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AIR TANKER WASHDOWN FACILITIES FY-96 PROJECT STATUS REPORT



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C. Fred Cammack, P.E
Mechanical Engineer
San Dimas Technology & Development Center

November 1996

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INTRODUCTION

Recent environmental concerns have identified the need to address airtanker ramp and helicopter pad washdown residues. Even though the material is, for the most part, a liquid fertilizer, there are environmental impact concerns which affect each facility. Whether the residue is going into a collection system, into an evaporation lagoon, into the ground, or sprinkled onto the land, the Forest Service needs to consider the environmental impact, harmful or not. It is essential that approved disposal systems be developed and implemented before the Forest Service is faced with outside direction to correct the problem. Providing and implementing effective treatment and/or disposal systems, in the short term, may prove to be less costly than a directed clean up of retardant soaked land.

In Fiscal Year 1993 (FY-93) Aviation and Fire Management requested the Forest Service's Technology and Development Center in San Dimas, California (SDTDC) to assess air tanker base operations and recommend improved methods of aircraft washdown residues treatment and disposal. This assessment required visits to air tanker bases and detailed looks at base configurations and equipment. This report discusses the results of these findings generated from ongoing investigations and related work with bases throughout the country from FY-93 through FY-96. Recommendations and conclusions are provided, as are examples and references to bases that have implemented partial solutions to the residues management and treatment problem.

PROJECT OBJECTIVE AND ACTIONS

The objective of this project was to determine how to economically manage residues created from base operations in a manner that promotes environmentally proper treatment or disposal. To accomplish the stated objective the following actions were planned by SDTDC.

Fiscal Year 1993

Action 1

Survey and evaluate washdown residue separation methods currently used at Forest Service and cooperating agency bases in Regions 1, 3, 5, and 6.

Action 2

Prepare an interim report of findings at the end of FY-93 recommending the actions required to develop and implement standard residue separation hardware and procedures.

Fiscal Year 1994

Action 1

Complete the evaluation of washdown residue separation methods currently used at Forest Service and cooperating agency bases in Regions 1, 3, 5, and 6.

Action 2

Report findings at the end of FY-94 recommending the actions required to develop and implement standard residue separation hardware and procedures, and include this information as part of the 1995 edition of the *"Interagency Retardant Base Planning Guide—Fixed and Rotor Wing."*

Action 3

Determine if the development of residue handling equipment should be initiated by the Forest Service.

Fiscal Year 1995

Action 1

Provide engineering support to a participating region during the construction of a residues collection system at a selected airtanker base. Document implementation of the system design and performance when the base is completed.

Action 2

Determine if further development of residue handling equipment should be undertaken by the Forest Service.

Action 3

Publish a final report during FY-96.

PROJECT ACTIVITIES AND ACCOMPLISHMENTS

To carry out the planned actions for this project, SDTDC conducted activities that resulted in the accomplishments discussed in this section. The activities are chronological beginning with FY-93.

Fiscal Year 1993

Attendance at the Region 6 Air Tanker Base Managers Meeting at Redmond Air Attack Center Redmond, Oregon:

SDTDC Engineers Fred Cammack and Dan McKenzie were invited to participate in the Pacific Northwest Region Air Tanker Base Managers Workshop. The workshop was an opportunity for SDTDC to present their findings to date on the project, and to hear and discuss with Region 6 base managers their concerns regarding washdown residues handling.

At the beginning of the meeting each base manager presented an overview of the operations and problems at their base. Both slides and diagrams were used to emphasize key operational methods and issues. Having gained the insight provided by the base overviews, SDTDC left the meeting on May 18 to tour the bases in the State of Oregon. At the conclusion of the base tour, May 21, 1993, SDTDC returned to the meeting and reported their impressions and findings to the attendees along with preliminary recommendations for future improvements.

A group discussion was held to determine key problems, concerns and issues in the Region and where Region 6 Base Managers thought SDTDC should focus their efforts to provide maximum benefit to the Region and the Forest Service. Region 6 had varying degrees of problems at each base. The preferred residues handling method in the Region is to use a separation tank to collect residues and remove any oil or solids prior to spreading the resulting effluent, by use of sprinklers, onto dedicated land areas near the base. Not all bases have this system installed, and the problems observed with implementation of this type of system are discussed later. After the SDTDC base visits and review of base operations it was determined that defining standard criteria and methods of treatment is feasible. However, current methods used may still be acceptable if they can meet the criteria defined later in this report. Also, it may be optimistic to assume one system will work for all bases because of differences in base geometry, available land, local regulations and economic issues. SDTDC had already accepted standardization as a project goal and could provide design criteria and equipment suggestions. Detail designs would have to be developed for each base by the Region using the criteria resulting from this project.



Selection of study base

SDTDC met with Region 6 Fire Management and expressed an interest in participating in a project that would install a suitable residues treatment system at an operational base. This would provide an opportunity to demonstrate treatment methods and procedures to the Forest Service and serve as a model for future base installations. Region 6, at the time, was concerned over the possible loss of spreading grounds for washdown residues at the Medford Airtanker Base. It was suggested that SDTDC consider Medford as a possible development site for their proposed treatment system(s). To accomplish the project would require close cooperation between Region 6 Engineering and SDTDC and a minimum of two fiscal years to accomplish. The outcome of these activities along with the standard plans and specifications for the systems defined and installed at the Medford base would be made available to all of the Forest Service by incorporation of this information into the *“Interagency Retardant Base Planning Guide—Fixed and Rotor Wing”*.

Air tanker base visits

During the course of the year SDTDC engineers visited airtanker bases in Region 1, 3, 5 and 6 to observe their piping and equipment arrangements and to evaluate varying methods for handling and treatment of washdown residues. At the conclusion of the visits common issues became apparent and the formulation of alternative methods for standardization of washdown treatment and handling were considered. Several bases visited in 1993 have already begun to correct some of their problems. Commentary on the observations made during these 1993 visits is provided below.

Missoula, Montana—Region 1

Washdown residues resulting from base operations are collected in a common sump and spread on adjacent land areas using a sump pump and sprinklers.

Sky Harbor, Phoenix, Arizona—Region 3

This base currently uses liquid concentrate products. An interesting feature of this base is the way washdown residues are handled and the provisions made to deal with potential retardant spills or tank leakage. Residues are managed so any fluids not evaporating on the runway (temperatures in Phoenix are extremely high and humidity very low during fire season) drain into a sump that is central to the loading ramp. The sump contents are pumped into a 5,000 gallon waste recovery tank for later removal from the base. There is a recessed spill containment pit located under the base storage tanks and their respective plumbing (figures 1 and 2). This containment pit was sized to contain all of the stored fluids on the base in the event an aircraft should veer off the runway and crash into the tanks. It also has a drain that is connected to a nearby sewer to drain water resulting from storms. The drain has a valve that is shut off during base operation to prevent retardant spills from draining into the sewer. Collected spills are pumped out and removed from the base for disposal when necessary. At this base, if washdown water is conserved, it is possible to potentially have no significant buildup of waste liquids. Basically this method, if managed well, isolates all wastes produced from the local environment.



Figure 1. Storage Tank Containment—Phoenix, AZ.

