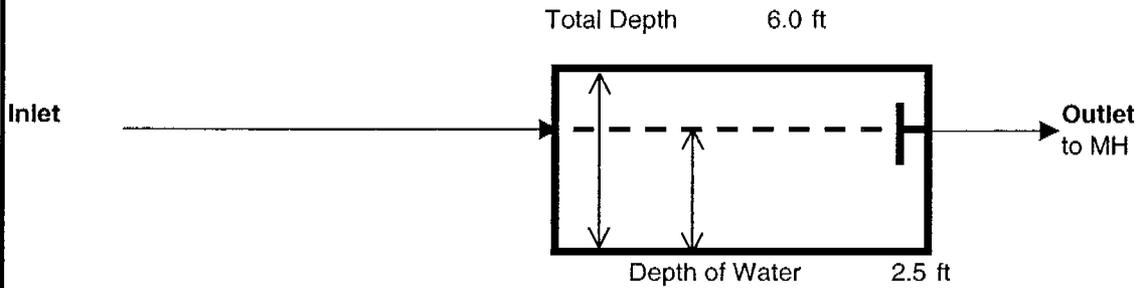
Page 2 of 3

OWS No.: 0031



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Good
Base/wall interface	Very Good

Additional Notes:

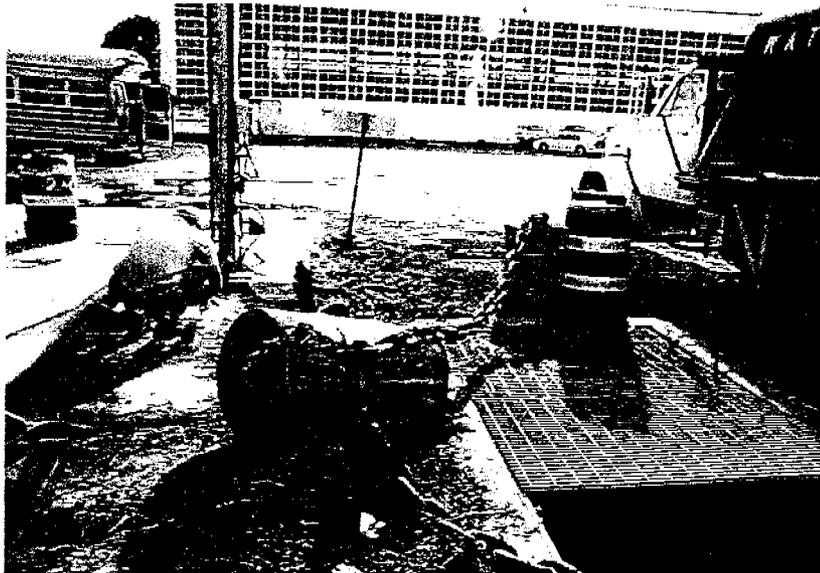
OWS services the truck wash.
PVC outlet tee cracked.
Some exposed aggregate (<5%).
Small amount of spalling (<5%).
275 Gallons of sludge removed

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0031





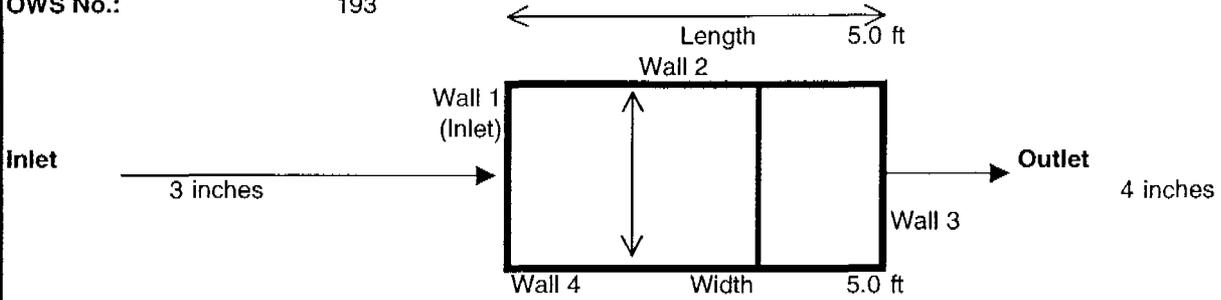
OWS Survey Form

Page 2 of 4

Stage 1

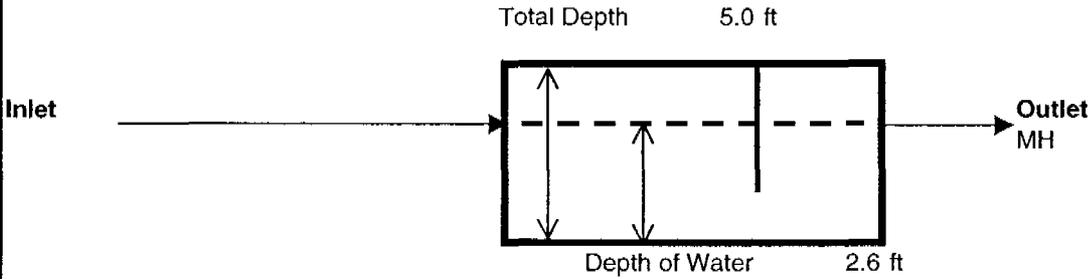
OWS No.:

193



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

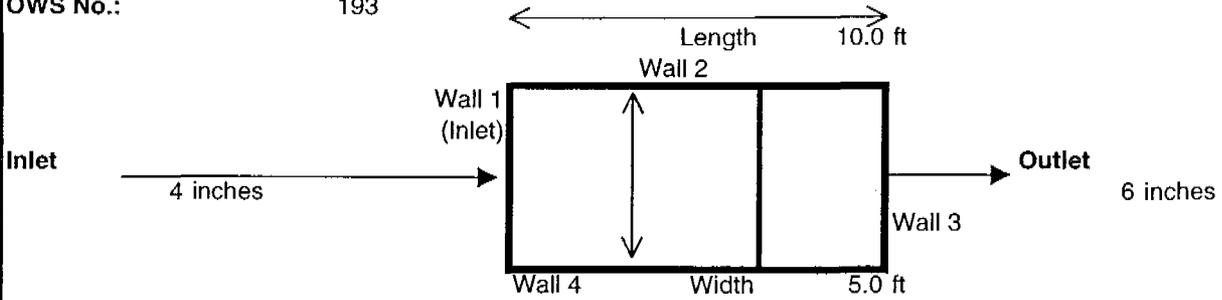
Additional Notes:


**OWS Survey Form**

Page 3 of 4

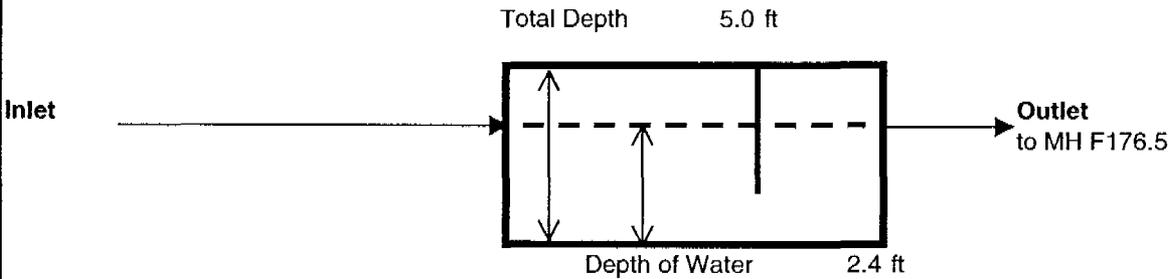
**Stage 2**

OWS No.: 193



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

440 Gallons of sludge removed

# OWS Survey Form

Page 4 of 4

Pictures

OWS No.:

193

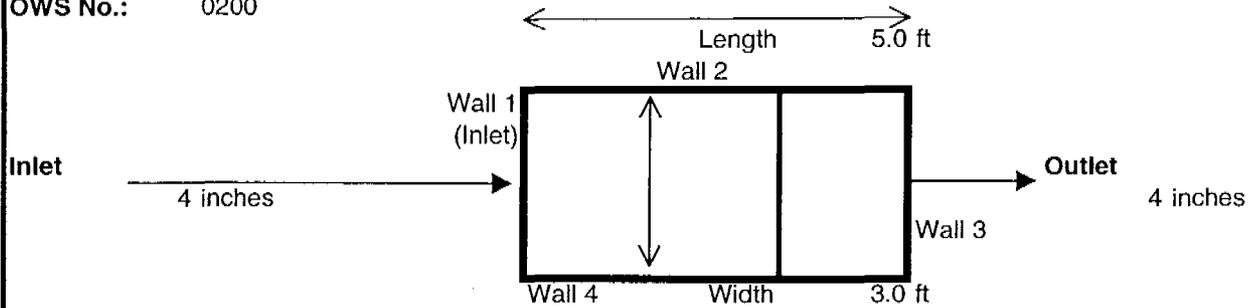




# OWS Survey Form

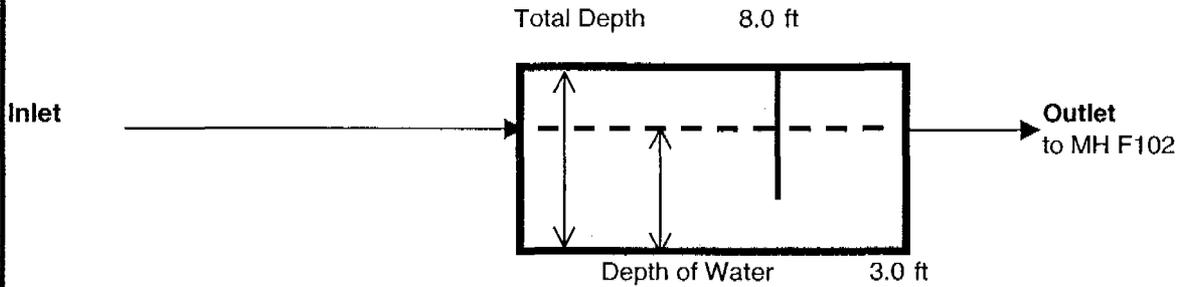
Page 2 of 3

OWS No.: 0200



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

## Plan View (Schematic)



## Section View (schematic)

Notes on Inspection

### Condition of concrete

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

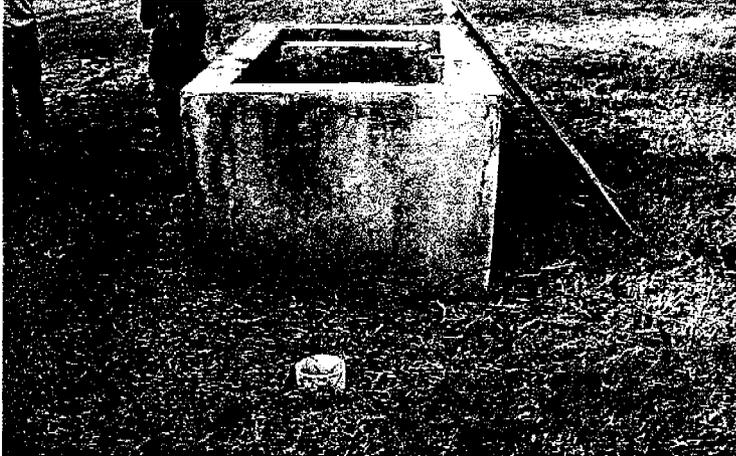
Area currently not in use. Appears to have been a storage area of some type.
Drainage valves are 1 - partially open and 1- closed
No sludge removed from this OWS

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0200

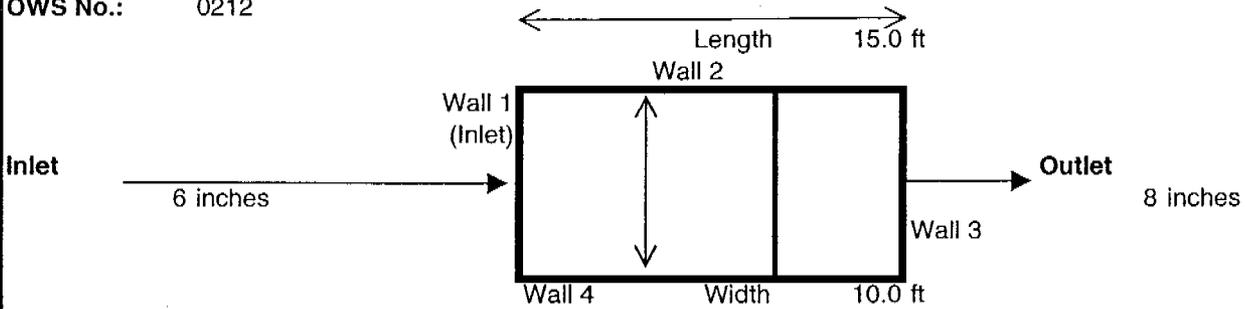




**OWS Survey Form**

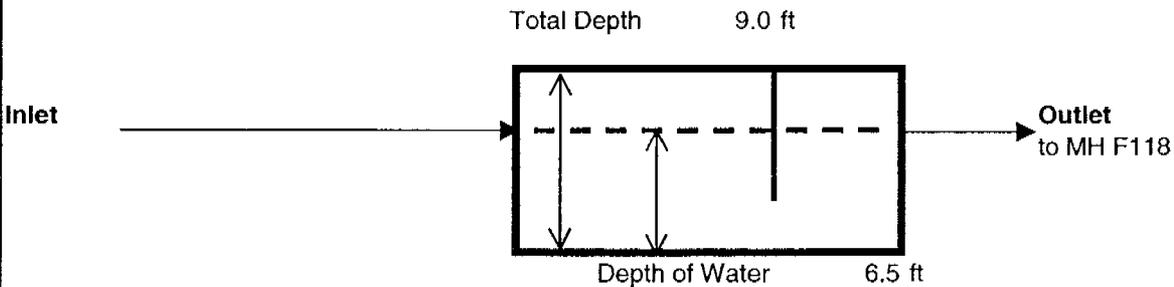
Page 2 of 3

OWS No.: 0212



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

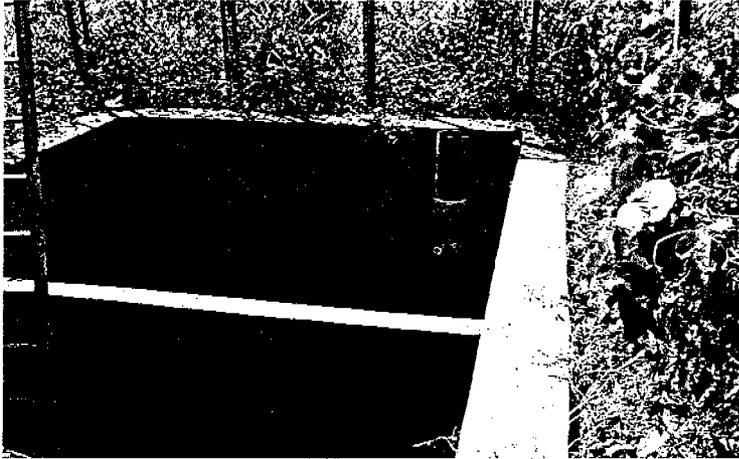
No water lines are apparent at this site. All lines are fuel.
440 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0212



# OWS Survey Form

Page 1 of 3

Base: Roosevelt Roads, Puerto Rico

OWS No.: 0266 Number of Stages 1

Date surveyed: 11/29/2001

Surveyors: Bill Cumbie /HRO  
Joe Kenderdine /WDC

Calculated Size of OWS: Stage 1  
2066 gallons

Measured dimensions: Stage 1  
Length 8.5 ft  
Width 6.5 ft  
Total Depth 7.0 ft  
Depth of Water 5.0 ft

Water source: None noted

Estimated max washdown flow: 0 gpm  
Estimated stormwater flow: 48 gpm (based on 5-in, 1 hr rain event with 90% runoff)  
Estimated capacity based on SA: 77 gpm Criteria: 2000 gpd/sf of SA  
Cap. assuming 0.1 gpm/gal vol: 207 gpm

Does OWS have sufficient capacity (Y/N)? Yes

Estimated drainage area: 1,020 ft<sup>2</sup> (estimated using 2% of pier surface area)  
Excessive drainage area (Y/N): No (Pier 1 estimated at 51,000 sf)  
If excessive, explain:

Connected to sanitary sewer: Yes

If yes, no. of nearest manhole: F-173

Check here if additional sheets are attached and provide description   
(note: the second sheet of this form does not constitute a new sheet)

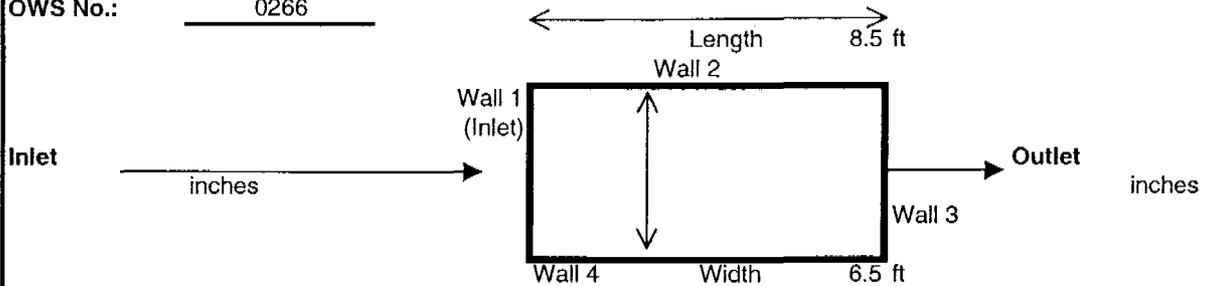
## Description of additional sheets

Sheet no.	Description

**OWS Survey Form**

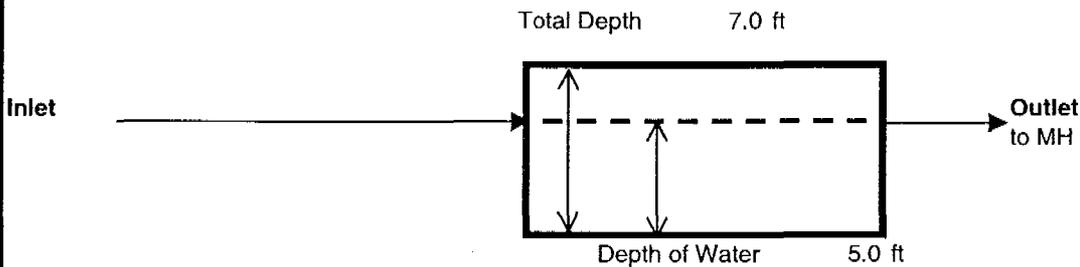
Page 2 of 3

OWS No.: 0266



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition

Wall 1

Wall 2

Wall 3

Wall 4

Base Slab

Base/wall interface

Very Good

**This OWS is a prefabricated unit located in a below grade open top concrete containment vault.**

Additional Notes:

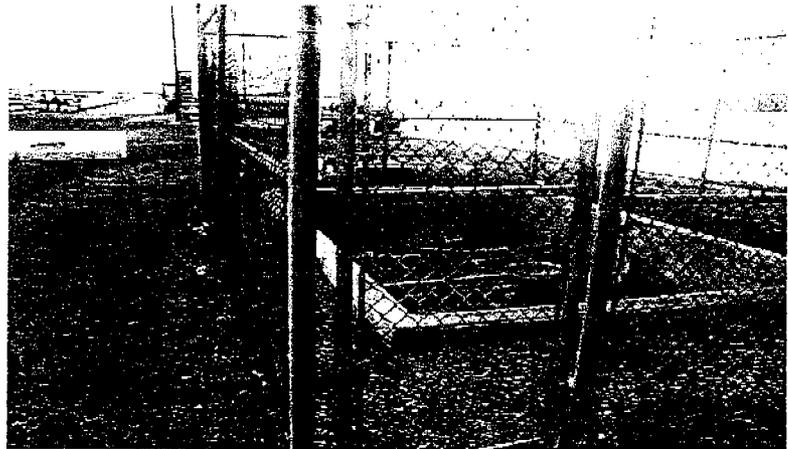
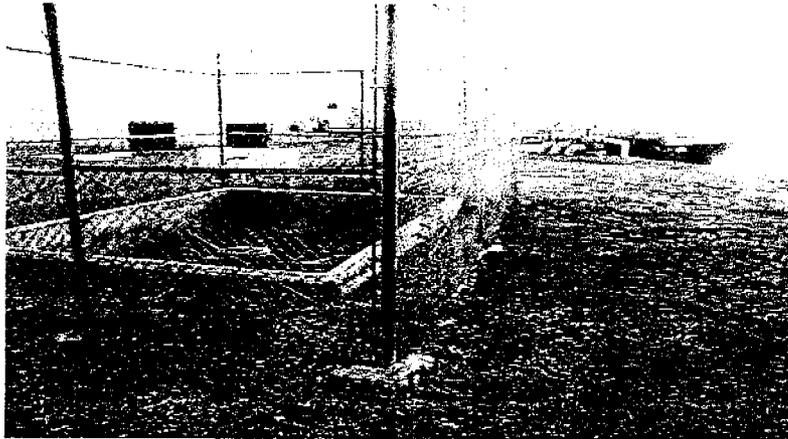
Inspected condition of concrete containment.
Prefabricated OWS inside concrete containment was not inspected.
Concrete containment dimensions are 14' L x 10' W x 9.3' D.
Recommend installing a Stage 1 sump similar to OWS-0799.
No sludge removed from this OWS

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0266

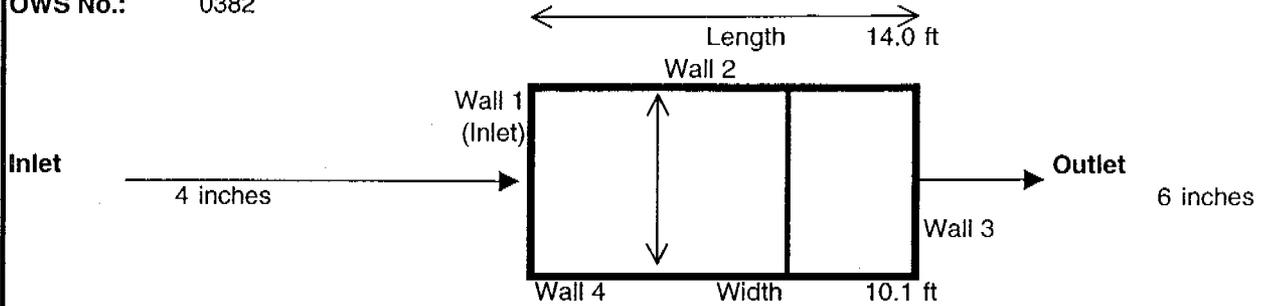




**OWS Survey Form**

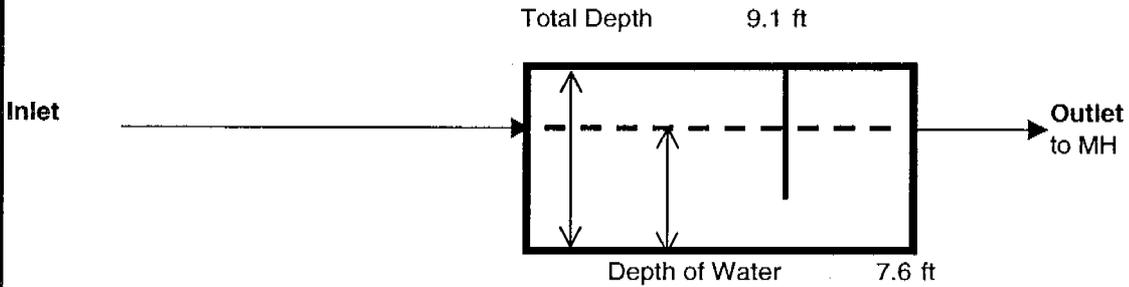
Page 2 of 3

OWS No.: 0382



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good
Wall 1	Good
Wall 2	Good
Wall 3	Good
Wall 4	Good
Base Slab	Good
Base/wall interface	Good

Additional Notes:

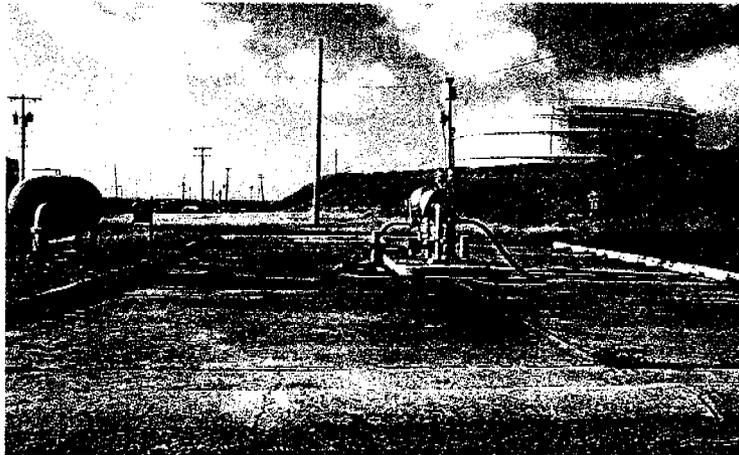
1540 gallons of sludge removed (28- 55 gallon drums)
Some exposed aggregate - aggregate crumbles when screwdriver is run across it

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0382

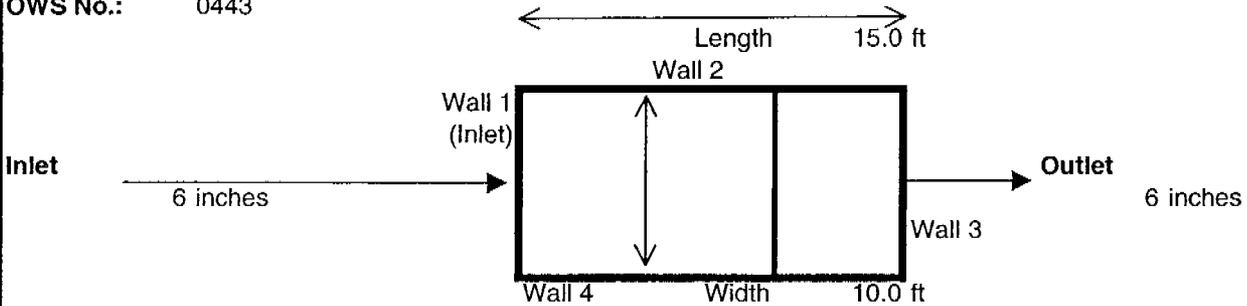




**OWS Survey Form**

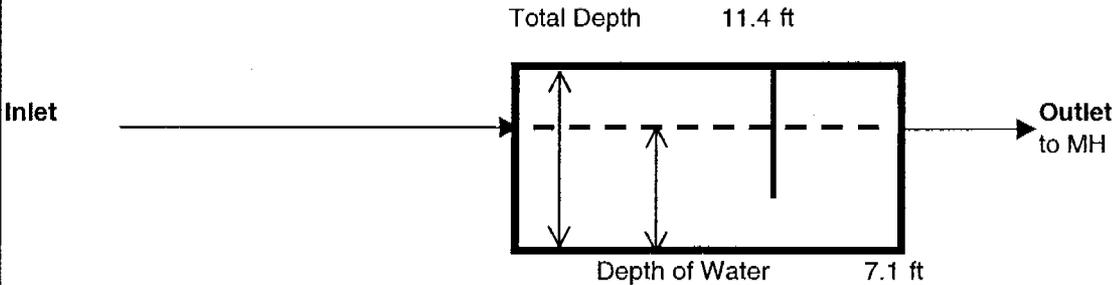
Page 2 of 3

OWS No.: 0443



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good
Wall 1	Good
Wall 2	Good
Wall 3	Good
Wall 4	Good
Base Slab	Good
Base/wall interface	Good

Additional Notes:

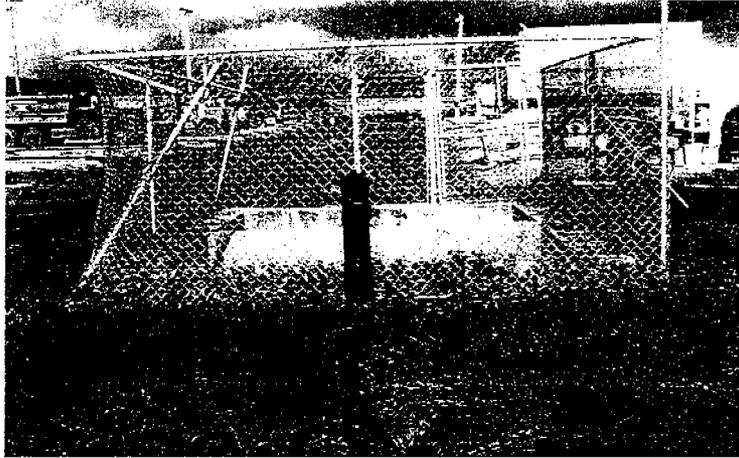
Sewer tie in - 120' straight line to existing manhole F176.5. Nearest sewer line is 80' and a manhole would be needed - nearest manhole in this direction is F536
1415 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0443

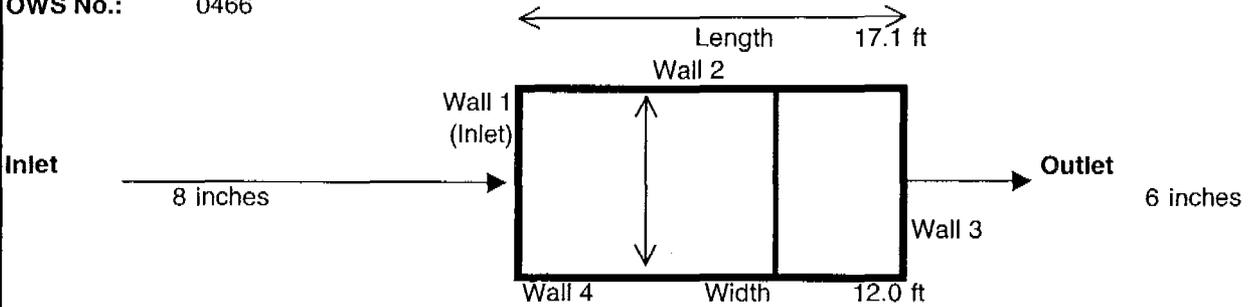




OWS Survey Form

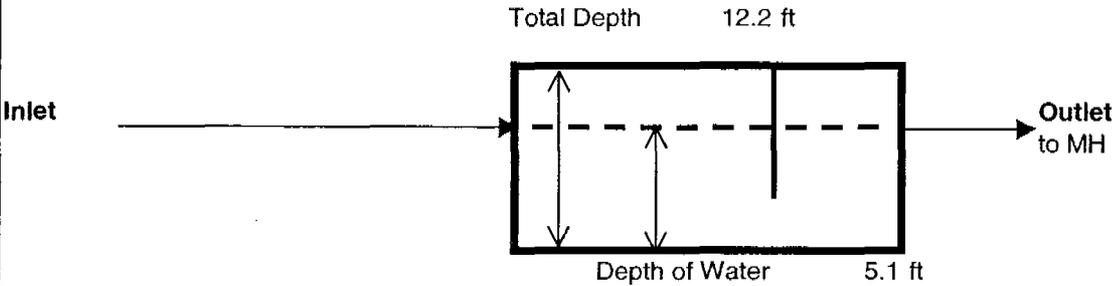
Page 2 of 3

OWS No.: 0466



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

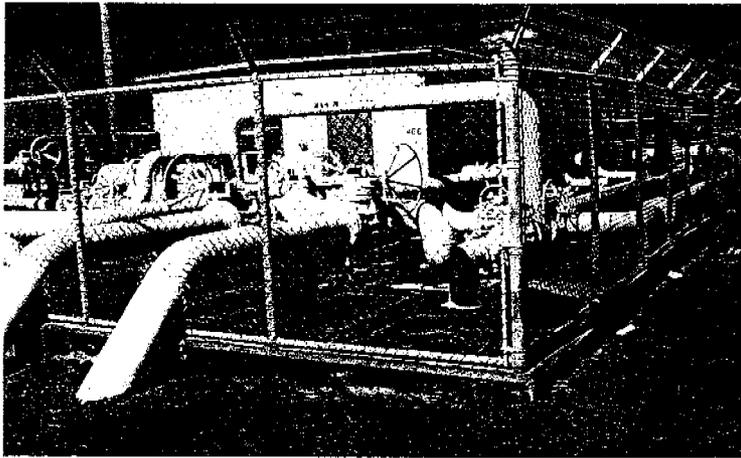
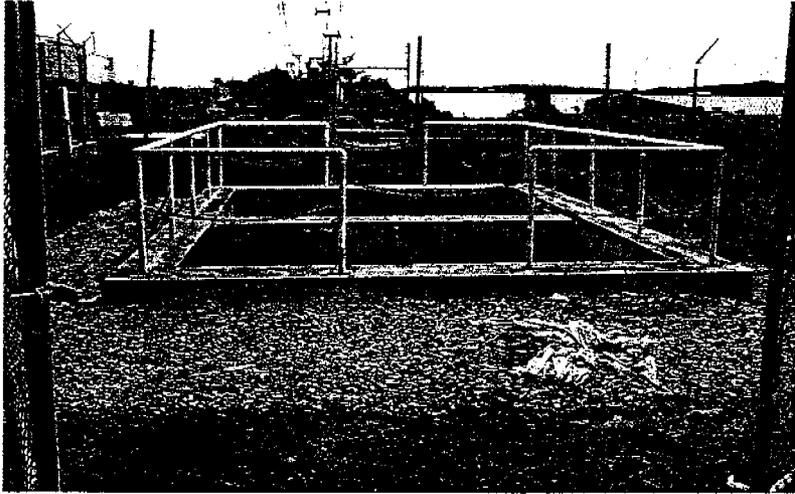
770 Gallons of sludge removed.
Inclined plate coalescer in very good condition

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0466

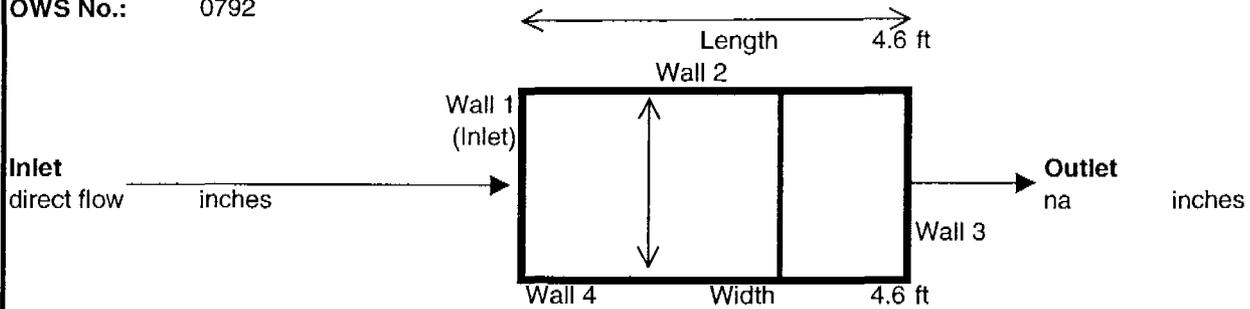




**OWS Survey Form**

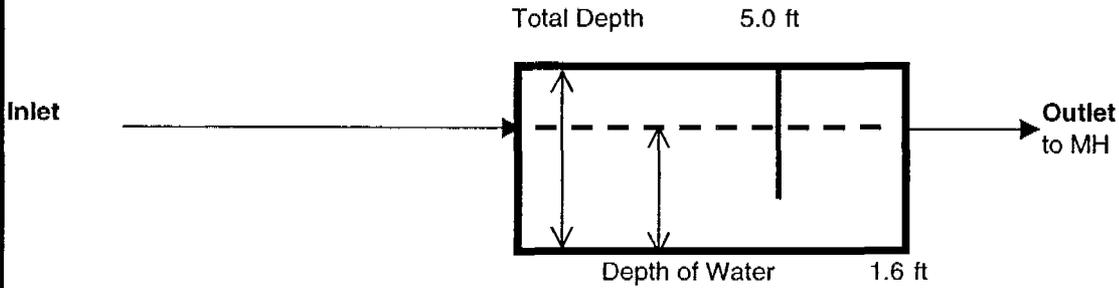
Page 2 of 3

OWS No.: 0792



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

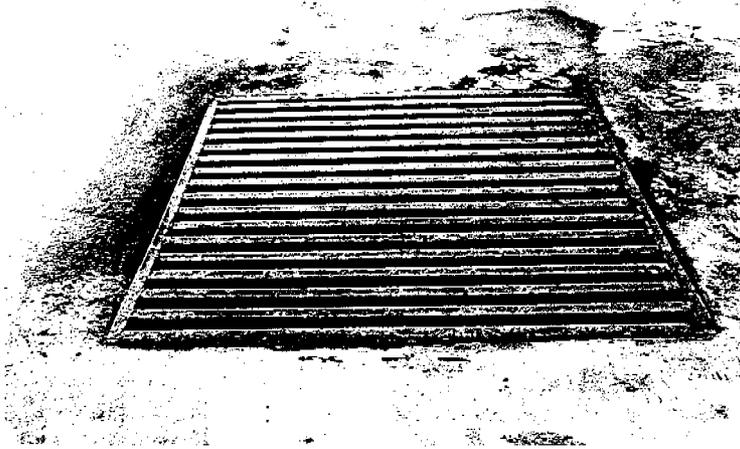
82.5 Gallons of sludge removed

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0792



# OWS Survey Form

Page 1 of 4

**Base:** Roosevelt Roads, Puerto Rico

**OWS No.:** 0799

**Number of Stages:** 2

**Date surveyed:** 11/29/2001

**Surveyors:** Bill Cumbie /HRO  
Joe Kenderdine /WDC

Calculated Size of OWS:	Stage 1	Stage 2	Total
	1163 gallons	2000 gallons	3163 gallons