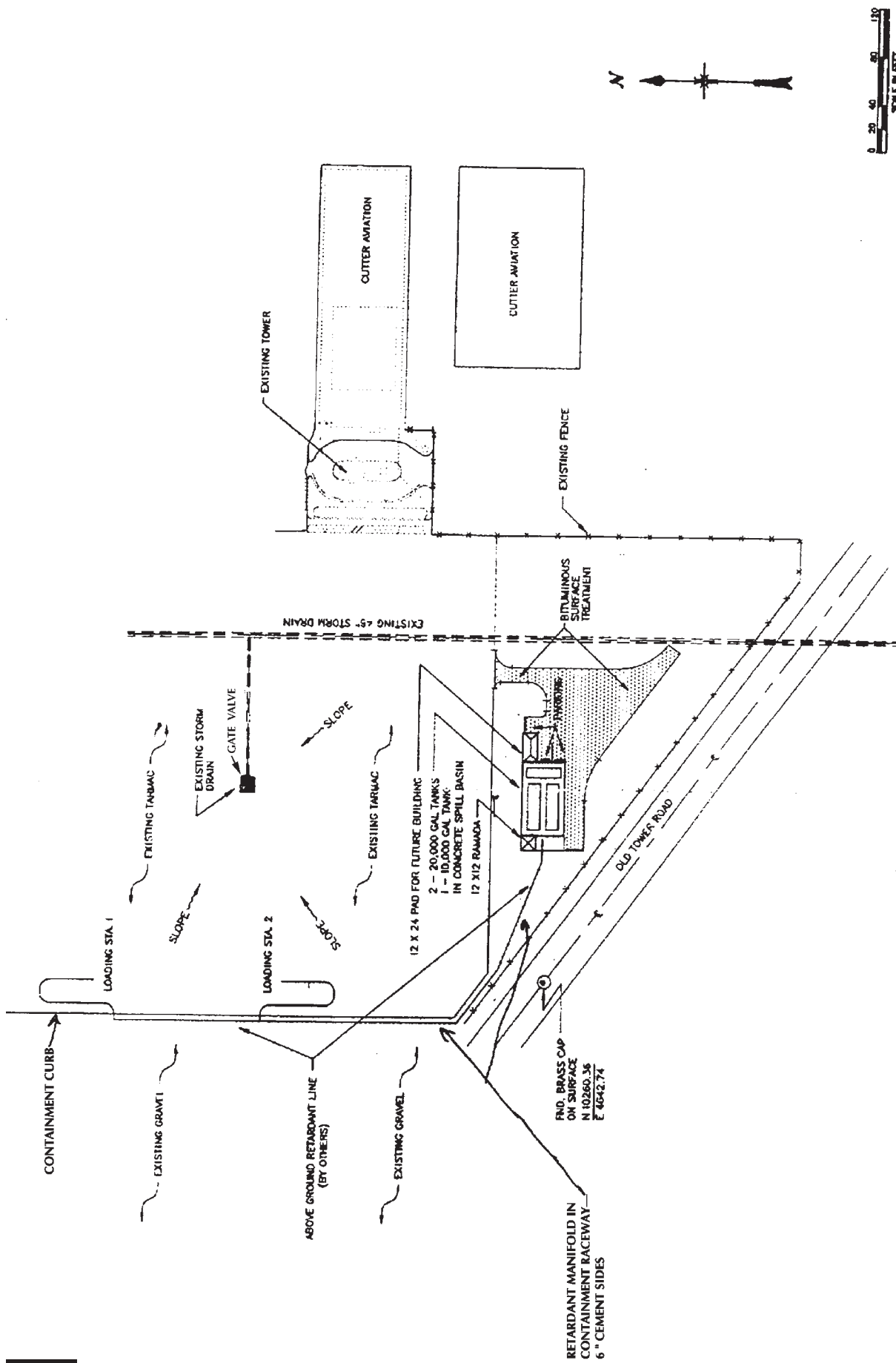


Figure 2. Base Layout—Phoenix, AZ.



Prescott, Arizona—Region 3

All wastes are collected in an evaporation lagoon (figure 3) where they are eventually evaporated. The climate in Prescott supports the lagoon concept. The exact reasoning for choosing the lagoon verses other methods was discussed. The plan was to provide a system that isolated all base produced wastes from the local environment. The design choices used to define the lagoon in terms of construction criteria and materials used are available for those interested from Prescott National Forest Engineering. Recirculation and other fluid handling is similar to the methods used at Phoenix.

Ryan Field, Hemet, California—Region 5

This base is a State of California facility. The primary concern of the visit was to review washdown residues handling at the base. The base uses dry powder products which are mixed with water and the resulting liquid retardant stored at the base. Washdown residues are collected in drainage ditches and conveyed to a separation tank and sump (figures 4, 5, and 6). When the sump is nearly full it is pumped out and spread in a field next to the base office. Spreading is accomplished by use of sprinklers. Periodically, settled salts are removed from the bottom of the tank by pumping the salts into a truck for offsite disposal. There was no visible soil or vegetation damage in the disposal field. The loading ramp and storage tank pad were large concrete surfaces (figure 7).

Because of these large surfaces, and the climate in Hemet during fire season, the sheet flow of washdown residues over these surfaces encouraged evaporation. There was no visible buildup of oily residues on the base. The base requires that aircraft maintenance be accomplished offsite.

Ramona, California—Region 5

At the time of the visit, this base had not installed a washdown residues treatment system. In the past no provisions for treatment of washdown or maintenance residues had been made. Residues were washed to the side of the runway and allowed to soak into the soil. There are plans underway to require the base Contractor to provide residues handling and treatment. The methods to accomplish this had not been defined at the time of the SDTDC visit. To date, Ramona has not reported any improvements to SDTDC.

Santa Barbara, California—Region 5

During the SDTDC visit the base was being refurbished by the base Contractor. Santa Barbara also uses powder products that are mixed with water and the resulting liquid retardant stored for use. The base handles washdown residues by draining the entire facility into a single collection trench (figures 8 and 9). The trench has a sump at one end that is pumped out whenever necessary. The collected residues are trucked offsite for proper disposal. The base has contracted with an approved waste disposal service to pump and truck the residues. The service is required to provide the base with a receipt from a pre-approved disposal site showing that removed wastes were disposed of in an environmentally proper method. Water conservation is practiced to minimize washdown flows. Airtanker crews are required to use a pressure washer for aircraft cleaning (figure 10).

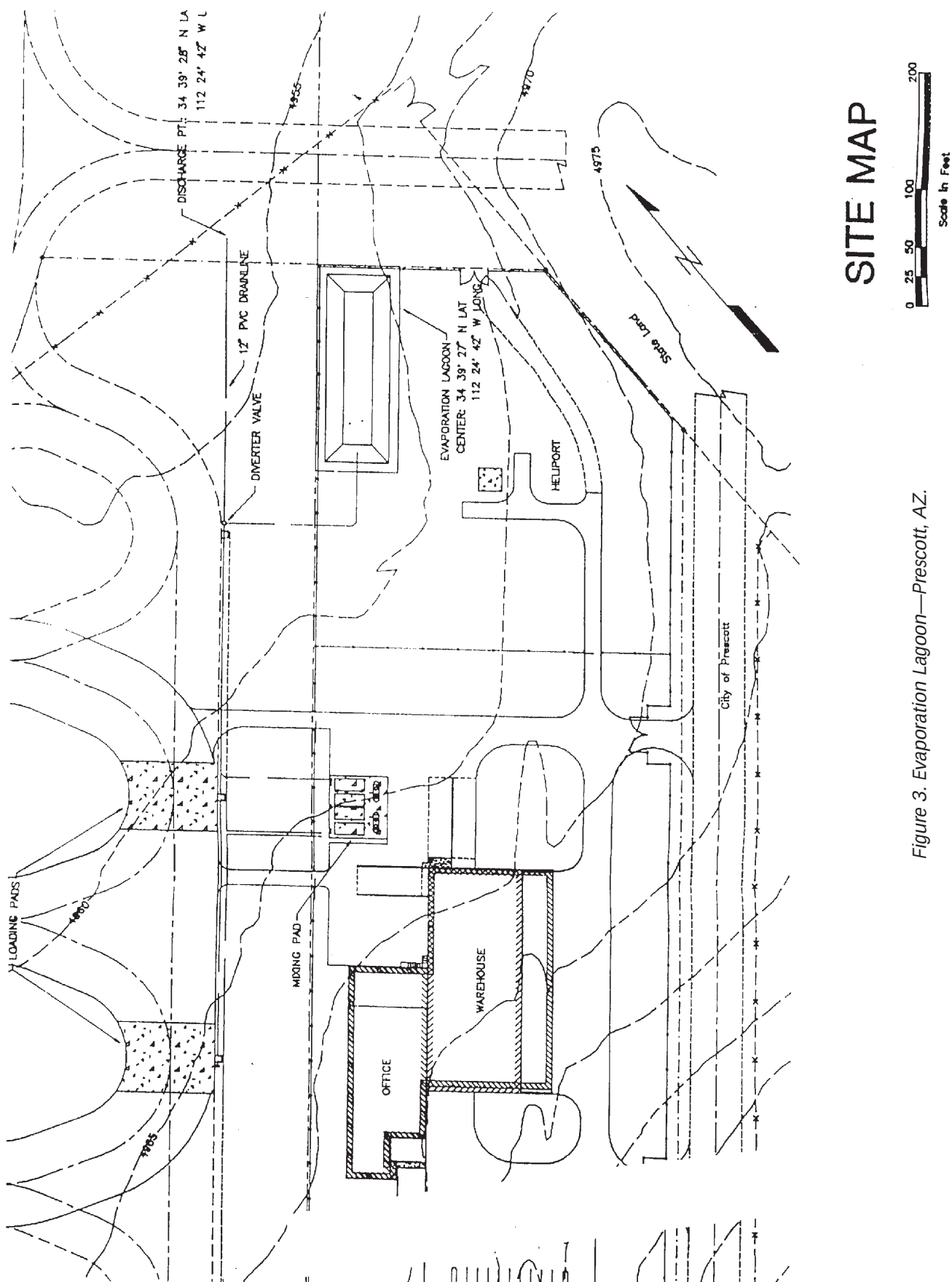


Figure 3. Evaporation Lagoon—Prescott, AZ.