Measured dimensions:	Stage 1	Stage 2
Diameter	6.0 ft	5.5 ft
Total Depth	19.0 ft	12.0 ft (length)
Depth of Water	5.5 ft	N/A ft

Water source: None noted

Estimated max washdown flow: 0 gpm (both pumps in service)  
Estimated stormwater flow: 123 gpm (based on 5-in, 1 hr rain event with 90% runoff)  
Estimated capacity based on SA: 250 gpm Criteria: 2000 gpd/sf of SA  
Cap. assuming 0.1 gpm/gal vol: 316 gpm  
Does OWS have sufficient capacity (Y/N)? Yes

Estimated drainage area: 2,640 ft<sup>2</sup> (estimated using 2% of pier surface area)  
Excessive drainage area (Y/N): No (Pier 3 estimated at 132,000 sf)  
If excessive, explain:

Connected to sanitary sewer: Yes

If yes, no. of nearest manhole: F-203

**Check here if additional sheets are attached and provide description**   
(note: the second and sheets of this form does not constitute a new sheet)

## Description of additional sheets

Sheet no.	Description

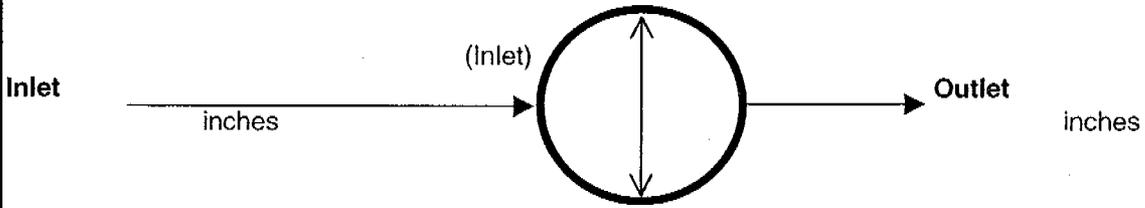
OWS Survey Form

Page 2 of 4

Stage 1

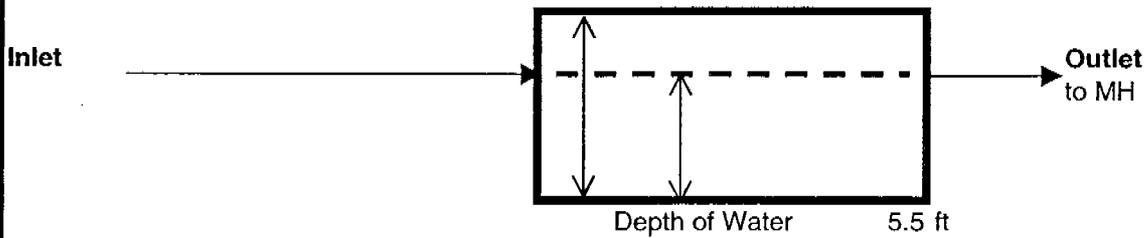
OWS No.: 0799

Diameter 6.0 ft



**Plan View (schematic)**

Total Depth 19.0 ft



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall	Very Good
Base Slab	not inspected
Base/wall interface	not inspected

**Two stage system. Circular concrete manhole is Stage 1 and acts as a wet well.**

Additional Notes:

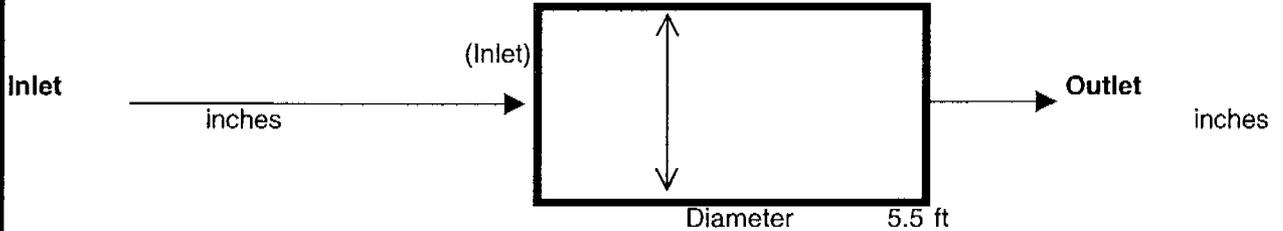
Stage 1 is the manhole concrete was inspected
Two inlets were observed from the manway. Stage 1 wet well was not entered during cleaning and inspection.
Drainage from pier is controlled by an automatic valve. The automatic flow control valve was in the remote position during inspection

# OWS Survey Form

Page 3 of 4

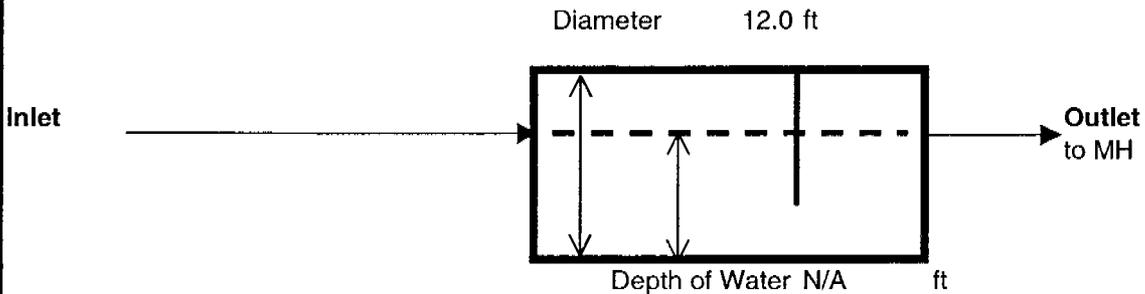
## Stage 2

OWS No.: 0799



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

### Plan View (schematic)



### Section View (schematic)

Notes on Inspection

#### Condition of concrete

(Excellent, Very Good, Good, Poor)

Overall concrete condition	N/A
Wall 1	N/A
Wall 2	N/A
Wall 3	N/A
Wall 4	N/A
Base Slab	N/A
Base/wall interface	N/A

**This OWS is a prefabricated unit that is in a below grade open top concrete containment vault**

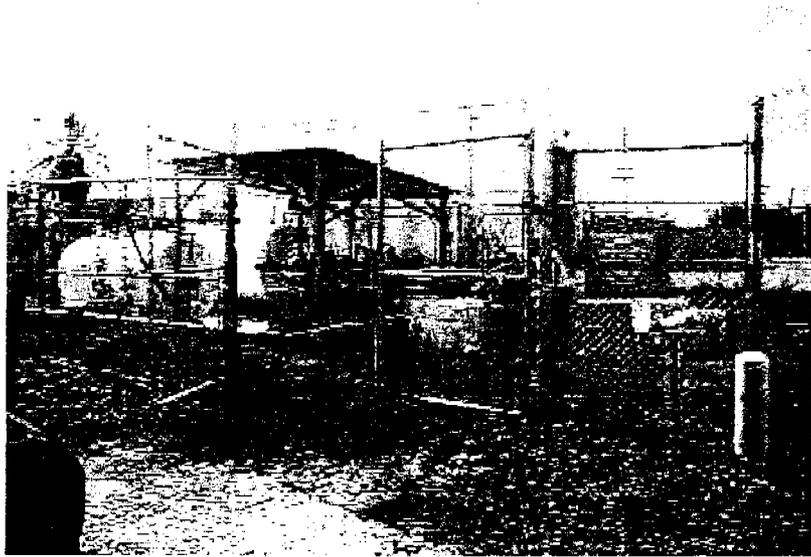
Additional Notes:

Stage 2 OWS is an aboveground cylindrical unit with separate waste oil storage tank. Stage 2 OWS was not cleaned or inspected.
Stage 2 OWS design flow rate is 200 gpm and has a capacity of 2000 gallons.
Influent from Stage 1 is pumped to the OWS using two lift station pumps (P-501 and P-502) at 50 gpm each.

# OWS Survey Form

Pictures  
Page 4 of 4

OWS No.: 0799

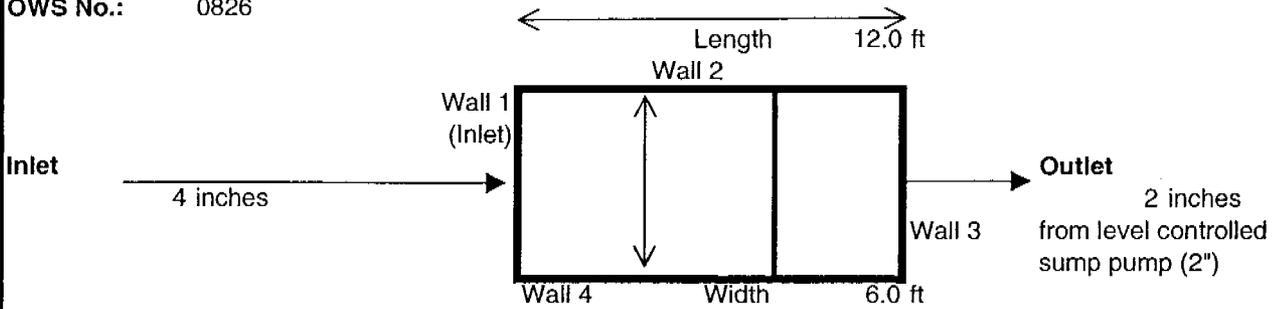




**OWS Survey Form**

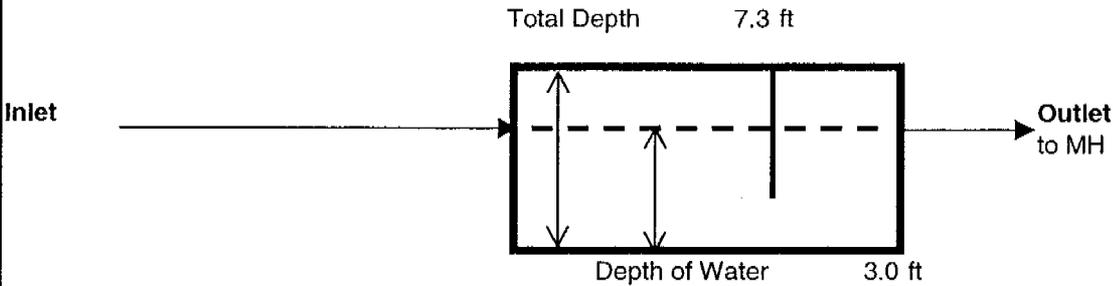
Page 2 of 3

OWS No.: 0826



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

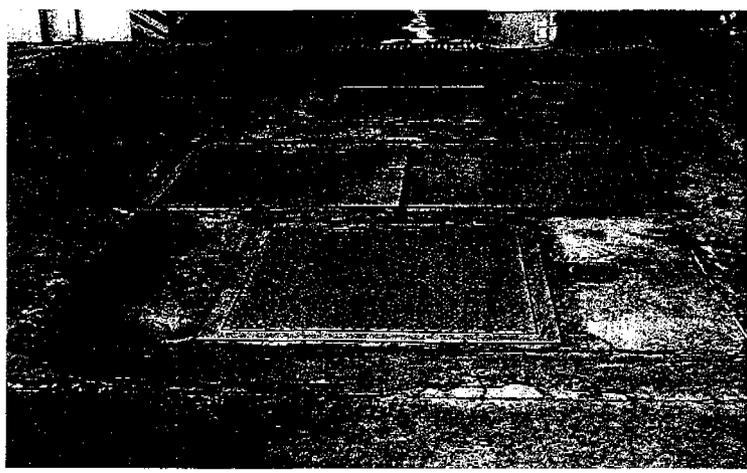
275 gallons of sludge removed (Eight 55 gallon drums)
Coalescer installed and in good condition. Walls are oily.

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0826



# OWS Survey Form

Page 1 of 4

Base: Roosevelt Roads, Puerto Rico

OWS No.: 827 Number of Stages 2

Date surveyed: 02/19/2002

Surveyors:

Joe Kenderdine /WDC  
Patti Clark /HRO

Calculated Size of OWS:	Stage 1 7289 gallons	Stage 2 823 gallons	Total 8111 gallons
-------------------------	-------------------------	------------------------	-----------------------

Measured dimensions:	Stage 1	Stage 2
Length	20.3 ft	10.0 ft
Width	5.0 ft	5.0 ft
Total Depth	11.0 ft	3.0 ft
Depth of Water	9.6 ft	2.2 ft

Water source: One- 3" (No. and size of washwater lines)

Estimated max washdown flow: 110 gpm

Estimated stormwater flow: 73 gpm (based on 5-in, 1 hr rain event with 50% runoff)

Estimated capacity based on SA: 210 gpm Criteria: 2000 gpd/sf of SA

Cap. assuming 0.1 gpm/gal vol: 811 gpm

Does OWS have sufficient capacity (Y/N)? Yes (mostly grassed area)

Estimated drainage area: 2826 ft<sup>2</sup> 70' diameter with 10' barrier ring

Excessive drainage area (Y/N): N

If excessive, explain:

Connected to sanitary sewer: Y

If yes, no. of nearest manhole: F-27

Check here if additional sheets are attached and provide description   
(note: the second and sheets of this form does not constitute a new sheet)

## Description of additional sheets

Sheet no.	Description

8 drums of sludge

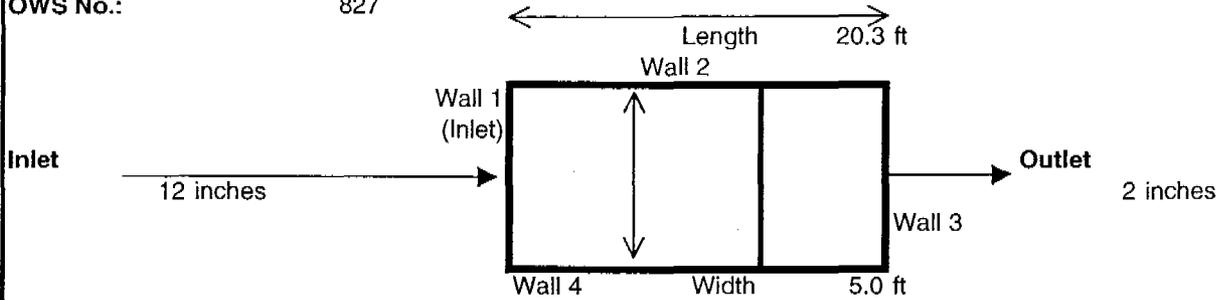
**OWS Survey Form**

Page 2 of 4

**Stage 1**

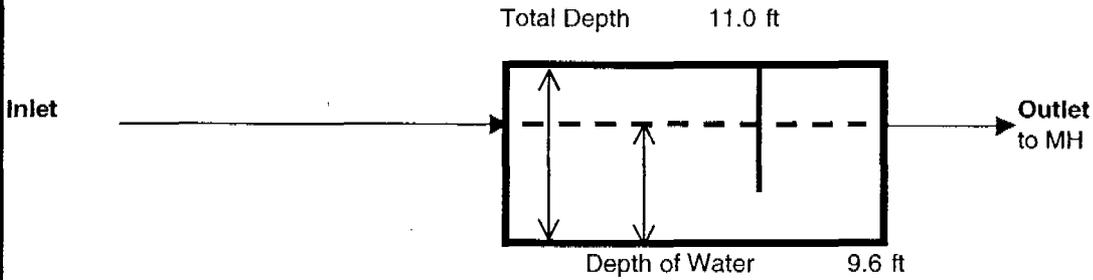
OWS No.:

827



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good
Wall 1	Good
Wall 2	Good
Wall 3	Good
Wall 4	Good
Base Slab	Good
Base/wall interface	Good

Additional Notes:

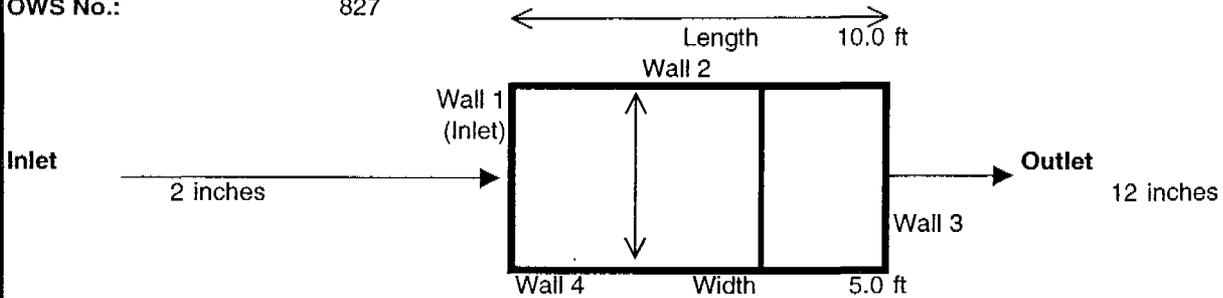
440 gallons of sludge ( 16 - 55 drums)
Some discoloration and cracking of concrete
Abandoned fire training area

**OWS Survey Form**

Page 3 of 4

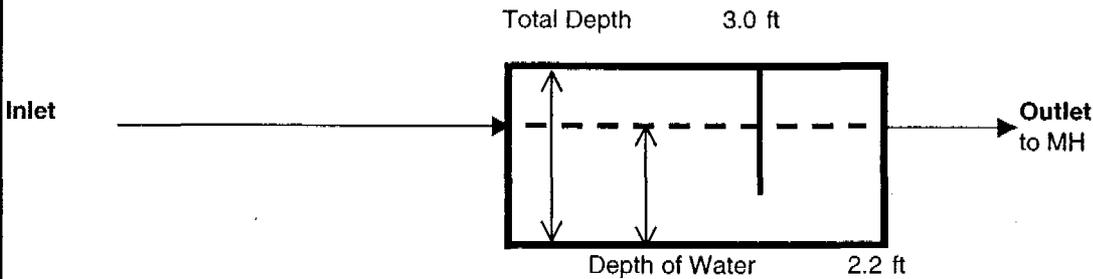
**Stage 2**

OWS No.: 827



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition

Wall 1

Wall 2

Wall 3

Wall 4

Base Slab

Base/wall interface

Good

Additional Notes:

Same comments as Stage one

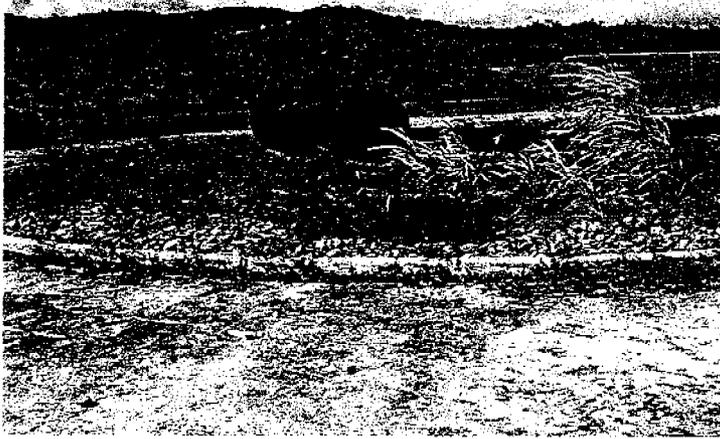
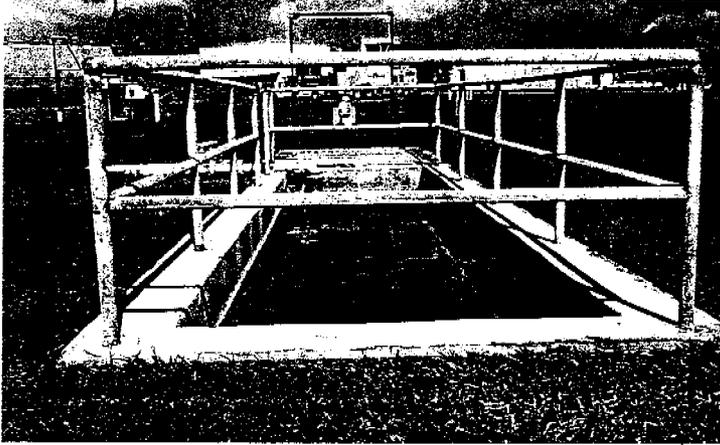
# OWS Survey Form

Page 4 of 4

Pictures

OWS No.:

827

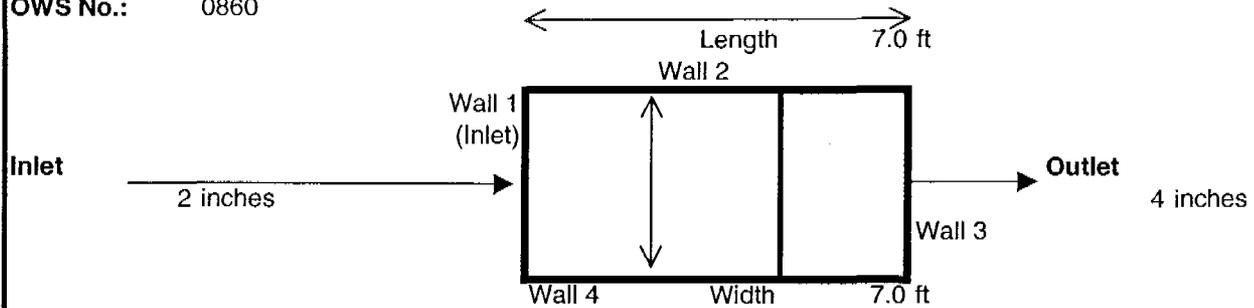




# OWS Survey Form

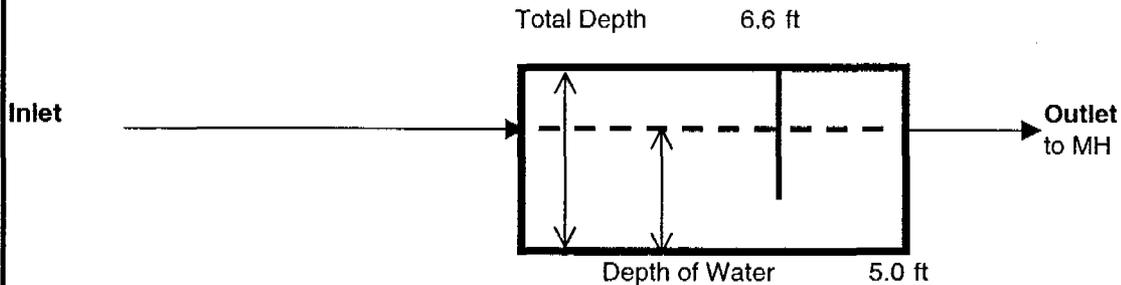
Page 2 of 3

OWS No.: 0860



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

## Plan View (Schematic)



## Section View (schematic)

Notes on Inspection

### Condition of concrete

(Excellent, Very Good, Good, Poor)

Overall concrete condition

Wall 1

Wall 2

Wall 3

Wall 4

Base Slab

Base/wall interface

Poor

Additional Notes:

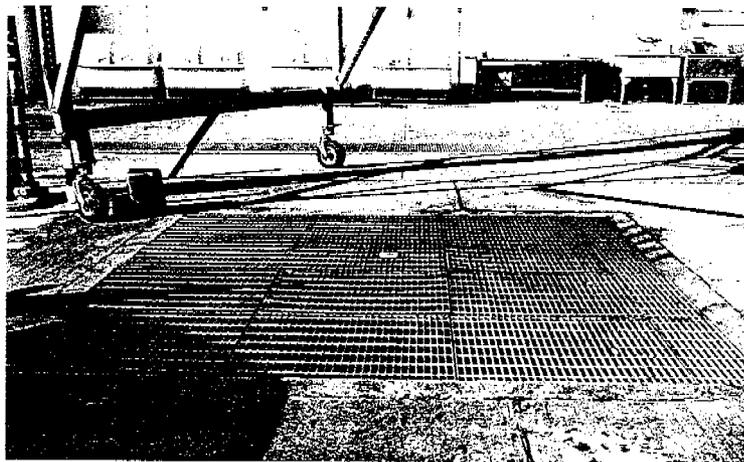
No sludge removed. Area used for spill containment. Small pin hole sized leak in one wall of OWS - continuous drainage of water from hole into OWS.

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 0860

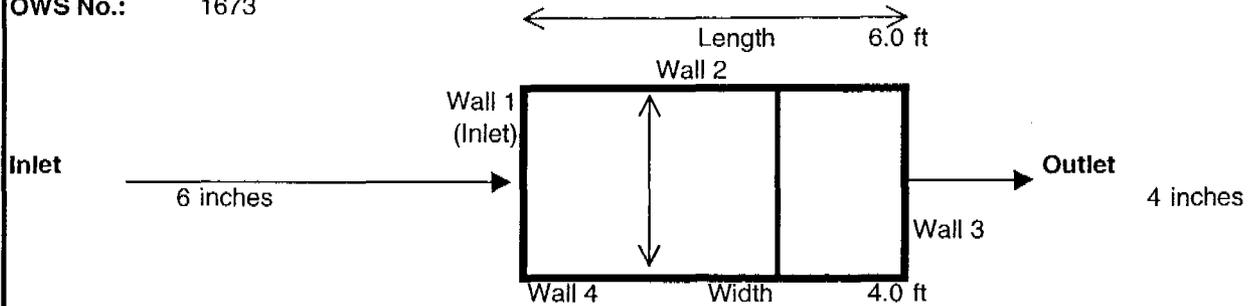




**OWS Survey Form**

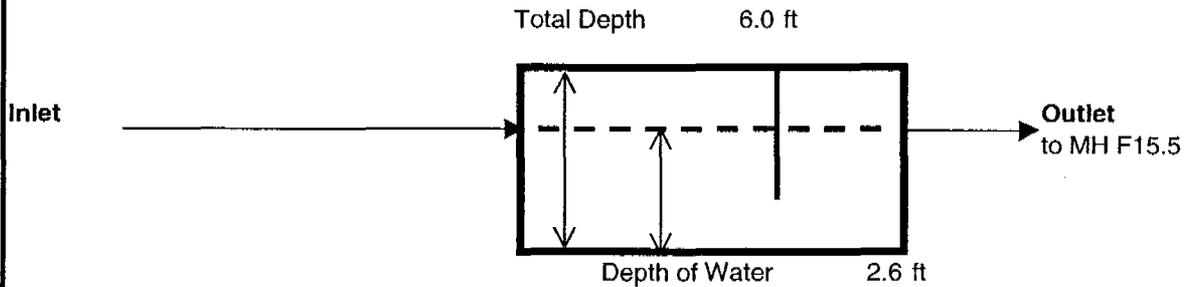
Page 2 of 3

OWS No.: 1673



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good to Very Good
Wall 1	Good to Very Good
Wall 2	Good to Very Good
Wall 3	Good to Very Good
Wall 4	Good to Very Good
Base Slab	Good to Very Good
Base/wall interface	Good to Very Good

Additional Notes:

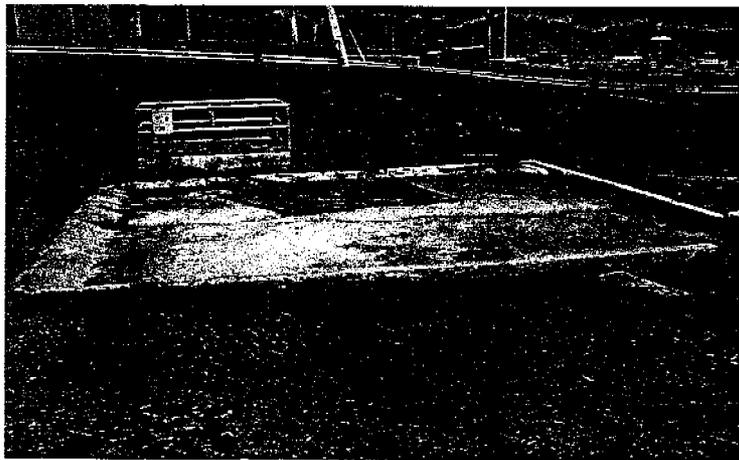
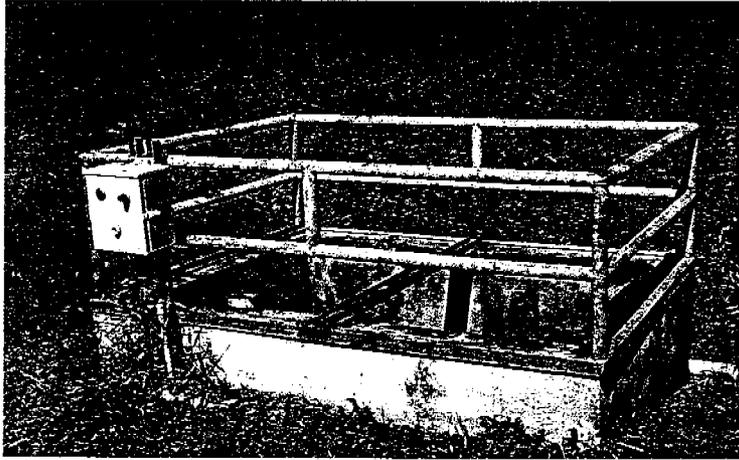
Surface outlet is 3"6" depth to water. Level alarm box connected (Type - Great Lakes Instruments 1311). Unknown status - Area appears to have not been used in a long time.
110 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 1673

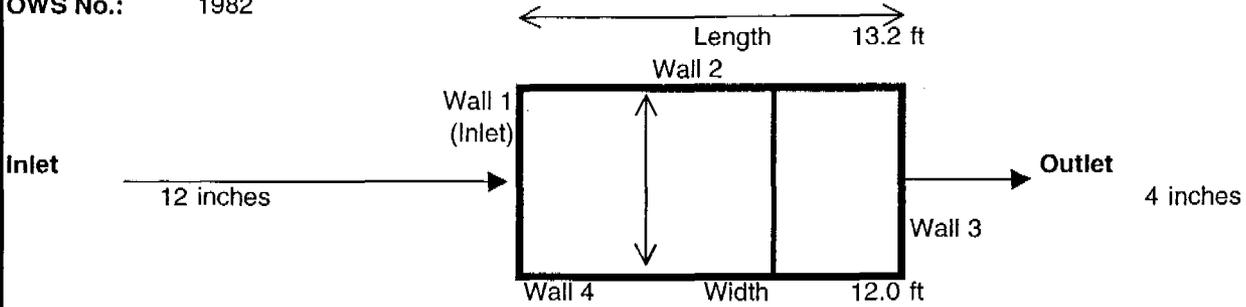




**OWS Survey Form**

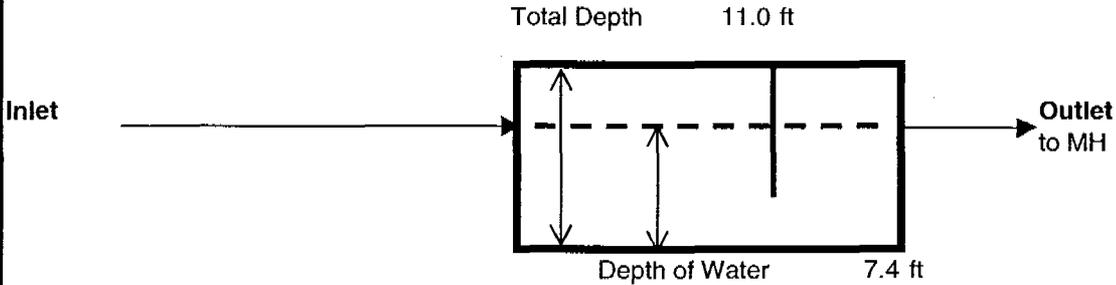
Page 2 of 3

OWS No.: 1982



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

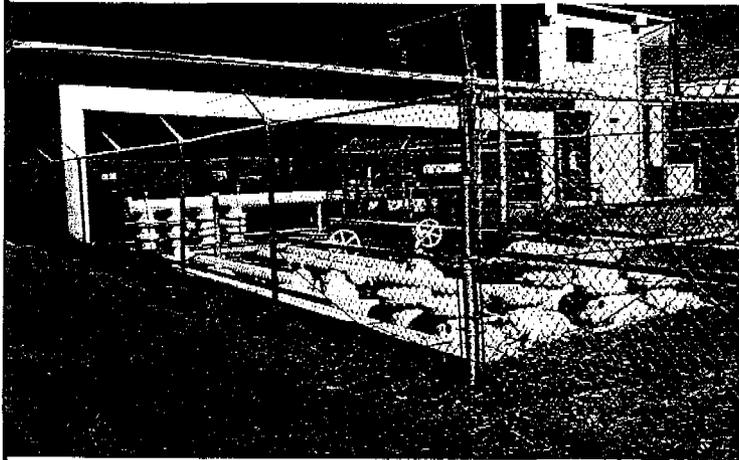
495 Gallons of sludge removed.
Inclined plate coalescer in very good condition.

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 1982

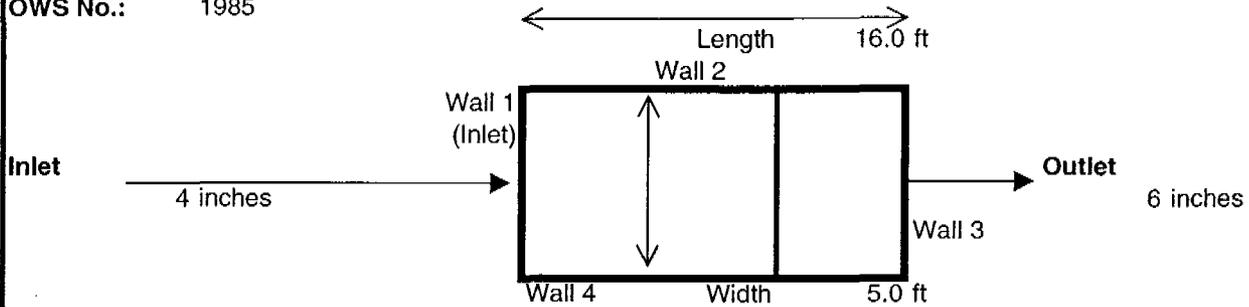




**OWS Survey Form**

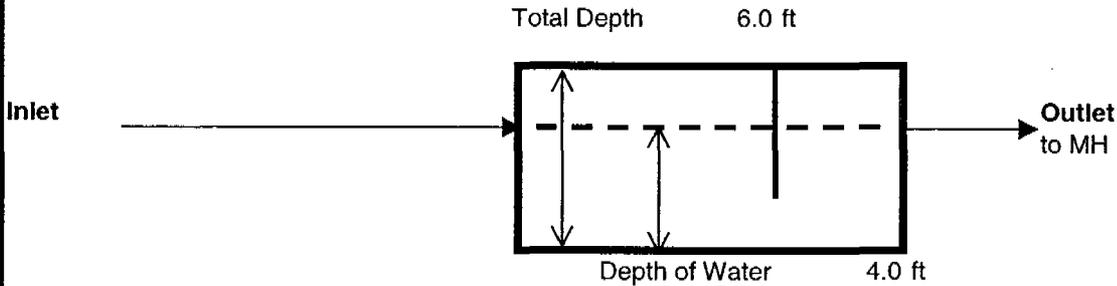
Page 2 of 3

OWS No.: 1985



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

880 gallons of sludge removed (16 - 55 drums)

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 1985

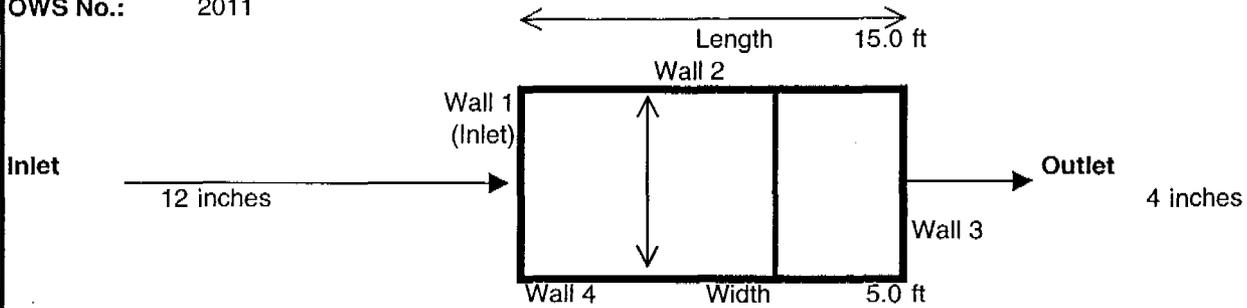




**OWS Survey Form**

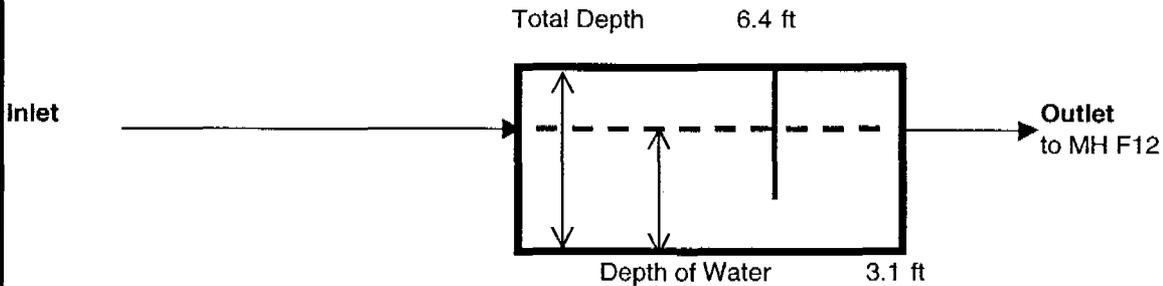
Page 2 of 3

OWS No.: 2011



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good
Wall 1	Good
Wall 2	Good
Wall 3	Good
Wall 4	Good
Base Slab	Good
Base/wall interface	Good

Additional Notes:

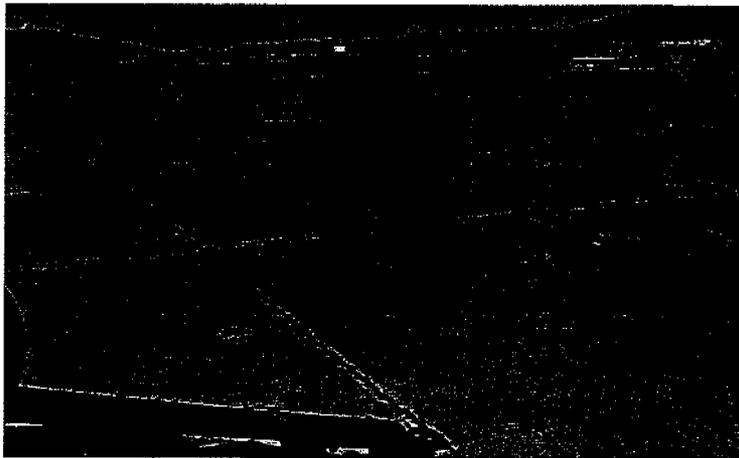
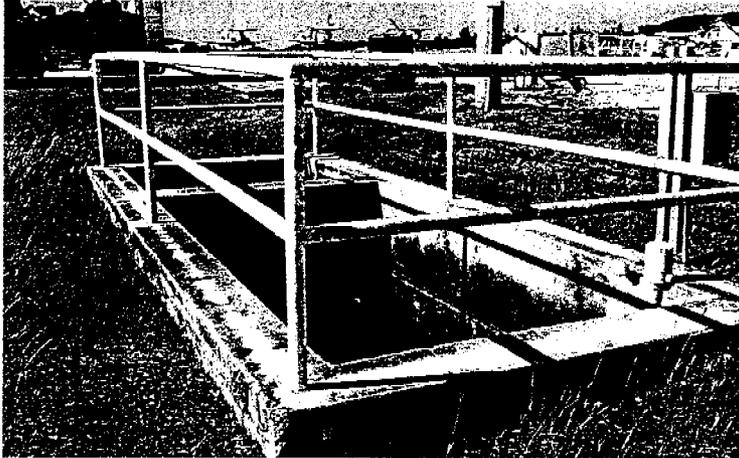
Inside walls oily and black
755 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2011

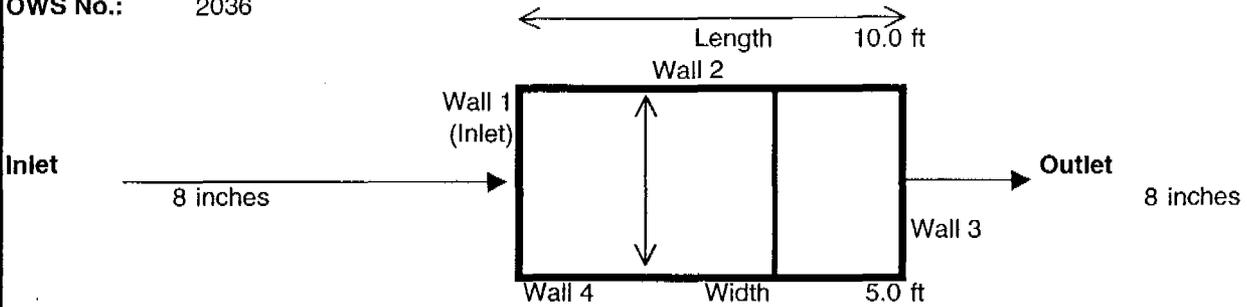




**OWS Survey Form**

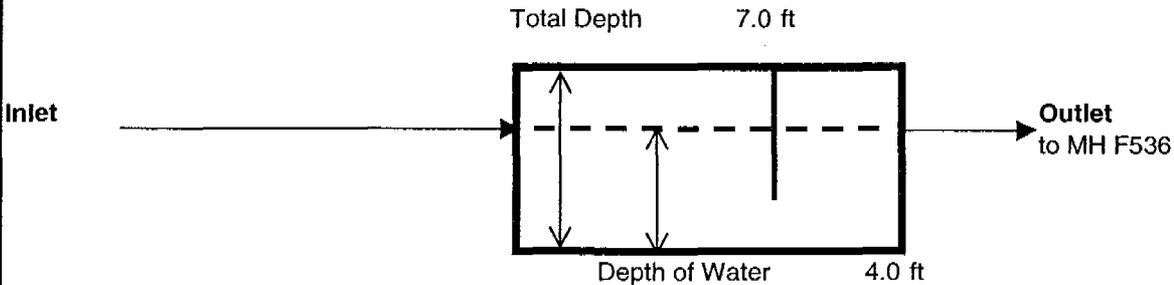
Page 2 of 3

OWS No.: 2036



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

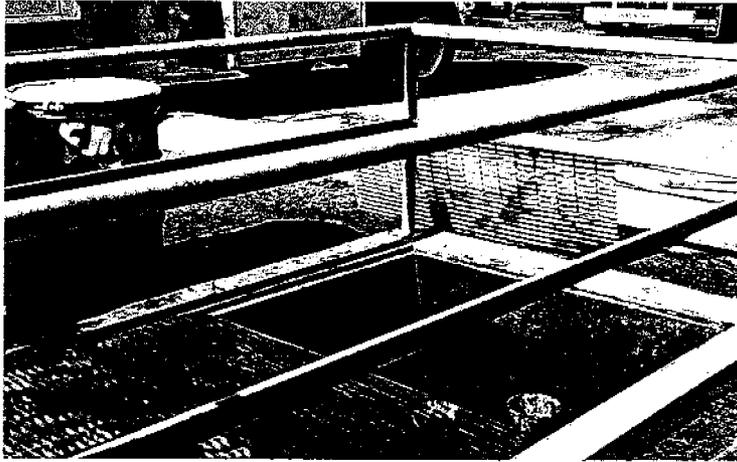
Equipment wash down area
165 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2036

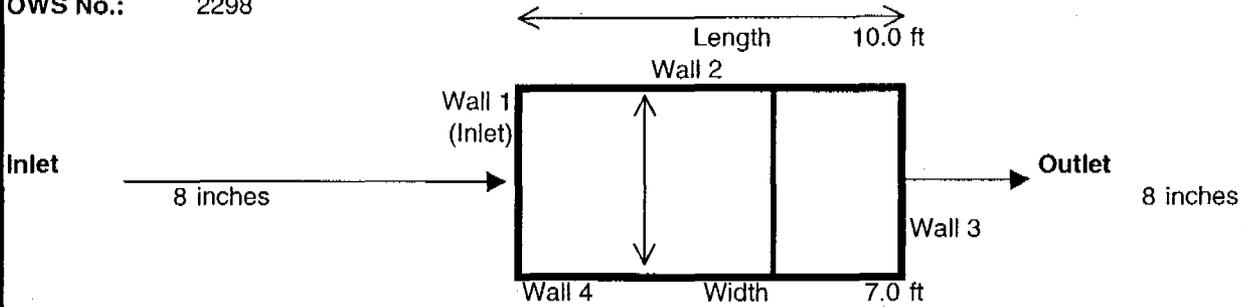




**OWS Survey Form**

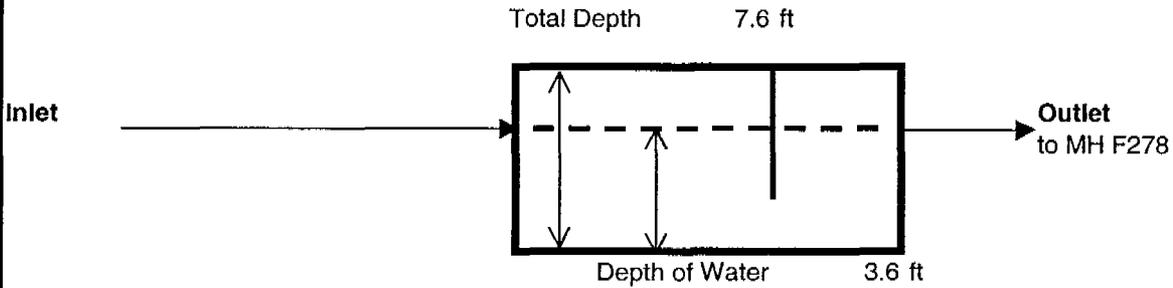
Page 2 of 3

OWS No.: 2298



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good
Wall 1	Good
Wall 2	Good
Wall 3	Good
Wall 4	Good
Base Slab	Good
Base/wall interface	Good

Additional Notes:

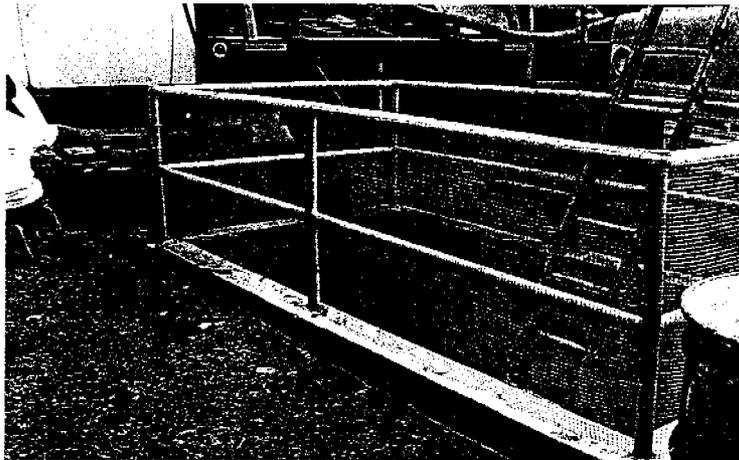
Oily - interior walls black
165 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2298

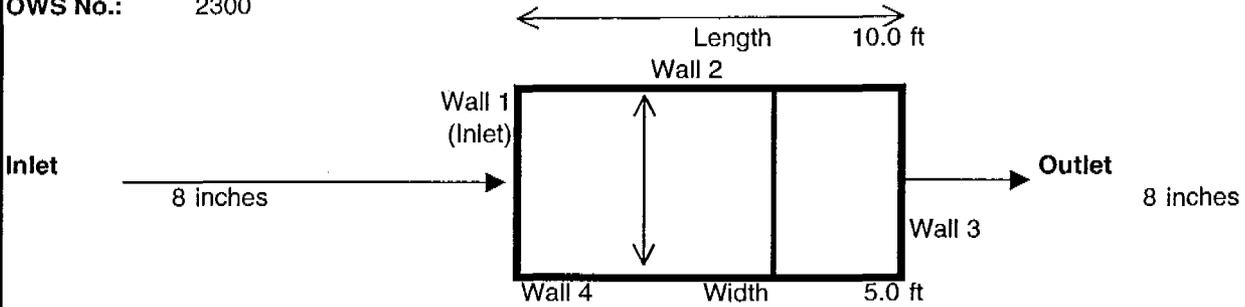




**OWS Survey Form**

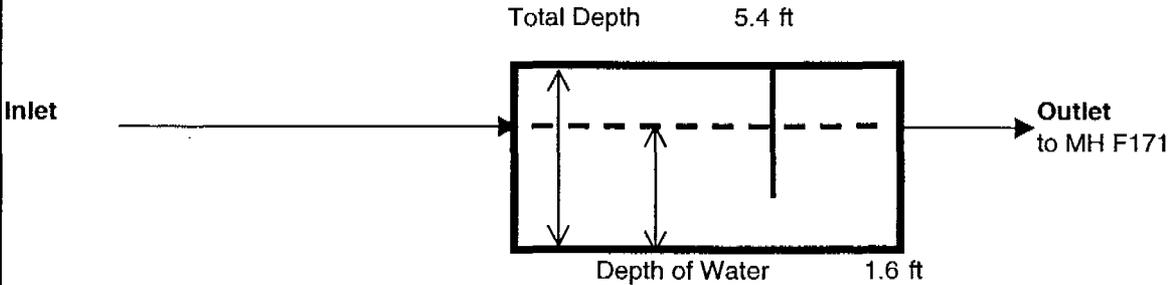
Page 2 of 3

OWS No.: 2300



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

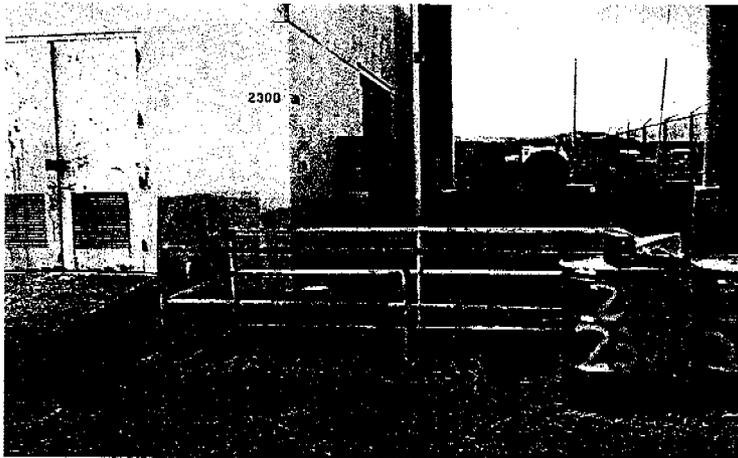
One drainage area is inside Bldg 2300 (45x83) and a smaller area (8x13) outside the building.
110 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2300

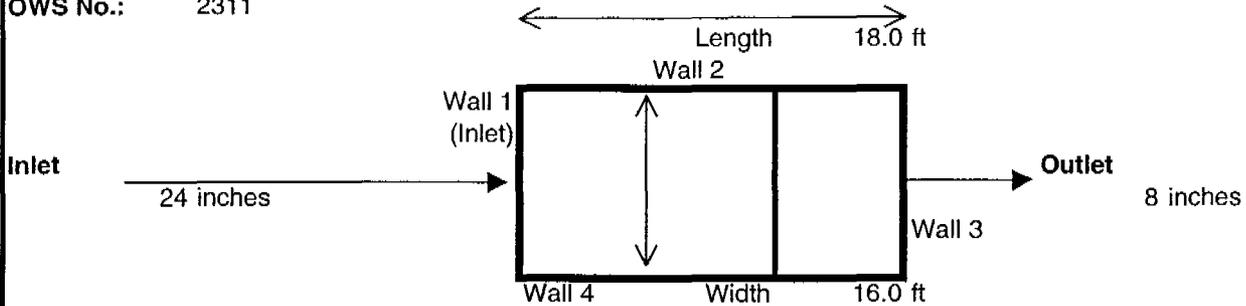




# OWS Survey Form

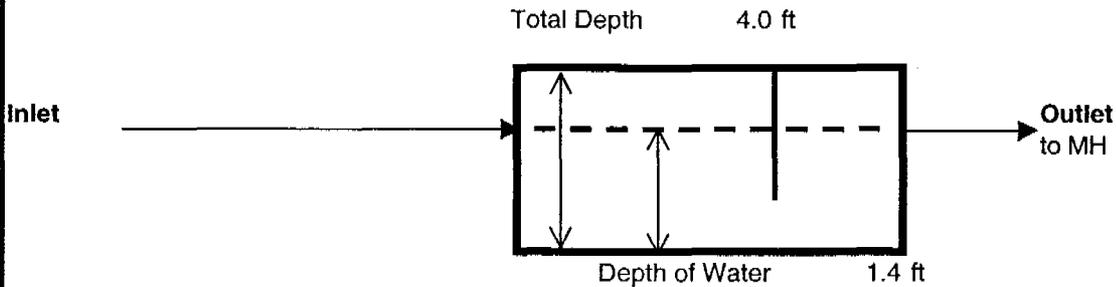
Page 2 of 3

OWS No.: 2311



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

## Plan View (Schematic)



## Section View (schematic)

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Poor
Wall 1	Poor
Wall 2	Poor
Wall 3	Poor
Wall 4	Poor
Base Slab	Poor
Base/wall interface	Poor

Additional Notes:

1485 gallons of sludge removed (27 - 55 gallon drums)
Significant cracks in concrete - 6" to 24" long and intersecting

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2311

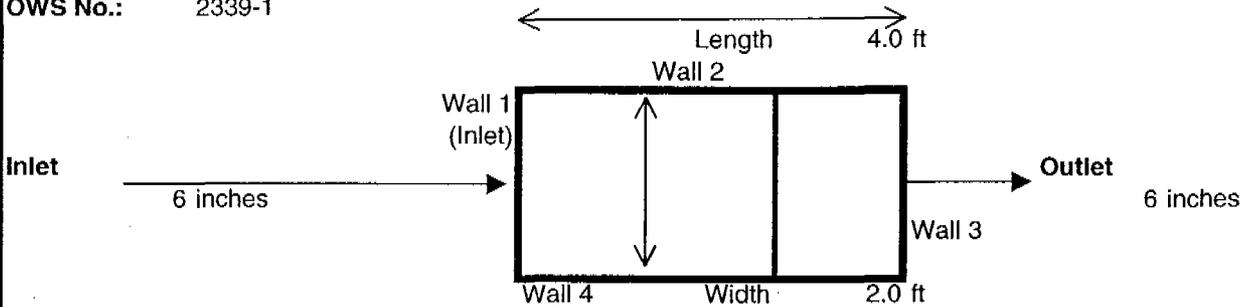




**OWS Survey Form**

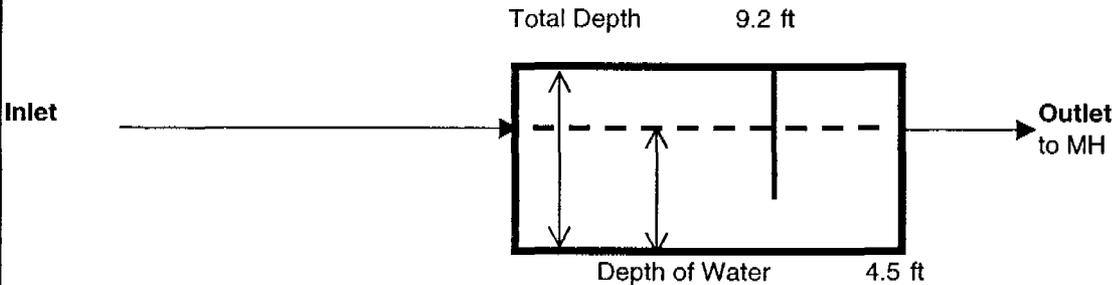
Page 2 of 3

OWS No.: 2339-1



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition

Very Good

Wall 1

Very Good

Wall 2

Very Good

Wall 3

Very Good

Wall 4

Very Good

Base Slab

Very Good

Base/wall interface

Very Good

Additional Notes:

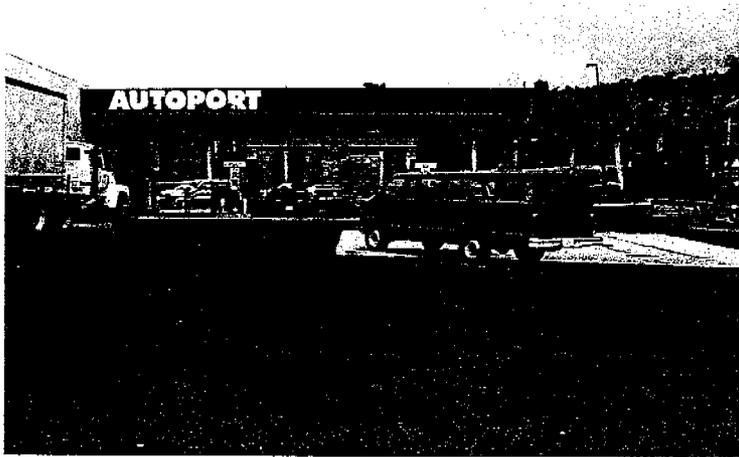
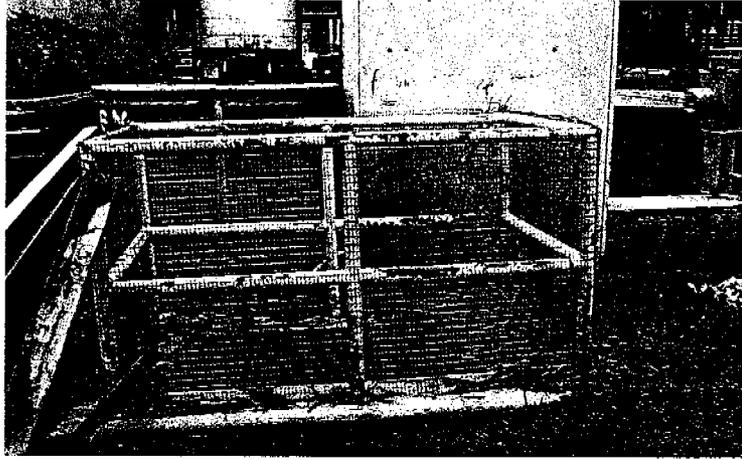
110 gallons of sludge removed (Two 55 gallon drums)

OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2339-1

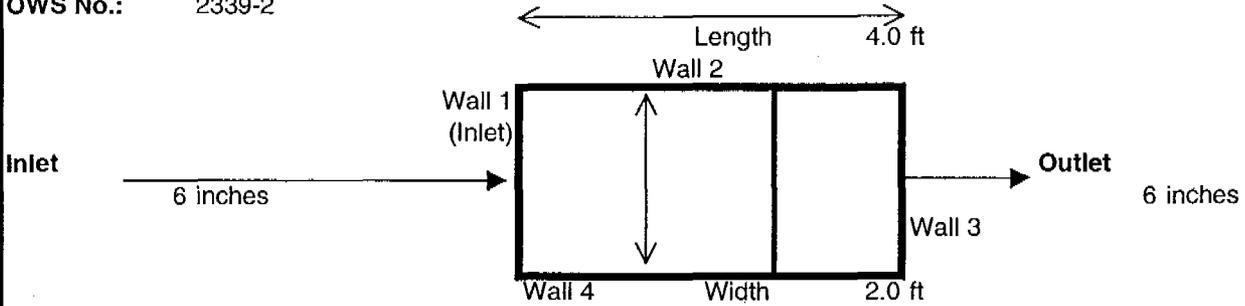




# OWS Survey Form

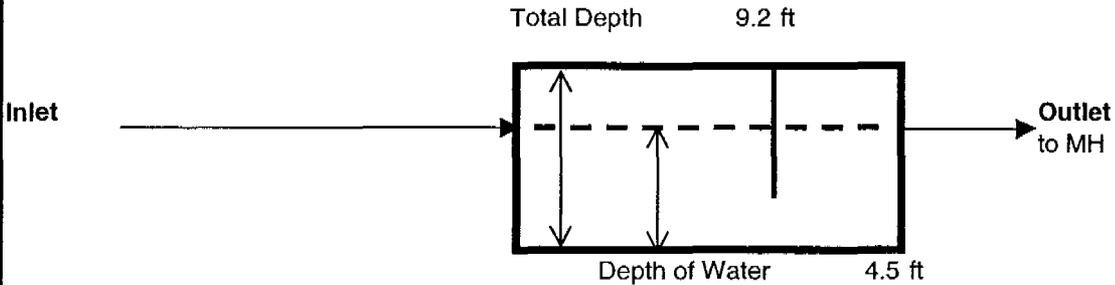
Page 2 of 3

OWS No.: 2339-2



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

## Plan View (Schematic)



## Section View (schematic)

Notes on Inspection

### Condition of concrete

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

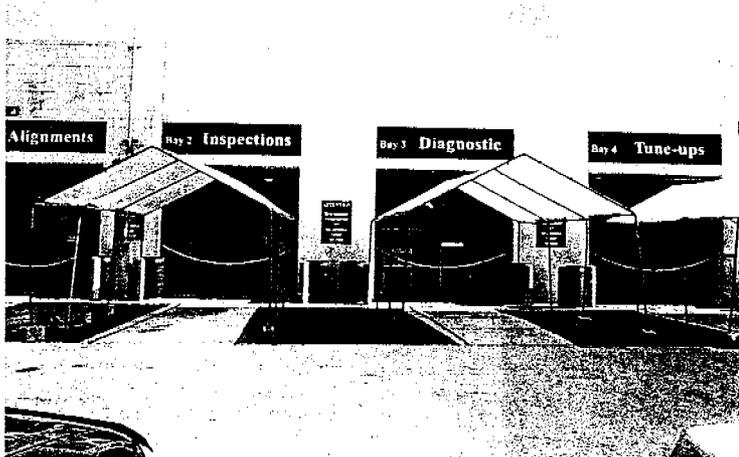
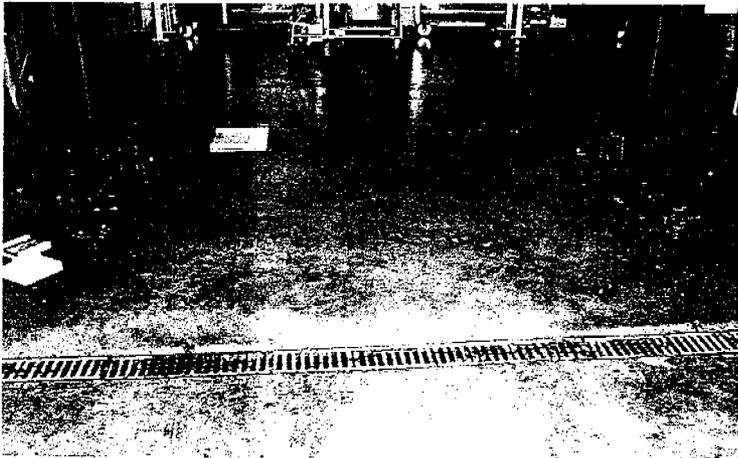
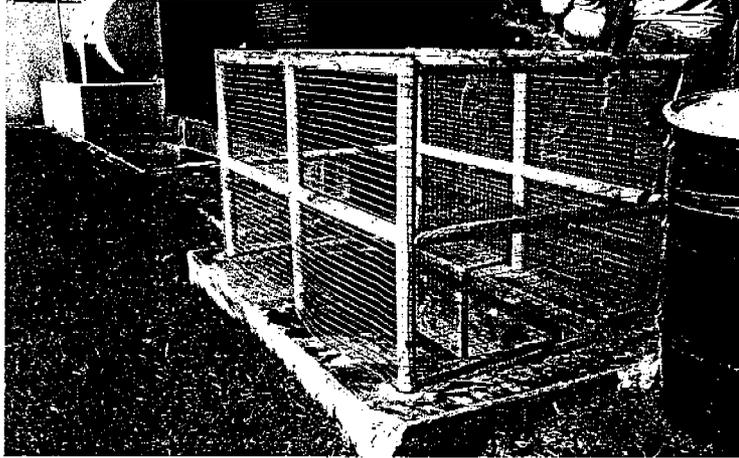
Human waste/sanitary napkins found in OWS when pumped out. When toilets are flushed in the building, water flows into OWS.

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2339-2

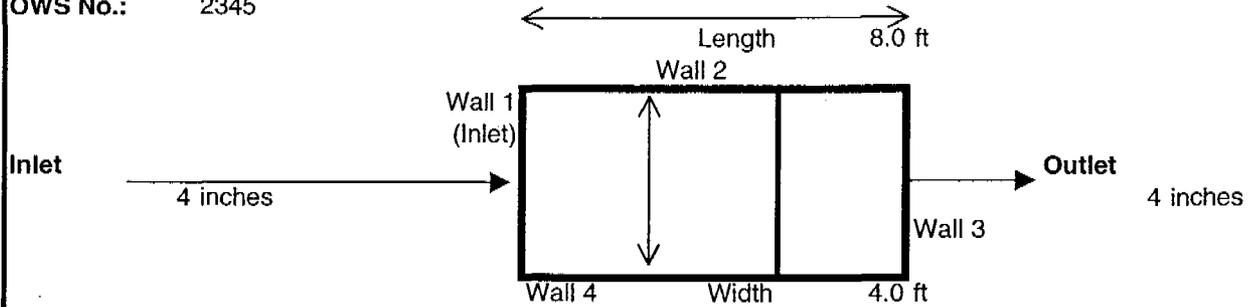




**OWS Survey Form**

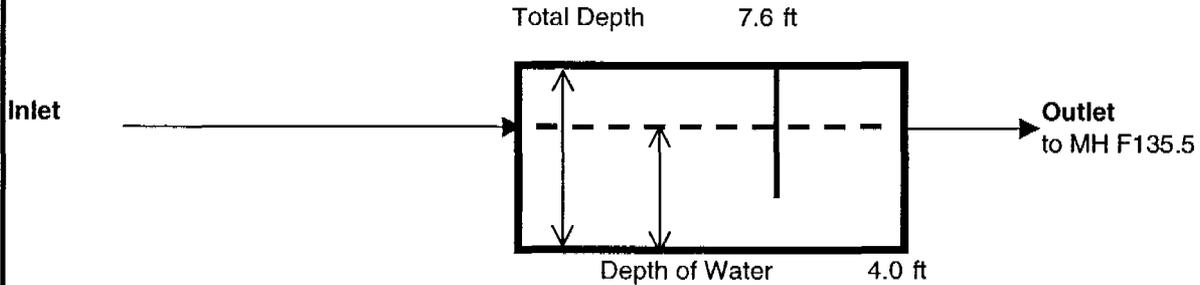
Page 2 of 3

OWS No.: 2345



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

Wash area drain appears to be plugged. Coalescer tubes have some evidence of breakdown - corrosion is evident.
0 Gallons of sludge removed

**OWS Survey Form**

Page 3 of 3

Pictures

**OWS No.:** 2345



# OWS Survey Form

Page 1 of 4

Base: Roosevelt Roads, Puerto Rico

OWS No.: 2364 Number of Stages 2

Date surveyed: 11/27/2001

Surveyors: Bill Cumbie /HRO  
Joe Kenderdine /WDC

Calculated Size of OWS:	Stage 1		Stage 2		Total
	1299	gallons	1169	gallons	2467 gallons

Measured dimensions:	Stage 1		Stage 2	
Length	20.0	ft	12.0	
Width	4.0	ft	6.0	
Total Depth	9.0	ft	9.5	
Depth of Water	2.2	ft	2.2	ft

Water source: Three - 3/4" (No. and size of washwater lines) ft

Estimated max washdown flow:	26 gpm	ft
Estimated stormwater flow:	153 gpm	(based on 5-in, 1 hr rain event with 90% runoff)
Estimated capacity based on SA:	211 gpm	Criteria: 2000 gpd/sf of SA
Cap. assuming 0.1 gpm/gal vol:	247 gpm	

Does OWS have sufficient capacity (Y/N)? Yes

Estimated drainage area: 3264 ft<sup>2</sup>

Excessive drainage area (Y/N): No

If excessive, explain:

Connected to sanitary sewer: Yes

If yes, no. of nearest manhole: F-196

Check here if additional sheets are attached and provide description   
(note: the second and sheets of this form does not constitute a new sheet)

## Description of additional sheets

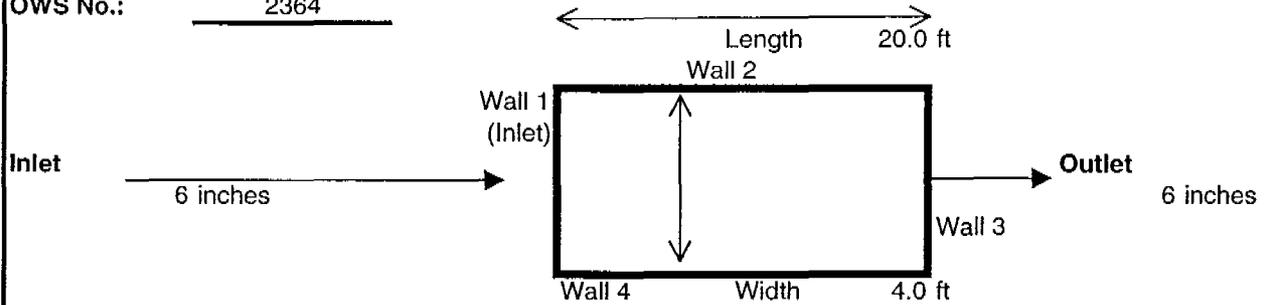
Sheet no.	Description

**OWS Survey Form**

Page 2 of 4

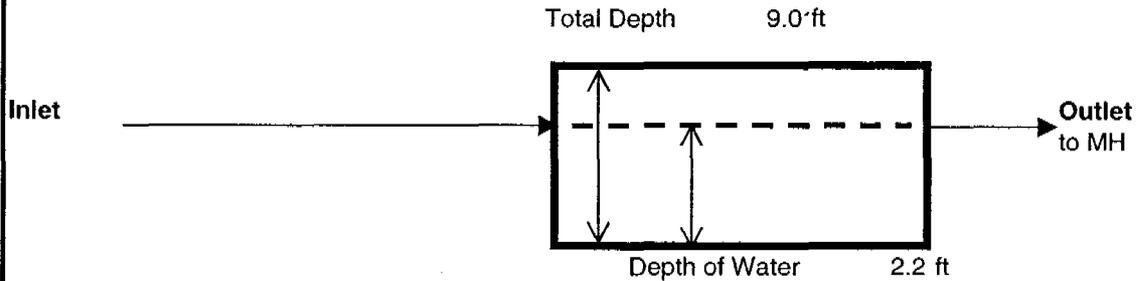
**Stage 1**

OWS No.: 2364



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

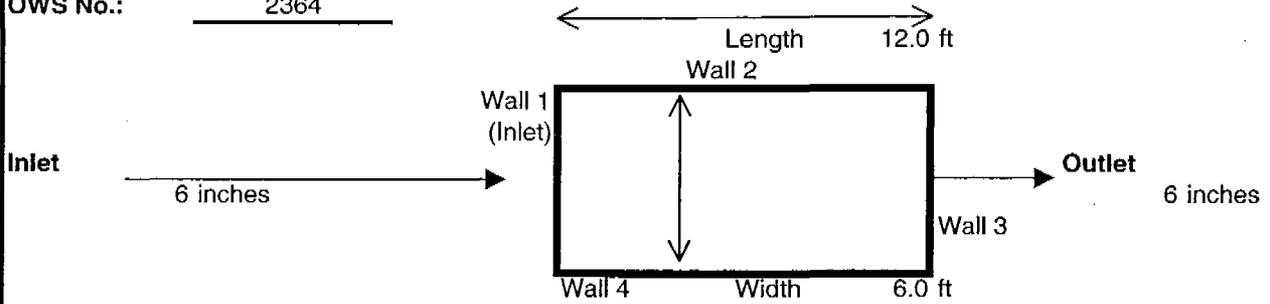
Steps in both OWSs in very good condition.
Inlet and outlet in good condition.
Small amount of spalling (< 1/4" deep) over less than 5% surface area.