Figure 4. Retardant Storage—Hemet, CA.



Figure 5. Base Drainage Ditches—Hemet, CA.



Figure 6. Residues Sump—Hemet, CA.



Figure 7. Loading Ramp & Base Overview—Hemet, CA.



Figure 8. Storage Tanks—Santa Barbara, CA.



Figure 9. Drainage Trench—Santa Barbara, CA.

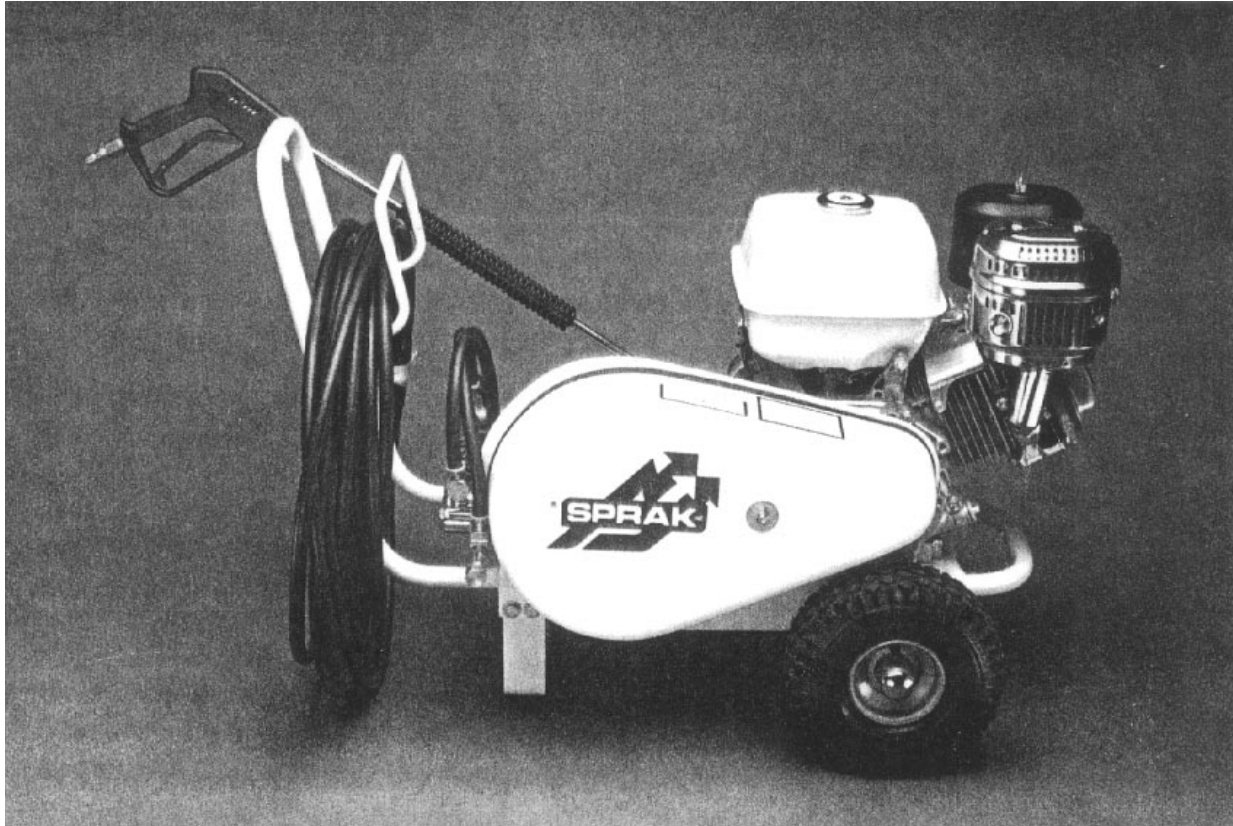


Figure 10. Pressure Washer.

The amount of water required to clean an aircraft with a pressure washer is estimated not to exceed 200 gallons. Because of the large concrete ramp surface, the fluids from washdown activities usually evaporate before they reach the collection trench. The trench volume is large enough to collect and contain a large retardant spill until it can be pumped out and removed from the base. Aircraft crews are required to place drip pans filled with oil absorbent sand under the aircraft while performing minor maintenance. Major maintenance is performed offsite. Significant retardant spills are contained by surrounding the spill with a pressurized fire hose until it can be broomed or squeegeed into the collection trench.

Region 6

As mentioned previously, in conjunction with the Airtanker Base Managers Workshop in Region 6, five bases in Oregon were visited.

- ◆ Redmond
- ◆ La Grande
- ◆ Lakeview
- ◆ Kingsley Field, Klamath Falls
- ◆ Medford



Earlier in the year, the base at Troutdale, Oregon was visited and the base at Wenatchee, Washington was viewed in 1992. All bases visited in Region 6 used liquid concentrate products. Washdown residues handling and treatment varied between bases in the Region. At the Base Managers Workshop an interest was expressed in the development of a standard method that could be used for all bases in the Region. This objective was in mind during the SDTDC visit to each base. It turned out that variations of standard treatment and handling of residues appeared to be feasible. However each base, because of its geometry and existing drainage, would need a slightly different design. The idea was to minimize the cost of modifications by using existing features at each base as much as possible. An overview of existing features and problems observed is discussed below.

Wenatchee, Washington. This base, as mentioned previously, was visited in 1992. During the time of the visit the base was being used as a test base for fluid concentrate products. A thorough overview of residues collection from the aircraft loading area was not conducted. It is understood the runoff is collected in a sump which is pumped, when necessary, into sprinklers located in a field adjacent to the runway and next to the retardant storage tank concrete pad (figure 11). The effluent is spread via sprinklers in this area and is allowed to soak into the ground. The tank storage



Figure 11. Storage Tank Pad—Wenatchee, WA.

pad drainage is directed into the same area. Runway slopes along the length of the spreading field appear to allow drainage without diversion into the same general area. There was evidence of high concentrations of retardant salt buildup in the spreading field (figures 12 and 13). This buildup appeared to have inhibited the growth of vegetation at the low points and produced a poor aesthetic impact for the base. Visual evidence of hydrocarbon accumulation was not apparent and could not be determined without conducting soil tests.

Troutdale, Oregon. This base uses a common collection trench to collect residues. The collected residues are drained into a series of large wells on the base where the residues are allowed to soak into the ground (figures 14 and 15). This method does not cause any surface accumulation of residues and there is no aesthetic impact using this procedure. Vegetation in the vicinity of the wells appears to be healthy. The use of this method concerned SDTDC because of the close proximity of the base to the Columbia River. It was assumed because of the river and the high amount of rainfall in the Columbia Gorge, the water table would be fairly high at the base. If this assumption is correct, most of the residues may end up in the Columbia River each year. If this does occur, the impact to the river should be determined (if it has not already been done). Since this base is used only for airtanker reloading operations there may not be a significant buildup of residues during any given year.



Figure 12. Residues Spreading Field—Wenatchee, WA.



Figure 13. Residues Spreading Field—Wenatchee, WA.

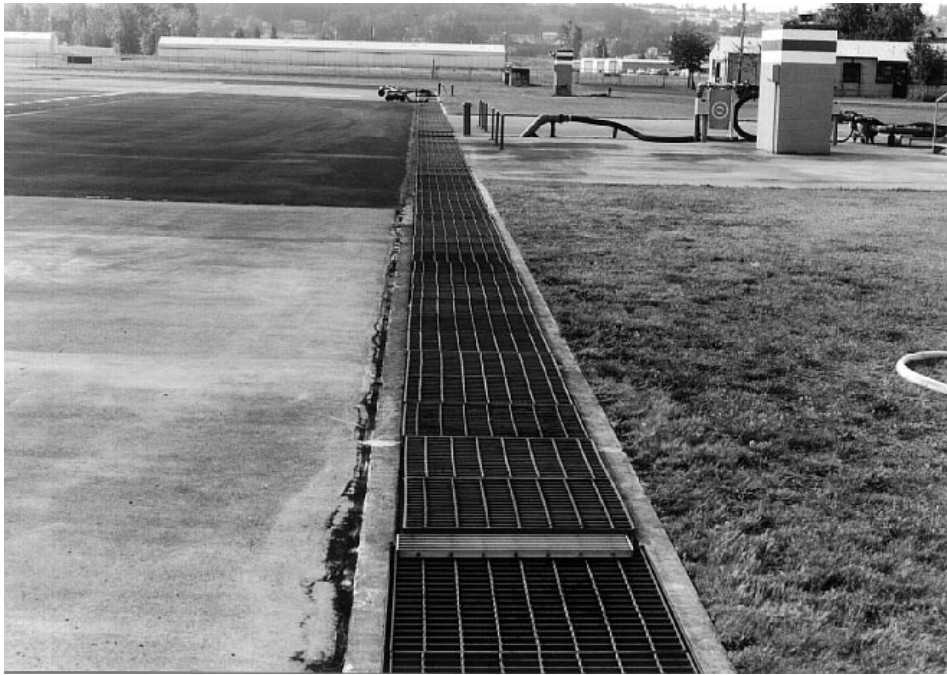


Figure 14. Residues Collection Trench—Troutdale, OR.



Figure 15. Residues Collection Wells—Troutdale, OR.



Redmond, Oregon. Redmond takes advantage of existing runway slopes to move surface flow of washdown residues to a drainage grate near the runway where residues drain into nearby separation tanks (figure 16). The tanks are pumped, as required, into a sprinkler system and the effluent is spread over a nearby field and allowed to soak into the soil (figure 17). Periodically, salt buildup in the separation tanks is removed and disposed of offsite. There was no mention of the need to remove separated hydrocarbons. The tanks have shutoff valves for isolation during rainstorms. The spreading area showed some impact to the vegetation. The area was red in hue from a buildup of iron oxide coloring on the soil and vegetation. The runway adjacent to the drainage had a reddish hue from the prevailing winds blowing washdown residues from the drainage depression onto the adjacent runway.

La Grande, Oregon. The tanks at La Grande are located at a high point on the runway. Taking advantage of existing runway slopes, aircraft washdown residues are drained into strategically located grates in the loading area (figure 18). The residues are transported (depending on the grating) to wells located in fields at opposite ends of the base where they soak into the soil. The wells have isolation valves to prevent them from filling with storm runoff. A third well is located behind the storage tank concrete pad (figure 19) and receives residues from base maintenance operations in the tank area.

There is some evidence of residues buildup near the well sites. Vegetation at the disposal wells did not appear to be harmed. There is some concern at the base concerning the long-term impact of this disposal procedure. The base has a nearby sewer pipe connected to the city sewer treatment plant. It may be feasible (if the city agrees) to dispose of residues in the sewer. Several items would require engineering expertise to determine if the method is feasible. While in La Grande SDTDC visited a local fertilizer supplier to look at their evaporation lagoon used to dispose of washdown residues (figure 20). The lagoon was lined with roofing paper coated with a rubberized roof sealing compound. SDTDC was interested in determining if similar low cost lagoons could be used elsewhere by the Forest Service. This method is currently in use at the base in Prescott, Arizona. However, the Prescott lagoon has a more substantial liner. The climate at La Grande could support this method.

Lakeview, Oregon. Lakeview allows washdown and maintenance residues to drain off the side of the runway into a pit adjacent to the base (figure 21). The pit overflows, when full, into a culvert that carries the excess under the base access road and onto a field where it is allowed to spread and soak into the ground (figure 22). The runway adjacent to the base has a series of grated dry wells that collect any other runoff on the runway and allows the runoff to seep into the ground. The accumulation of residues in the pit over the years has created a rather unsightly coloration of the pit walls. This may cause public concern in the future. Lakeview has corrected some of their problems.

Kingsley Field, Klamath Falls, Oregon. Klamath Falls has grated drains located in the aircraft loading areas (figure 23) that collect all residues produced at the base. The drains are connected to underground pipes which carry the residues to a separation tank alongside the runway. The tank overflows into a sump (figure 24) which is pumped, when required, into a sprinkler system located in a field behind the base tower building (figure 25). The effluent is spread by the sprinklers onto the field and is allowed to soak into the ground. There was evidence of some vegetation damage in the spreading field. The field is colored a reddish hue from the sprinkler spreading. Behind the tanker base tower there is an unlined storm drainage ditch for runway storm runoff collection. This ditch separates the residue sump from the spreading field (figure 26). The ditch has a red stain on the soil and vegetation near the sump indicating that the sump has overflowed from time to time into the ditch. This overflow was probably due to not isolating the separation tank and sump from runway runoff during rain storms. The tanks have isolation valves for use during storms. Salts collected in the separation tank are removed periodically and hauled off base for proper disposal.



Figure 16A. Runway Adjacent to Base—Redmond, OR.



Figure 16B. Runway Drain—Redmond, OR.



Figure 17. Spreading Field—Redmond, OR.



Figure 18. Ramp Drainage—LaGrande, OR.



Figure 19. Storage Tank Pad LaGrande, OR.



Figure 20. Evaporation Lagoon—LaGrande, OR.



Figure 21. Residues Collection Pit—Lakeview, OR.



Figure 22. Overflow Culvert and Drainage—Lakeview, OR.



Figure 23. Runway Drain—Klamath Falls, OR.



Figure 24. Separation Tank Sump—Klamath Falls, OR.



Figure 25. Spreading Field—Klamath Falls, OR.



Figure 26. Runway Drainage Ditch—Klamath Falls, OR.

Medford, Oregon. Medford has a series of lined trenches covered by grating used to collect base residues (figures 27 and 28). These trenches perform a dual function. In addition to the collection of washdown residues they are used to house the base pipe runs. The trenches take advantage of the existing runway slope and transport collected residues to an unlined dirt ditch where they are transported to a culvert (figure 29) under the base access road. The culvert carries residues to a settling pond located in a field across the road where they are allowed to soak into the ground or evaporate. There are no provisions to separate the salt and other materials from the runoff. Also, there is no provision to isolate runway storm runoff from the collection system. The base has been notified by the airport that they may lose use of the settling pond area and if this should occur a new system requiring less land area would be required. If a suitable system cannot be designed for the smaller site, the base may have to relocate. As mentioned previously, during the Region 6 Base Managers Workshop, Medford was offered as a test site for SDTDC's implementation of a suitable disposal system. During the visit to the base SDTDC determined a suitable system could be designed within the remaining base area. The components of a system for this base as well as for other constraints of the problem bases in the Region are discussed later in this paper.

A consulting firm, Martech International, Inc., was engaged by SDTDC to study the problems. The firm submitted a survey report to SDTDC that addressed the problems and suggested potential treatment methods for airtanker base residues. Their report is included as Appendix A. At the end of FY-93 a report of the findings with recommendations for FY-94 was submitted to the Fire Program Leader at SDTDC along with recommended actions for FY-94. Those actions were approved by Fire Management for implementation during FY-94. It was agreed by Region 6 that a base, or bases, in the Region would be used to develop the methods identified and recommended as result of the work accomplished this year.

Because of the variety of site specific problems encountered in the FY-93 SDTDC survey, additional surveys were conducted during FY-94 and -95. Meetings were also held with manufacturers and consultants to determine if a universal solution could be identified. Waste management guidelines were presented by SDTDC at Regional meetings of airtanker base managers and published in the *"Interagency Retardant Base Planning Guide."* Technical support was given to Forest Service and BLM engineers planning base modifications or new bases in Regions 1, 2, 3, 5 and 6.

Fiscal Year 1994 **November 1993**

SDTDC contacted Region 6 and requested a cooperative effort be initiated between the Region and SDTDC to implement the recommendations and findings. This conversation was followed by a memorandum from SDTDC to the Region 6 Director, Aviation and Fire Management listing the issues and the SDTDC findings. The memo requested the Region enter into a cooperative agreement.