**OWS Survey Form**

Page 3 of 4

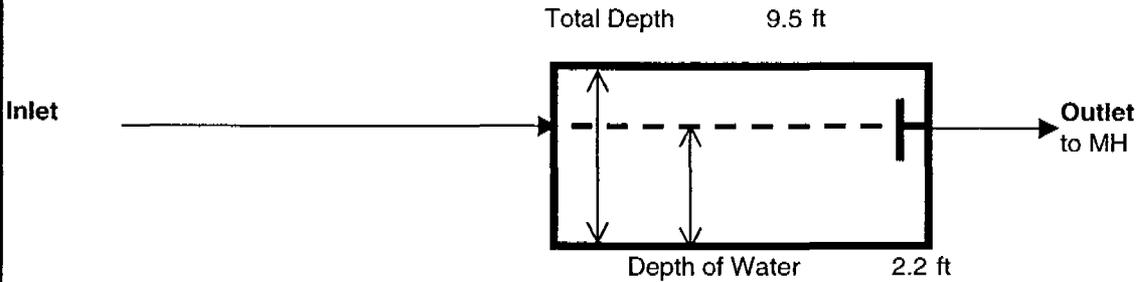
**Stage 2**

OWS No.: 2364



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

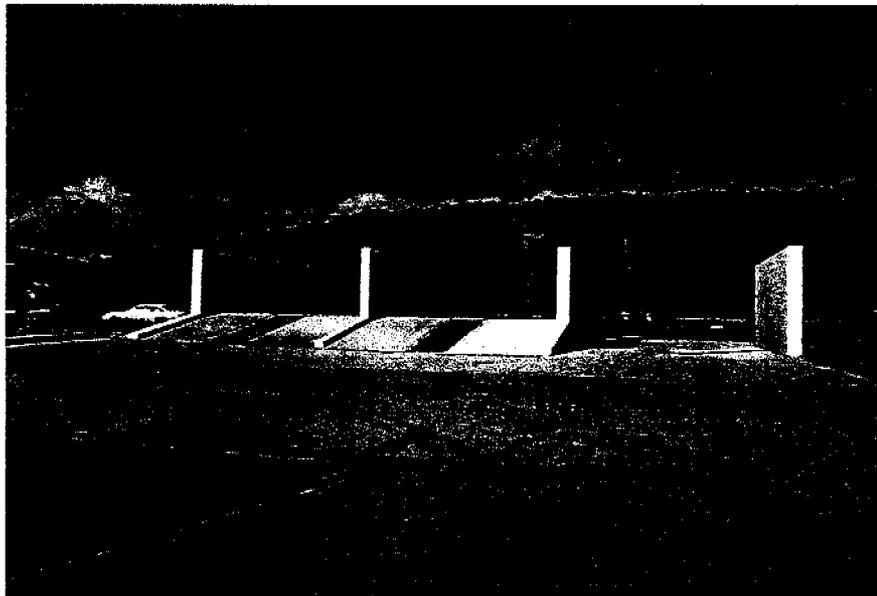
Additional Notes:

Small amount of spalling of parging (<5%)
Steps in both OWSs in very good condition
Inlet and outlet in good condition

OWS Survey Form

Page 4 of 4

OWS No.: 2364

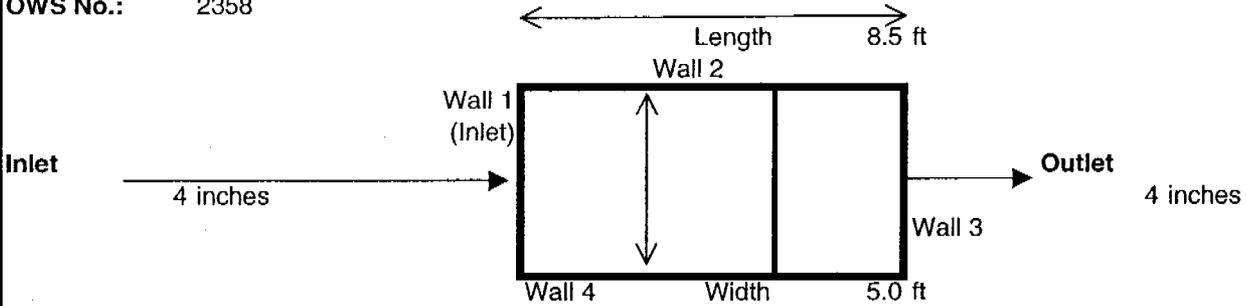




**OWS Survey Form**

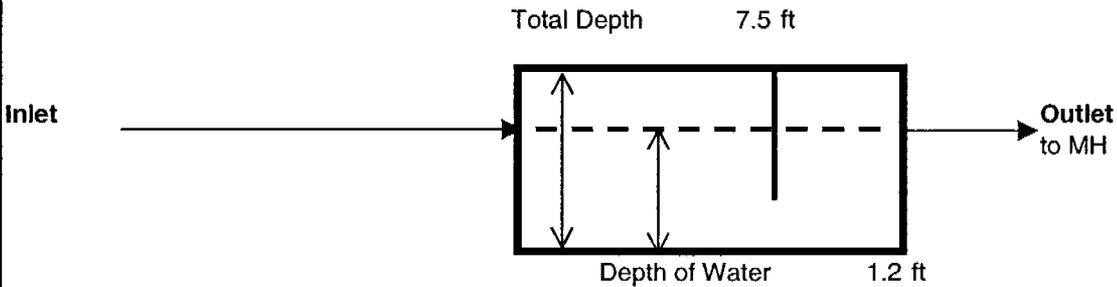
Page 2 of 3

OWS No.: 2358



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Good to Very Good
Wall 1	Good to Very Good
Wall 2	Good to Very Good
Wall 3	Good to Very Good
Wall 4	Good to Very Good
Base Slab	Good to Very Good
Base/wall interface	Good to Very Good

Additional Notes:

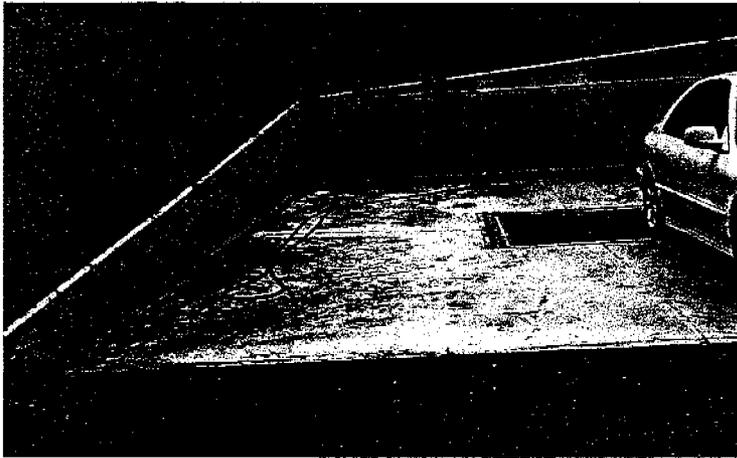
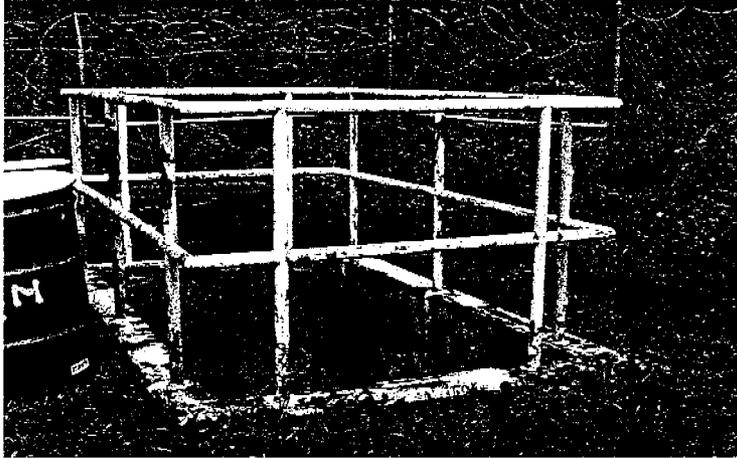
110 gallons of sludge removed (Two - 55 gallon drums)
Minor cracking on top walls of OWS

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 2358



# OWS Survey Form

Page 1 of 3

Base: Roosevelt Roads, Puerto Rico

OWS No.: 2431 Number of Stages 1

Date surveyed: 02/20/2002

Surveyors: Joe Kenderdine /WDC  
Patti Clark /HRO

Calculated Size of OWS: Stage 1  
2488 gallons

Measured dimensions: Stage 1  
Length 12.6 ft  
Width 6.6 ft  
Total Depth 12.6 ft  
Depth of Water 4.0 ft

Water source: three - 3/4" (No. and size of washwater lines)  
Estimated max washdown flow: 26 gpm  
Estimated stormwater flow: 38 gpm (based on 5-in, 1 hr rain event with 90% runoff)  
Estimated capacity based on SA: 116 gpm Criteria: 2000 gpd/sf of SA  
Cap. assuming 0.1 gpm/gal vol: 249 gpm  
Does OWS have sufficient capacity (Y/N)? Yes

Estimated drainage area: 819 ft<sup>2</sup> (Covered area not included in drainage area)  
Excessive drainage area (Y/N): N  
If excessive, explain:

Connected to sanitary sewer: Y  
If yes, no. of nearest manhole: Unknown

Check here if additional sheets are attached and provide description   
(note: the second sheet of this form does not constitute a new sheet)

## Description of additional sheets

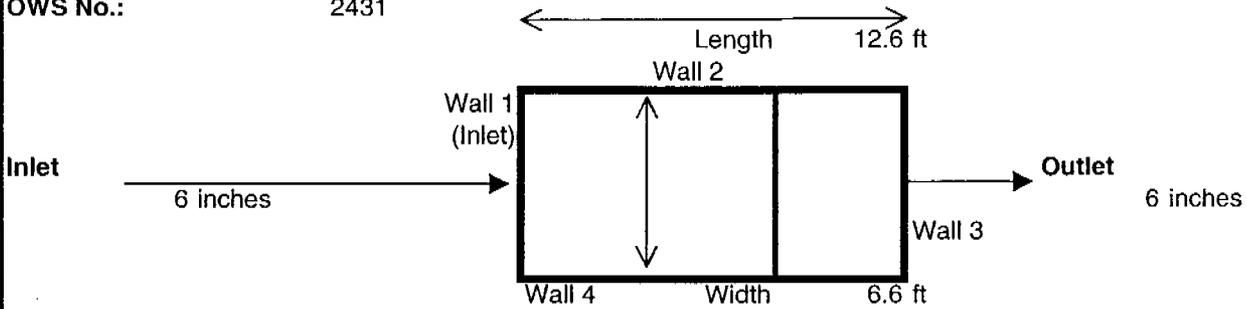
Sheet no.	Description

12 drums of sludge removed

**OWS Survey Form**

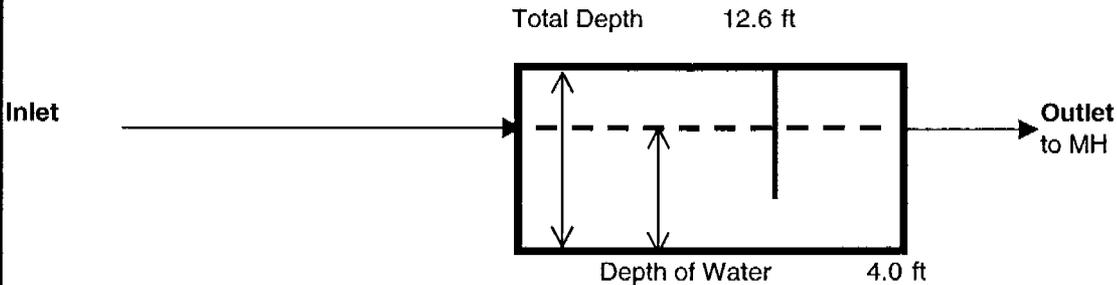
Page 2 of 3

OWS No.: 2431



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

660 gallons of sludge removed (12 - 55 gallon drums)
Lift station pumps not operating when placed in manual (hand) mode - it appears that the sewer may be backflowing through the outlet
Drainage on washrack may be plugged

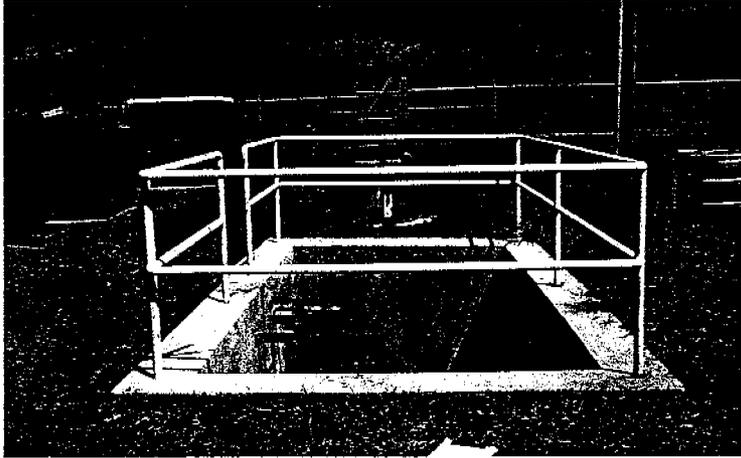
OWS Survey Form

Page 3 of 3

Pictures

OWS No.:

2431



# OWS Survey Form

Page 1 of 4

Base: Roosevelt Roads, Puerto Rico

OWS No.: 3137 Number of Stages 2

Date surveyed: 01/15/2002

Surveyors: Joe Kenderdine /WDC  
Patti Clark /HRO

	Stage 1	Stage 2	Total
Calculated Size of OWS:	718 gallons	4189 gallons	4907 gallons

Measured dimensions:	Stage 1	Stage 2
Length	8.0 ft	20.0 ft
Width	4.0 ft	7.0 ft
Total Depth	7.6 ft	8.6 ft
Depth of Water	3.0 ft	4.0 ft

Water source: one - 2" (No. and size of washwater lines)

Estimated max washdown flow: 52 gpm

Estimated stormwater flow: 27 gpm (based on 5-in, 1 hr rain event with 90% runoff)

Estimated capacity based on SA: 478 gpm Criteria: 2000 gpd/sf of SA

Cap. assuming 0.1 gpm/gal vol: 491 gpm

Does OWS have sufficient capacity (Y/N)? Yes

Estimated drainage area: 570.00 ft<sup>2</sup> (plus additional if missing berm is not replace)

Excessive drainage area (Y/N): Y

If excessive, explain: Small berm missing on one side (west) of the wash area

Connected to sanitary sewer: Y

If yes, no. of nearest manhole: F293

Check here if additional sheets are attached and provide description

(note: the second and sheets of this form does not constitute a new sheet)

## Description of additional sheets

Sheet no.	Description

15 drums of sludge removed

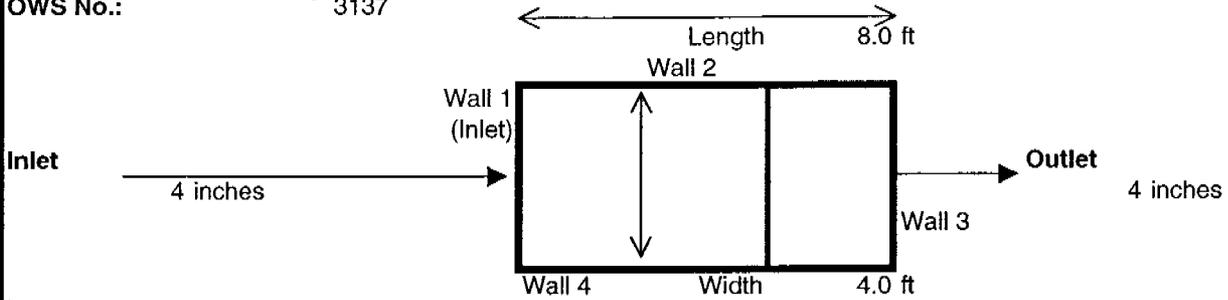
**OWS Survey Form**

Page 2 of 4

**Stage 1**

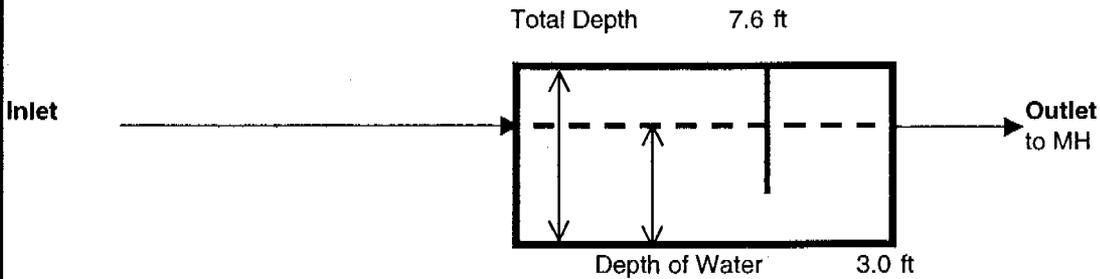
OWS No.:

3137



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

Wash area drainage appears to be plugged. Water runs to sanitary sewer manhole
Ladder in very good condition
825 Gallons of sludge removed

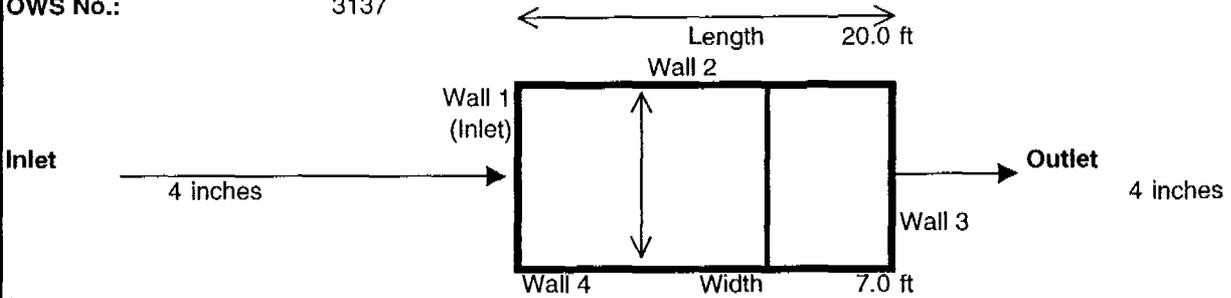
**OWS Survey Form**

Page 3 of 4

**Stage 2**

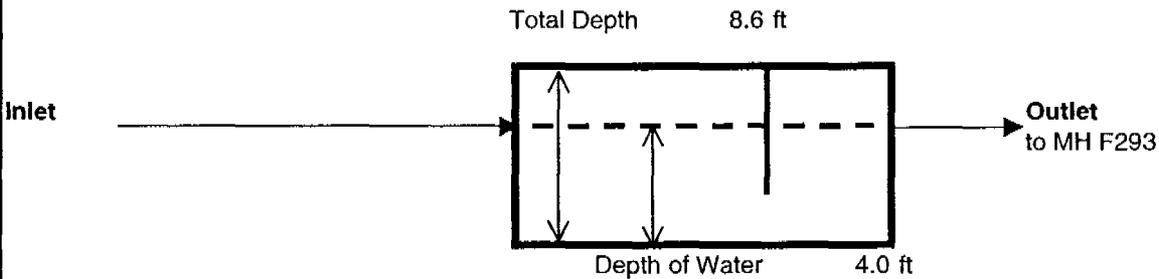
**OWS No.:**

3137



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete**

(Excellent, Very Good, Good, Poor)

Overall concrete condition	Very Good
Wall 1	Very Good
Wall 2	Very Good
Wall 3	Very Good
Wall 4	Very Good
Base Slab	Very Good
Base/wall interface	Very Good

Additional Notes:

Same notes as above
Ladder in very good condition

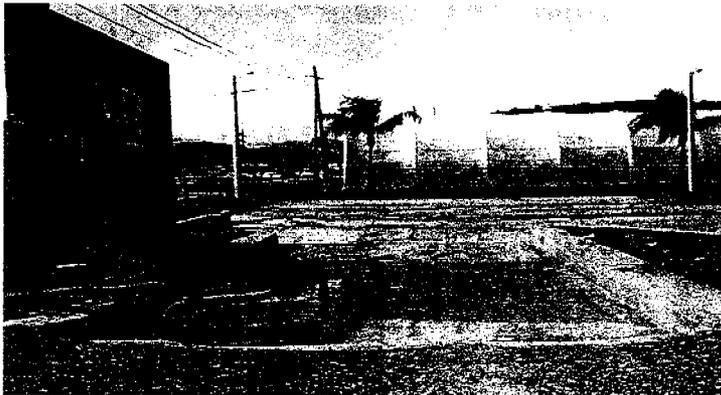
OWS Survey Form

Page 4 of 4

Pictures

OWS No.:

3137

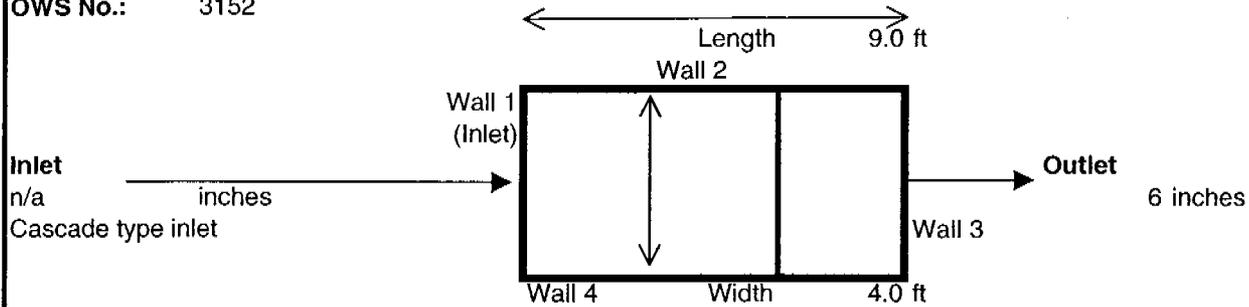




**OWS Survey Form**

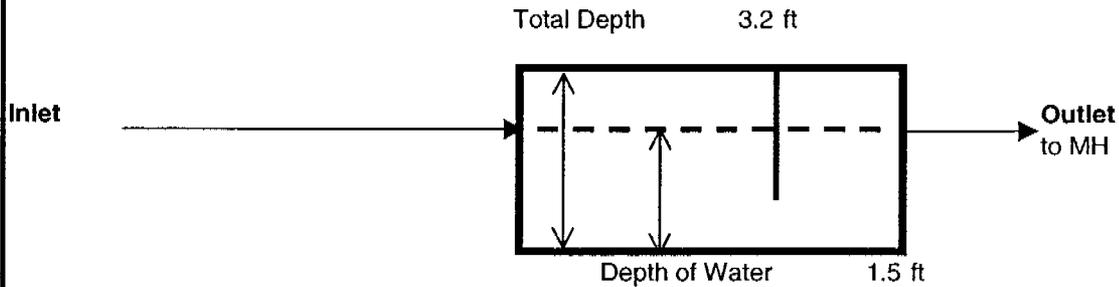
Page 2 of 3

OWS No.: 3152



Note: Inlet is wall 1 and other walls are numbered clockwise from inlet

**Plan View (Schematic)**



**Section View (schematic)**

Notes on Inspection

**Condition of concrete** (Excellent, Very Good, Good, Poor)

Overall concrete condition	Good
Wall 1	Good
Wall 2	Good
Wall 3	Good
Wall 4	Good
Base Slab	Good
Base/wall interface	Good

Additional Notes:

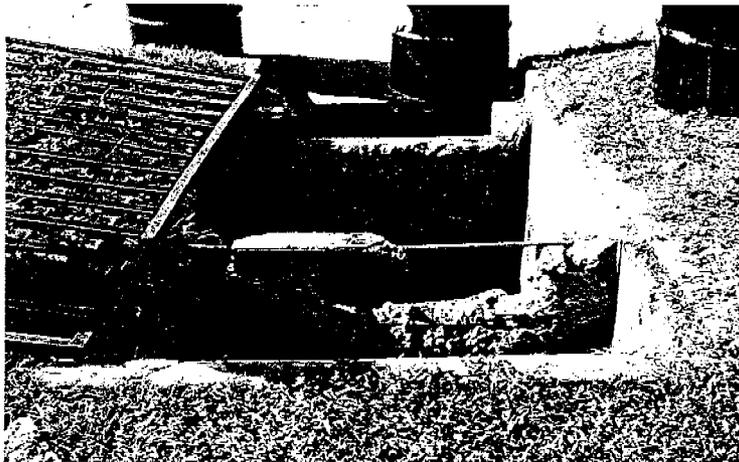
Exposed rebar in baffles. Some concrete missing also - Baffle condition poor.
Associated building (3152) is across the street from the OWS, but is the nearest building. Area appears unused and yard is empty.
165 Gallons of sludge removed

# OWS Survey Form

Page 3 of 3

Pictures

OWS No.: 3152



**Flow Estimates from various size lines**

<b>Line Size (In)</b>	<b>Flow @ 8 fps (gpm)</b>	<b>Flow @ 5 fps (gpm)</b>
1/2	8	5
3/4	13	8.5
1	22	13
1-1/2	51	32
2	84	52
3	180	110
4	318	195

Note: Flows based on 8 ft/sec

2036	Oil Spill Team Compound	No			
2311	Temporary Wash Rack	No	Yes		
2339-2	Service Station/Mini Mart			Yes	
2345	Garbage Truck Wash Rack			Yes	
2431	Waste Management Area			Yes	
3137	SeaBees Camp - Alpha Co.			Yes	
3152	SeaBees Camp - Bravo Co.	No	Yes		

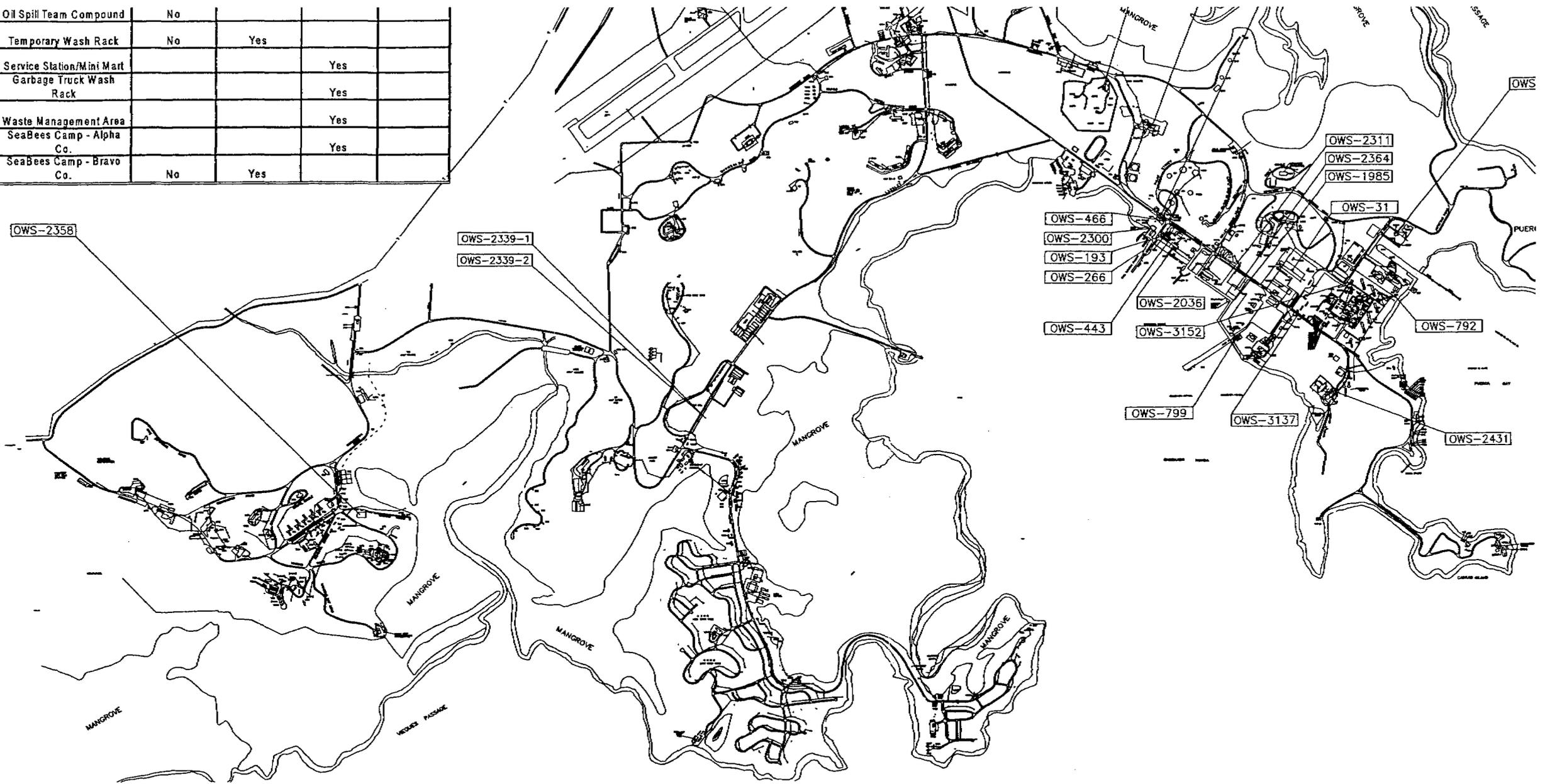
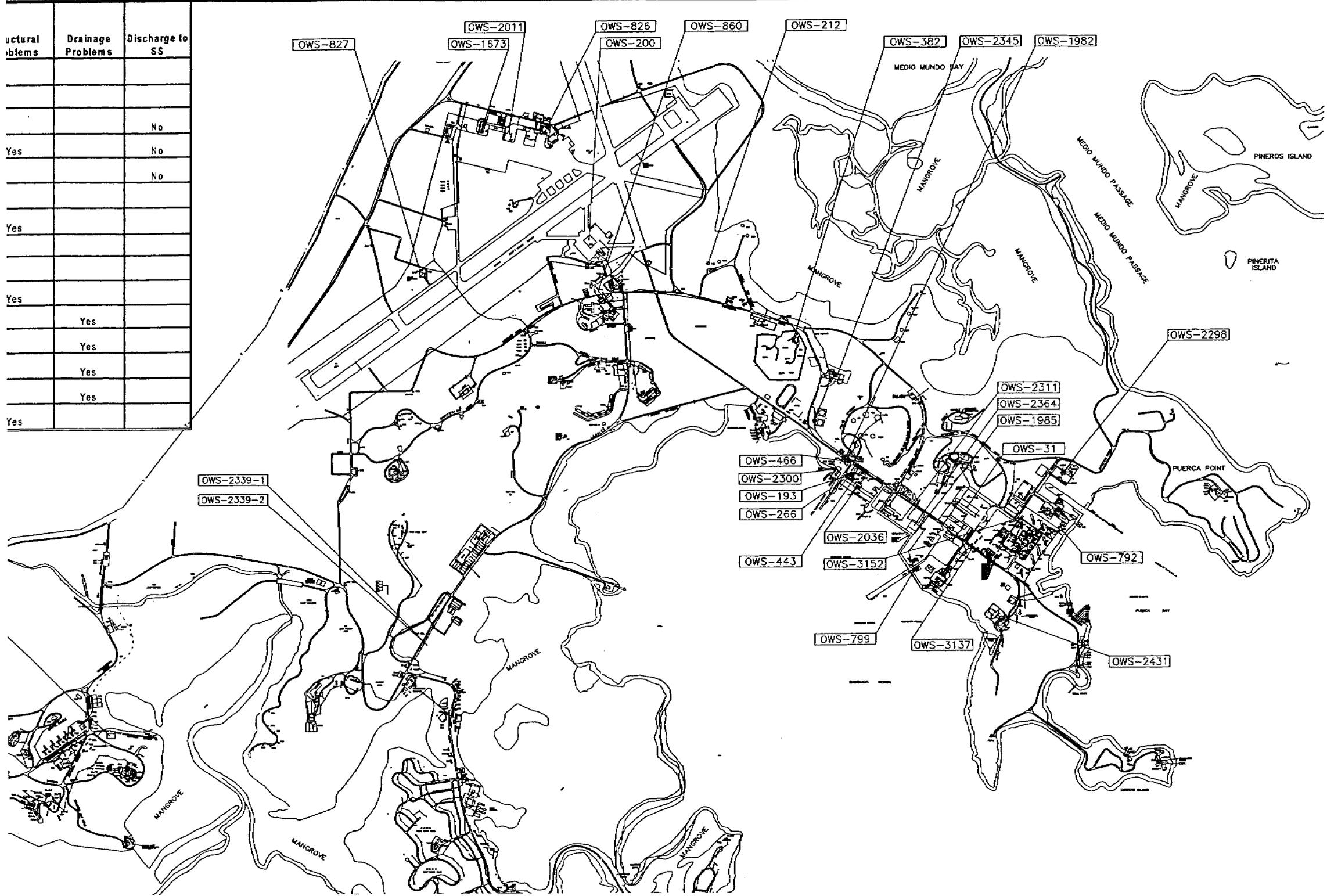


FIG  
LOCATIC  
FOR OIL-WAT

**CH2I**

Structural Problems	Drainage Problems	Discharge to SS
		No
Yes		No
		No
Yes		
Yes	Yes	
	Yes	
	Yes	
Yes	Yes	



TIC DIVISION		NVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	
ROSEVELT ROADS PARATOR LOCATIONS		N62470-96-D-5911	
PUERTO RICO		DATE	
APPROVED		DATE	
PROJECT MANAGER		DATE	
QUALITY CONTROL		DATE	
DESIGN DIRECTOR		DATE	
1989 SWP3 UPDATE		12/23/89	
DRG		DATE	
REVISIONS		DATE	

**Table 1 - Summary of Oil-Water Separator Evaluations**

Roosevelt Roads Naval Station (November 2001 to February 2002)

OWS	Description	Listed Size (gal)	Calculated Size (gal)	Capacity at 2gpm/gal vol (gpm)	Capacity based on Surface Area of OWS (gpm)	Estimated Max Washdown Flow (gpm)	Estimated Max Storm Flow (gpm)	Adequately Sized	Structural Problems	Drainage Problems	Discharge to Sanitary Sewer	Additional Notes
31	PWD-Transportation	1128	935	94	69	17	187	No	No	No	Yes	Drainage area not contained and excessive drainage possible during significant storm events.
193	Aircraft Fuel Truck Area - Hose Storage	940	1384	138	104	5	5	Yes	No	No	Yes	Incorrectly identified as 0443 in RFP
200	Aircraft Hangar	370	337	34	21	0	188	No	No	No	Yes	
212	Fueling Area	6767	7293	729	208	0	76	Yes	No	No	No	
266	Pier 1		2066	207	77	0	48	Yes	No	No	Yes	
382	Aircraft Fuel Truck Area	6767	8038	804	196	0	122	Yes	Yes	No	No	Added during 6/01 visit. Some exposed and crumbling aggregate
443	Aircraft Fuel Truck Area - Parking	3276	7966	797	212	0	76	Yes	No	No	No	Previously identified as "UNKNOWN"
466	Aircraft Fuel Compound	8019	7828	780	285	8.5	61	Yes	No	No	Yes	Added during 6/01 visit
792	NSWU Warehouse - Boat Wash	514	253	25	29	10	140	No	No	No	Yes	
799	Oil Pollution Control System - Pier #3	2000	3163	316	250	0	123	Yes	No	No	Yes	
826	Aerospace Ground Support	826	1616	162	100	5	30	Yes	No	No	Yes	
827	Fire Department - Crash Crew	1128	8111	811	210	110	73	Yes	No	No	Yes	
860	Drone Support	3850	1833	183	68	9	5	Yes	Yes	No	Yes	Small leak in OWS wall - continuous stream of water entering OWS
1673	CFT Ground Support	940	467	47	33	8.5	12	Yes	No	No	Yes	
1982	Fuel Storage Compound	6767	8768	877	220	8.5	111	Yes	No	No	Yes	
1985	Vehicle Wash Rack - Surface Ops	1504	2394	239	111	110	52	Yes	No	No	Yes	
2011	VC-8 Wash Rack	940	1739	174	104	64	655	No	No	No	Yes	
2036	Oil Spill Team Compound	1128	1496	150	69	8.5	105	No	No	No	Yes	
2298	Army Reserve Maintenance Hangar	1015	1885	188	97	5	88	Yes	No	No	Yes	
2300	Army Reserve - Boat Maintenance Hangar	1015	598	60	69	34	0	Yes	No	No	Yes	

193	Aircraft Fuel Truck Area - Hose Storage	940	1384	138	104	5	5	Yes	No	No	Yes	Incorrectly identified as 0443 in RFP
200	Aircraft Hangar	370	337	34	21	0	188	No	No	No	Yes	
212	Fueling Area	6767	7293	729	208	0	76	Yes	No	No	No	
266	Pier 1		2066	207	77	0	48	Yes	No	No	Yes	
382	Aircraft Fuel Truck Area	6767	8038	804	196	0	122	Yes	Yes	No	No	Added during 6/01 visit. Some exposed and crumbling aggregate
443	Aircraft Fuel Truck Area - Parking	3276	7966	797	212	0	76	Yes	No	No	No	Previously identified as "UNKNOWN"
466	Aircraft Fuel Compound	8019	7828	780	285	8.5	61	Yes	No	No	Yes	Added during 6/01 visit
792	NSWU Warehouse - Boat Wash	514	253	25	29	10	140	No	No	No	Yes	
799	Oil Pollution Control System - Pier #3	2000	3163	316	250	0	123	Yes	No	No	Yes	
826	Aerospace Ground Support	826	1616	162	100	5	30	Yes	No	No	Yes	
827	Fire Department - Crash Crew	1128	8111	811	210	110	73	Yes	No	No	Yes	
860	Drone Support	3850	1833	183	68	9	5	Yes	Yes	No	Yes	Small leak in OWS wall - continuous stream of water entering OWS
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2036	Oil Spill Team Compound	1128	1496	150	69	8.5	105	No	No	No	Yes	
2298	Army Reserve Maintenance Hangar	1015	1885	188	97	5	88	Yes	No	No	Yes	
2300	Army Reserve - Boat Maintenance Hangar	1015	598	60	69	34	0	Yes	No	No	Yes	
2311	Temporary Wash Rack	3366	3016	302	400	8.5	903	No	Yes	Yes	Yes	Also called the 'swimming pool'
2339-1	Service Station/Mini Mart	500	269	27	11	8.5	0	Yes	No	No	Yes	
2339-2	Service Station/Mini Mart	500	269	26.928	11	8.5	0	Yes	No	Yes	Yes	Sanitary waste flowing directly into OWS
2345	Garbage Truck Wash Rack	500	957	96	44	8.5	65	No	No	Yes	Yes	Drain appears to be plugged
2358	USMC- Vehicle Maintenance Area	1150	381	38	59	8.5	36	Yes	No	No	Yes	
2364	Heavy Equipment Wash Area	3500	2467	247	211	26	153	Yes	No	No	Yes	
2431	Waste Management Area		2488	249	116	26	38	Yes	No	Yes	Yes	Added during 11/01 visit. Wash area drainage appears plugged and lift station pumps are inop in manual mode
3137	SeaBees Camp - Alpha Co.	1500	4907	491	478	52	27	Yes	No	Yes	Yes	Drain appears to be plugged
3152	SeaBees Camp - Bravo Co.	500	404	40	50	32	75	No	Yes	No	Yes	Missing concrete/exposed rebar

Note: Highlighted cells identify areas of concern