January 1994

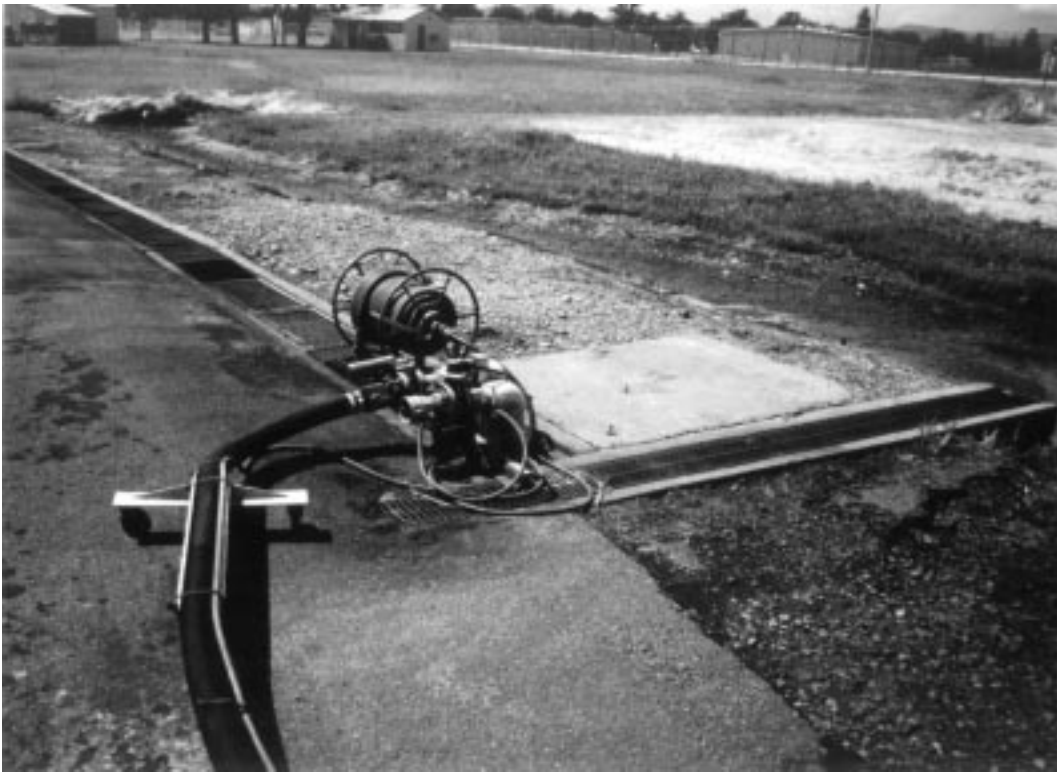
Region 6 was contacted by SDTDC and a meeting was requested to set up the terms of cooperation between SDTDC and Region 6. In addition, the meeting would identify bases within the Region to be used or upgraded to demonstrate and study SDTDC recommended methods for base waste residues treatment. The Region agreed to meet in February at the Redmond Air Center. Also during this month SDTDC was contacted by Region 2 requesting information on any findings that could help in the design of Jeffco Airtanker Base in Colorado.



Figures 27 A&B. Loading Ramp Drains—Medford, OR.



Figures 28 A&B. Tank Pad Drain—Medford, OR.



Figures 29 A&B. Residues Drainage Ditch—Medford, OR.

February 1994

A meeting was held February 7 and 8 at Redmond Air Center in Region 6 to define the elements of a cooperative effort between SDTDC and Region 6 to design an effective residues management and treatment system at a base within the Region. At the conclusion of the meeting it was decided that the Redmond Air Tanker Base would be upgraded and used to implement a residues management system. To accomplish this SDTDC and Region 6 agreed to the following actions.

1. SDTDC would provide preliminary waste handling/management system layouts and equipment requirements to the Deschutes National Forest Engineering for review and comment by March 15, 1994.
2. SDTDC would provide a pressure washer to Redmond Air Tanker Base by May 1994 for use during the FY-94 fire season. SDTDC requested the base report their evaluation of its usefulness at season's end.
3. SDTDC would assist Deschutes NF when requested (governed by available SDTDC funding and resources) in the development of a preliminary set of contract drawings and specifications for the Redmond Base.
4. A preliminary review of drawings and specifications was tentatively planned for early July 1994 in Redmond between SDTDC, Redmond Base personnel, and Deschutes National Forest.
5. A final review of drawings and specifications for Redmond Base was planned for mid September 1994.
6. SDTDC agreed to assist during base modifications at Redmond and facilities check-out as requested by Region 6.
7. SDTDC agreed to work with Region 6 and Redmond base personnel during FY-95 and -96 to assure successful implementation of residues management at the base.
8. SDTDC would report their findings at the end of FY-96.

March 1994

SDTDC sent their preliminary plans for Redmond Airtanker Base to Deschutes National Forest for review and comment. A pressure washer for the Redmond Base was ordered. During this month SDTDC received preliminary drawings of the Jeffco Base from Region 2 for review and comment. Most of SDTDC's ideas concerning residues management were considered by Region 2 and incorporated into their plans. SDTDC was contacted by the Apache-Sitgreaves National Forest requesting help and information to support planning of upgrades on the Winslow Airtanker Base. SDTDC provided names of people in Regions 2, 5 and 6 who were currently involved in base upgrades. Also, the Forest was sent copies of information developed to date by SDTDC concerning base residues management. SDTDC attended the Region 3 Airtanker Base Managers Workshop where findings on base residues management were presented. This information generated interest from the base manager at Silver City, New Mexico. Since the workshop, SDTDC has discussed their plans for upgrading the base residues treatment facility and encouraged Silver City to implement as many SDTDC recommendations as possible.



April 1994

A meeting was held between SDTDC and the Deschutes National Forest at the Redmond Airtanker Base to discuss the SDTDC plans for that base (figure 30). A list of changes was generated at the meeting and incorporated into the base plans. At the conclusion of the meeting it was decided to meet again in June to go over implementation of items discussed into details to be prepared by the Deschutes Facilities Engineer.

May 1994

A pressure washer was delivered to Redmond (appendix A-1).

June 1994

The Deschutes Facilities Engineer was contacted by SDTDC for a status report on the plans and specifications for the Redmond base. Other priorities had delayed their work on the plans and SDTDC agreed to check back with the Forest at the end of July for an update. The meeting in July did not take place because of an unusually busy fire season. It was agreed SDTDC would check back with all parties in August and a meeting was tentatively scheduled for the end of August in Region 6.

July & August 1994

During this period on-going coordination was maintained with Regions 2 and 3 to keep abreast of developments in the rehab planning for Winslow, Silver City and Jeffco. Region 6 was put on hold until the end of August. In the meantime calls came in for help from BLM at Grand Junction, Colorado. BLM was looking at a comprehensive plan to upgrade the Grand Junction Airtanker Base. SDTDC assisted by sending their project files to the base manager. BLM was particularly interested in the Center's ideas on waste treatment. Contact was made with PureMat Recovery Systems, Inc., an Arizona company, that provides a product designed to recover and treat aircraft deicing and washdown residues (figure 31 and appendix D). The product looked like it would meet some of the objectives SDTDC had to treat and manage airtanker base residues. SDTDC traveled to the Las Vegas Airport in August and met with Jack Henessee, President and Owner of PureMat, to look at the product. After the Las Vegas meeting, SDTDC accompanied Mr. Henessee to the bases at Winslow and Prescott Arizona to view typical bases and their respective problems. Mr. Henessee showed Winslow base planners a video on the PureMat System as well as allowing SDTDC to interface with Region 3 on the Winslow base planning. The Winslow base plan, if fully implemented, would take into account the primary features of the SDTDC residues management recommendations. At the end of August SDTDC contacted all parties in Region 6 for a status report. An intense fire season and other issues had prevented any activity on the Redmond Base. At this point the opportunity to prepare contract plans and specifications for Redmond by the end FY-94 had passed.

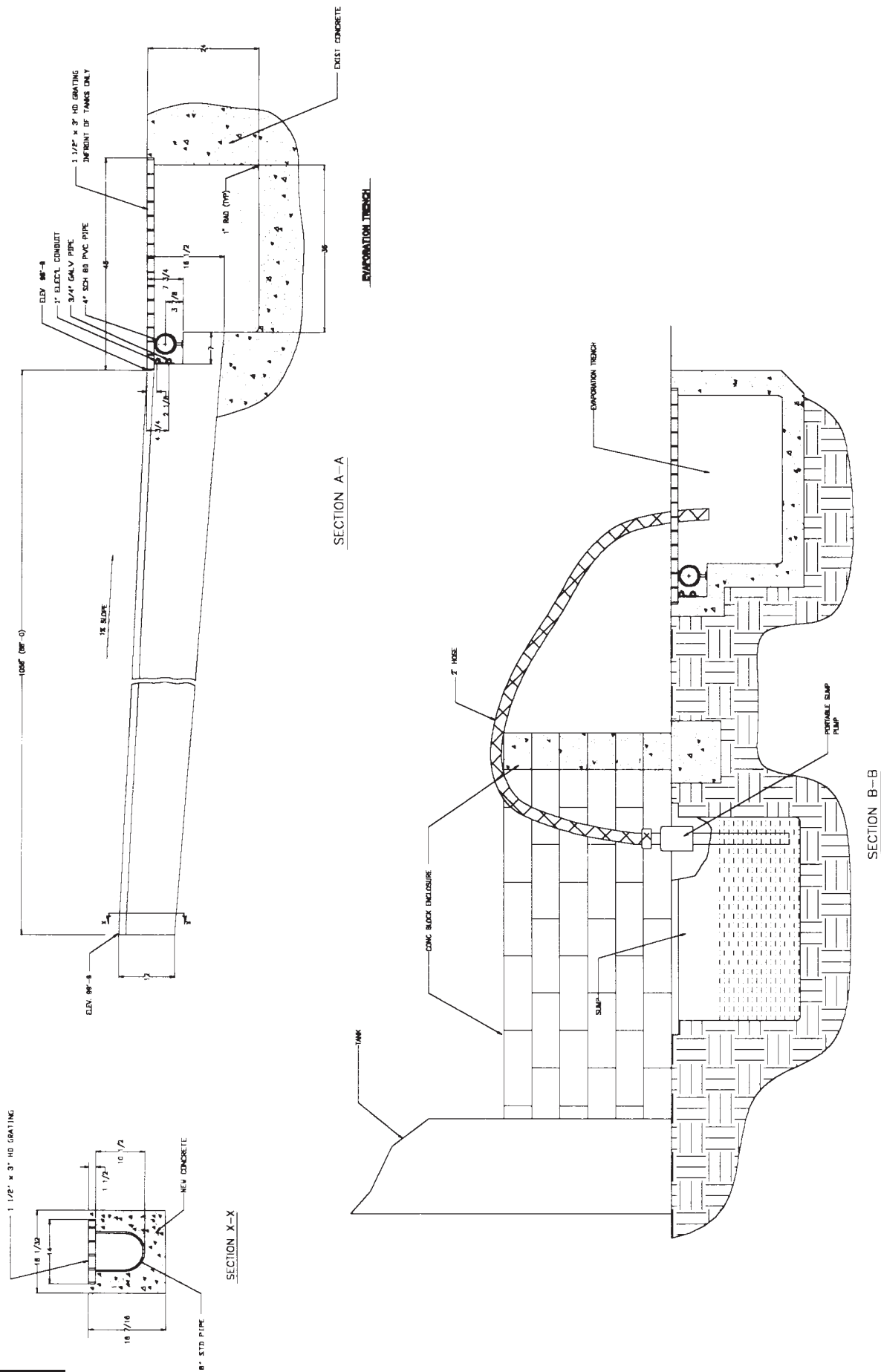
September 1994

A meeting was requested by SDTDC with Fire Management in Region 6 to discuss the residues treatment project. The purpose of the meeting was to determine a plan to put the project back on track and accomplish FY-94 goals in FY-95. The meeting was held in the R-6 Regional Office.

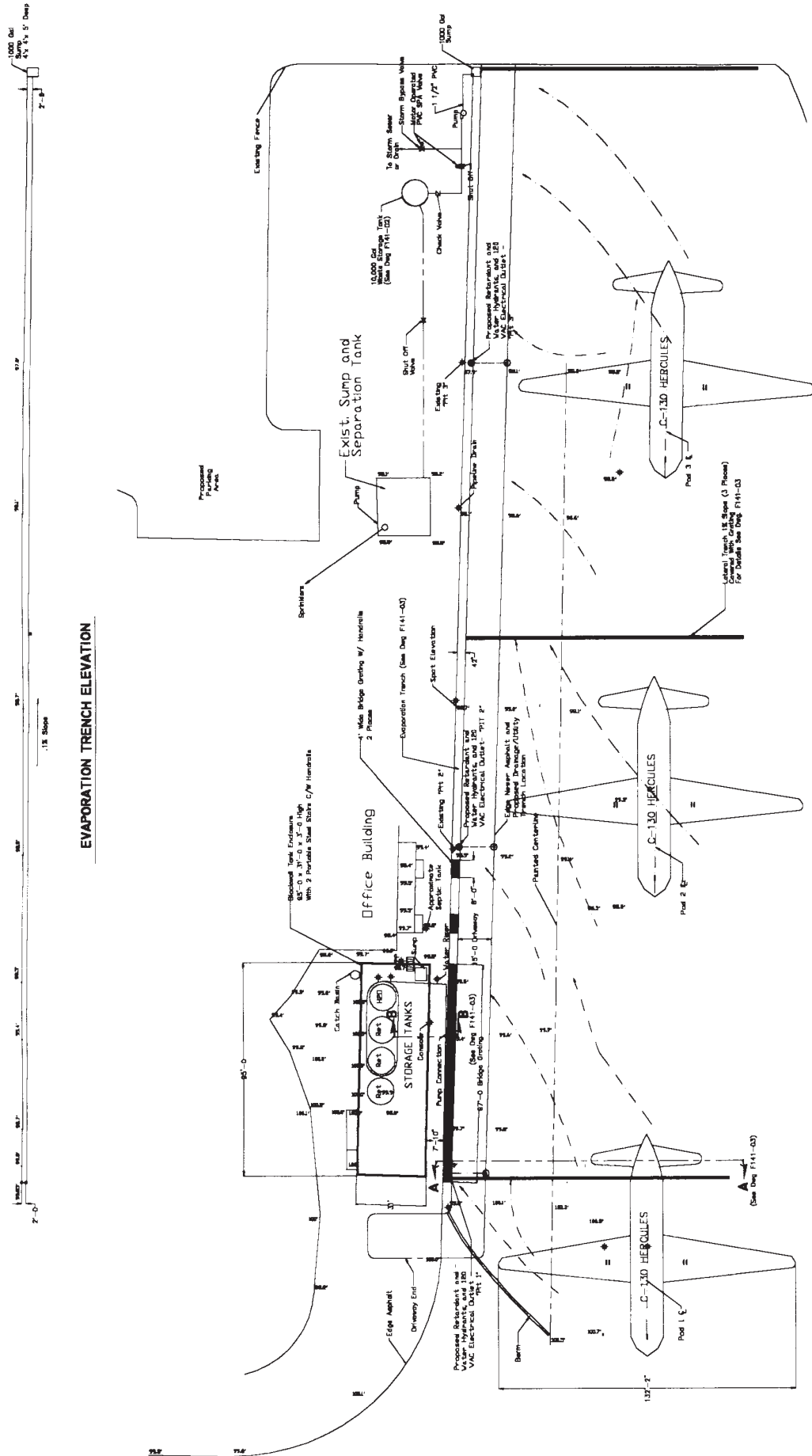
The main topic addressed was the SDTDC concerns that Region 6 had not been able to fully support project needs at Redmond. A review of the information provided to the Region during the year was conducted. SDTDC wanted to see if the project was still on track, review accomplishments with Region 6, and determine who SDTDC should coordinate with to continue the work planned for the

NOTES:





Figures 30A. SDTDC Preliminary Layout for Base—Redmond, OR.



Figures 30B. SDTDC Preliminary Layout for Base Drainage Trench Details—Redmond, OR.



Figures 31 A&B. PureMat Residues Collection Mat and Treatment System.



Redmond base. Region 6 assured SDTDC that the Region wanted to continue with all aspects of the project. It was agreed SDTDC would travel to Redmond the following day to meet with the principals at the base and get things started. The key issue at the Redmond base was funding. Where would the dollars come from to prepare the detailed plans in FY-95 and the following two fiscal years to accomplish the construction. Preliminary estimates indicated that \$100,000 would be needed for plans and specifications and an additional \$800,000 or more to accomplish base improvements. These estimates are subject to change as more information on total base needs are identified. Region 6 planned to do a needs assessment of all their bases to determine where best to spend improvement dollars. Until that assessment has been completed it was uncertain if all the goals at the Redmond Base could be fully supported. A video tape explaining the PureMat Recovery System was viewed at the end of the meeting.

As planned, the day after the meeting, SDTDC met with base personnel at Redmond. Issues concerning base upgrades were discussed without resolution pending funding commitments from the Region. Use of the pressure washer was discussed with the base manager. Base personnel complained that gum thickened retardant was nearly impossible to wash off asphalt ramp areas and increased base waste volumes by having to use high pressure fire hoses to clean asphalt surfaces and aircraft. The pressure washer was not effective cleaning gum off asphalt; however, the washer worked well with retardants that did not use gum for thickening.

October 1994

Pat Basch the Air Service Manager at Grand Junction airtanker base requested a meeting with SDTDC and BLM engineers at the base to discuss proposed upgrades and to review base issues with BLM engineers and management. SDTDC agreed to the meeting because of a commonality of issues between BLM and the Forest Service. Meetings were conducted with BLM throughout the first week of October at Grand Junction. Key issues discussed included the current set of base plans, what looked best for the base in terms of overall planning, funding issues and residues management. SDTDC



Figure 32. Retardant Storage Tanks—Grand Junction, CO.

was given a general orientation of base issues and inspected base facilities. The SDTDC evaluation of the base in terms of residues management is discussed below.

1. The retardant storage area needed a tank-spill containment system and better drainage (figure 32).
2. The ramp drainage needed improvement to assure containment and controlled run-off of aircraft washdown and retardant spills.

3. The residues collection and drainage system consisted of a dirt trench at a low point off the side of the ramp. The trench received ramp runoff and channeled into a collection basin (figures 33 and 34). The basin was constructed by use of dirt dikes around the edges and had a small overflow spillway. The primary problems with the system were:

(a) Collection trenches and basin were not lined and allowed residues to soak into the soil.

(b) Storm runoff drained into the same system without diversion. The collection basin was not large enough to handle storm runoff. Storm waters would flush out the basin over the spillway causing stored wastes to flow into the surrounding environment and eventually soak into the soil. Storm water diversion is a requirement for the system to have any integrity.

(c) Not all runoff made it to the collection trench due to ramp drainage slope problems.

4. Environmental impact at the base.

(a) Currently no consideration is given to waste management by attempting to segregate ramp accumulated wastes by types.

(b) The ramp drainage is not adequate to assure all runoff is channeled to the correct location.

(c) Runoff waste collection and treatment is not environmentally acceptable.

The meeting adjourned without a decision on funding to support the needed base upgrades. Everyone agreed that the plans discussed were fairly well thought out and with some minor revisions could be used as a base master planning document.

November 1994 - Present

SDTDC completed the "*Interagency Retardant Base Planning Guide*" and it was published in May 1995. Included in the appendix are the Center's current recommendations on base residues treatment management and planning.

During the months of August and September 1995 SDTDC toured selected bases in Region 1, 3, 4, 5, and 6 to define solutions to common residues management problems. The information gathered from these site visits is discussed later in this report with respect to base-common problems and issues.

SDTDC is currently participating in the funding of the initial planning, and providing consulting services to Region 6 in the redevelopment of the airtanker base at Wenatchee, Washington. SDTDC has consulted with Region 6 on current planning for the Medford base. Based on the experience gained from base surveys conducted, and evaluation of waste treatment problems experienced during the planning of Wenatchee and other base upgrades from FY-94 through FY-97, SDTDC will determine, in FY-97, if further development of waste treatment systems by the Forest Service is needed. Ongoing technical support will continue to be provided by SDTDC by answering requests for technical information from all bases to encourage the implementation of SDTDC waste management planning. Information gathered to date from this project is included in this report.



Figure 33. Unlined Drainage Trench—Grand Junction, CO.



Figure 34. Residues Collection Basin—Grand Junction, CO.



The future of the washdown/residues treatment project is uncertain at this time pending one base mentioned in this report receiving funding to implement SDTDC recommendations. Because of the large capital costs involved at each base to achieve treatment goals, it may be sometime before any base is fully funded to install the needed equipment and modify their waste collection system. In the meantime, SDTDC plans to continue with investigations to define improved waste treatment methods and equipment.

FINDINGS

Investigation of Washdown Problems and Tentative Solutions

As a result of the base surveys conducted, an overview of base residues handling problems and solutions was defined by SDTDC. A description of some of the methods used were discussed earlier in this report. The need to define more standard operating procedures and handling methods was a concern at all bases visited.

Washdown Residues Treatment

As a result of airtanker base visits SDTDC determined the handling of residues resulting from base operations was as much of a base management issue as it was an issue of developing new equipment or methods. Parts of a workable system were present in most bases visited. However, few had addressed the entire problem. It was concluded the sensible way to solve the problem was to divide the problem into elements of base operations from which residues are created. Once these elements are defined, it is then possible to provide a method to handle treatment of wastes based on their type and source. Prior to defining methods it was necessary to define what the objective of the final treatment should be. It was concluded the only reasonable objective was to assure that wastes were contained and disposed of in a manner that guaranteed the environment surrounding the base (within the control of the Forest Service) would not be impacted in any manner. To assure this meant all waste residues produced would be handled in a manner to assure their total containment and eventual treatment or removal from the site via an approved method.

Base operations were divided into the following elements from which residues are created.

Aircraft Washdown

Retardant Storage & Delivery Facility Maintenance

Accidental Spills

Aircraft Maintenance

A standard management plan for each of these potential sources of residues should be developed and implemented at each base. Each source has its own unique problems and requires facilities able to deal with these problems as well as personnel trained to respond correctly if the need arises. The problem with handling all elements with a single treatment method and response is the extremely high cost of providing a catch all solution. If an integrated management plan is used instead, elements of an existing system may still be usable and a lower cost modification may be possible.



Facilities Planning

Prior to defining and implementing a waste management plan it is necessary to look at the issues and decision factors that must be considered to plan an effective waste handling facility. Some of the primary considerations are discussed below.

Basics

The Forest Service is responsible to local governments to properly handle the wastes resulting from their operations.

- ◆ You can't treat or dispose of residues unless they can be collected first.
- ◆ You can't define a system to treat waste unless you know how much, and what type of waste requires treating.
- ◆ Economical disposal may depend on certification of the composition of the waste products being disposed of—if you don't know what is in it, it usually costs more to get rid of it.
- ◆ Don't collect storm runoff in your waste collection system. Provisions to exclude or bypass storm waters are essential.

Collection Methods

- ◆ One drain located at the low point in the facility catches all residues via a system of gutters or surface depressions. (This requires careful planning of ramp grading and concentration of facility sheet flows).
- ◆ Individual drains at aircraft service locations, loading ramps, and retardant storage & loading facilities interconnected by sub-surface drain pipes to a common collection sump or tank (figures 35 through 39).
- ◆ Use of barrier walls around (or pits under) tanks & piping to collect spillage and maintenance washdown runoff and channel it to a collection sump (figures 40 through 44).
- ◆ Use of barriers around aircraft service areas (such as sand bags, curbs, asphalt bumps, pressurized fire hose, etc.) to dam, concentrate or direct residues into a location where they can be concentrated for disposal (figures 45 and 46).

Collection system selection and sizing depends on

- ◆ Existing base grades.
- ◆ Anticipated runoff.
- ◆ Capacity of waste treatment facilities downstream.



Figure 35. Aircraft Loading Pad Drain—Fresno, CA.

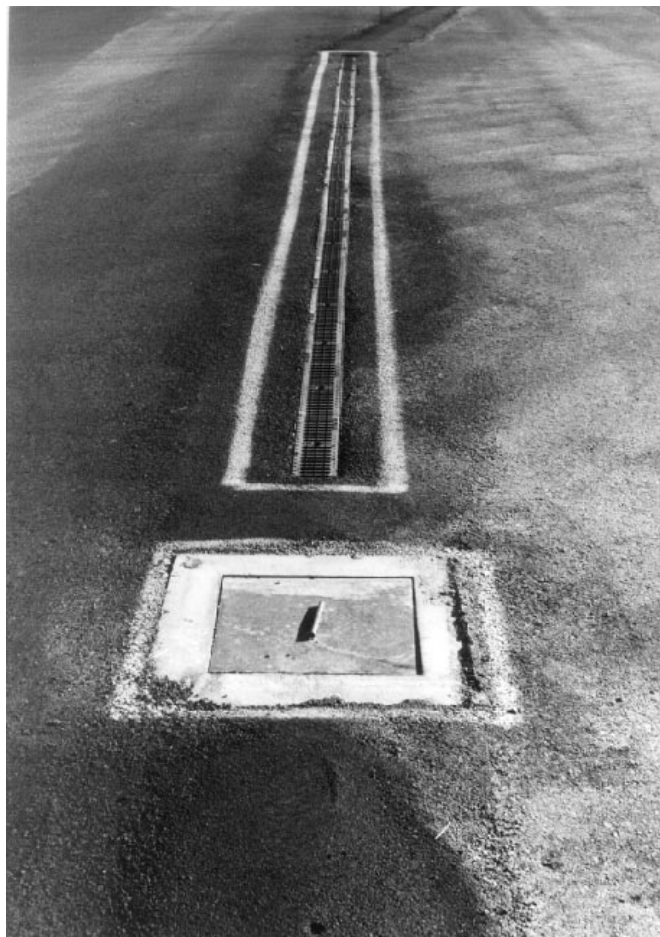


Figure 36. Aircraft Loading Area Drain—Pocatello, ID.

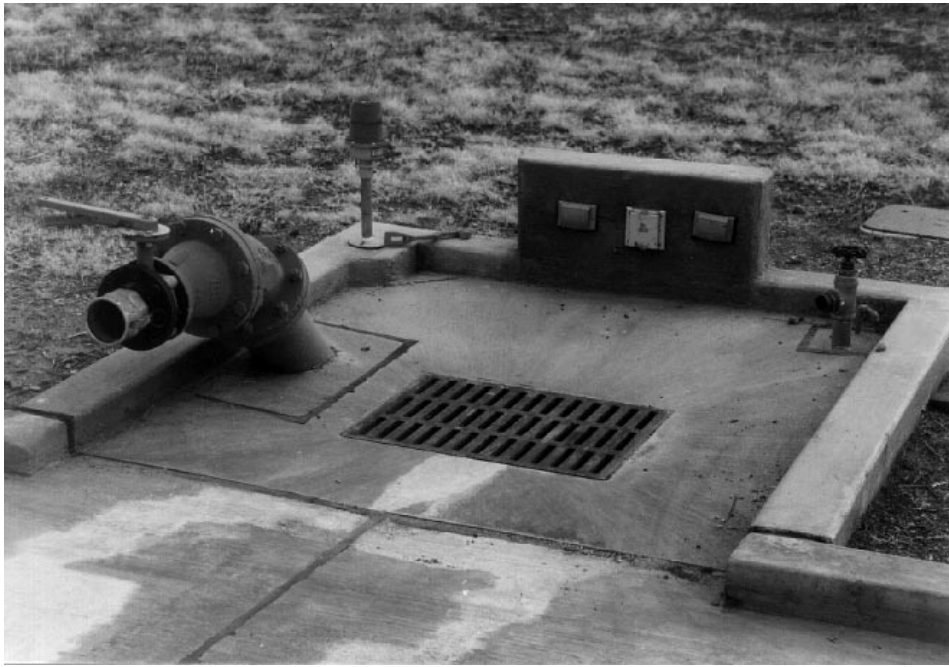


Figure 37. Aircraft Loading Pad Drain—Prescott, AZ.



Figure 38. Aircraft Loading Area Drain—Phoenix, AZ.



Figure 39. Aircraft Loading Pad Drain—Fox Field, CA.



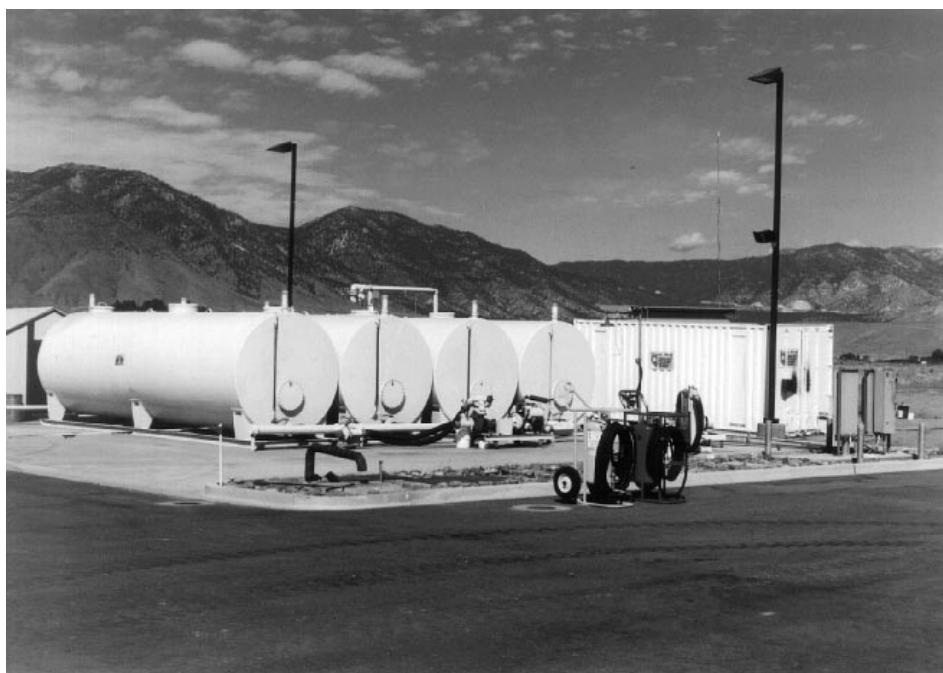
*Figure 40. Tank and Service Area Spill Containment Concrete Berm—Fresno, CA.
Berm allows for service equipment access to tanks and their associated equipment.
This method requires a larger concrete surface (tank pad) to achieve proper spill containment.
It is a good idea, if feasible, for all bases to consider.*



Figures 41 A&B. Tank Spill Containment Pit—Phoenix, AZ.



Figures 42 A&B. Tank Spill Containment Wall—Pocatello, ID.



Figures 43 A,B&C. Tank Spill Containment—Minden, NV.



Figure 44. Tank Spill Containment—Lakeview, OR.



Figure 45. Asphalt Berm and Drain—Pocatello, ID.



*Figure 46.
Asphalt Berm with Drain—Wenatchee, WA.*

Waste Treatment Alternatives

- ◆ Common sump or tank which can be pumped out to allow for off site disposal and/or treatment (figures 47 and 48).
- ◆ Connection to municipal sewer system (figure 49).
- ◆ Mechanical treatment and disposal.
- ◆ Evaporation methods (lagoons, ponds or other) (figure 50).
- ◆ Biological treatment methods (managed wet lands, water hyacinth, bacteria, etc.)
- ◆ Septic tanks with leaching field.
- ◆ Soil treatment, sprinklers which spread waste on large land surface (figure 51).



Figure 47. Residues Collection Sump—Hemet, CA.

Location Considerations

- ◆ Soils and site geology must be known to define types of tests and/or studies required to define a treatment method.
- ◆ The effects of climate and other environment on the site.

Treatment System Sizing

- ◆ The general nature and makeup of residues in terms of aircraft and base operations, fire retardant chemistry and other factors must be known. Need samples for lab analysis.
- ◆ Capacity, runoff volume (max. flowrates) must be estimated.
- ◆ Look at ways to control runoff, including, water usage limits for washdown and maintenance activities.
- ◆ Residues catch sump or holding tank capacity and treatment method or rate must be defined based on daily runoff estimates and choice of disposal method to be used.
- ◆ Define local independent labs capable of conducting analyses and certifying treatment effectiveness and/or content of residues.
- ◆ Loading ramps and storage and handling tank farm drainage issues and methods.
- ◆ Isolation of storm runoff from waste collection system.
- ◆ Consider methods of spill isolation in retardant storage tank areas (figure 52).



Figure 48. Residues Collection Trench with Sump—Santa Barbara, CA.



Figure 49. Oil/Sand Separation Tank for Municipal Sewer Connection—Fresno, CA.

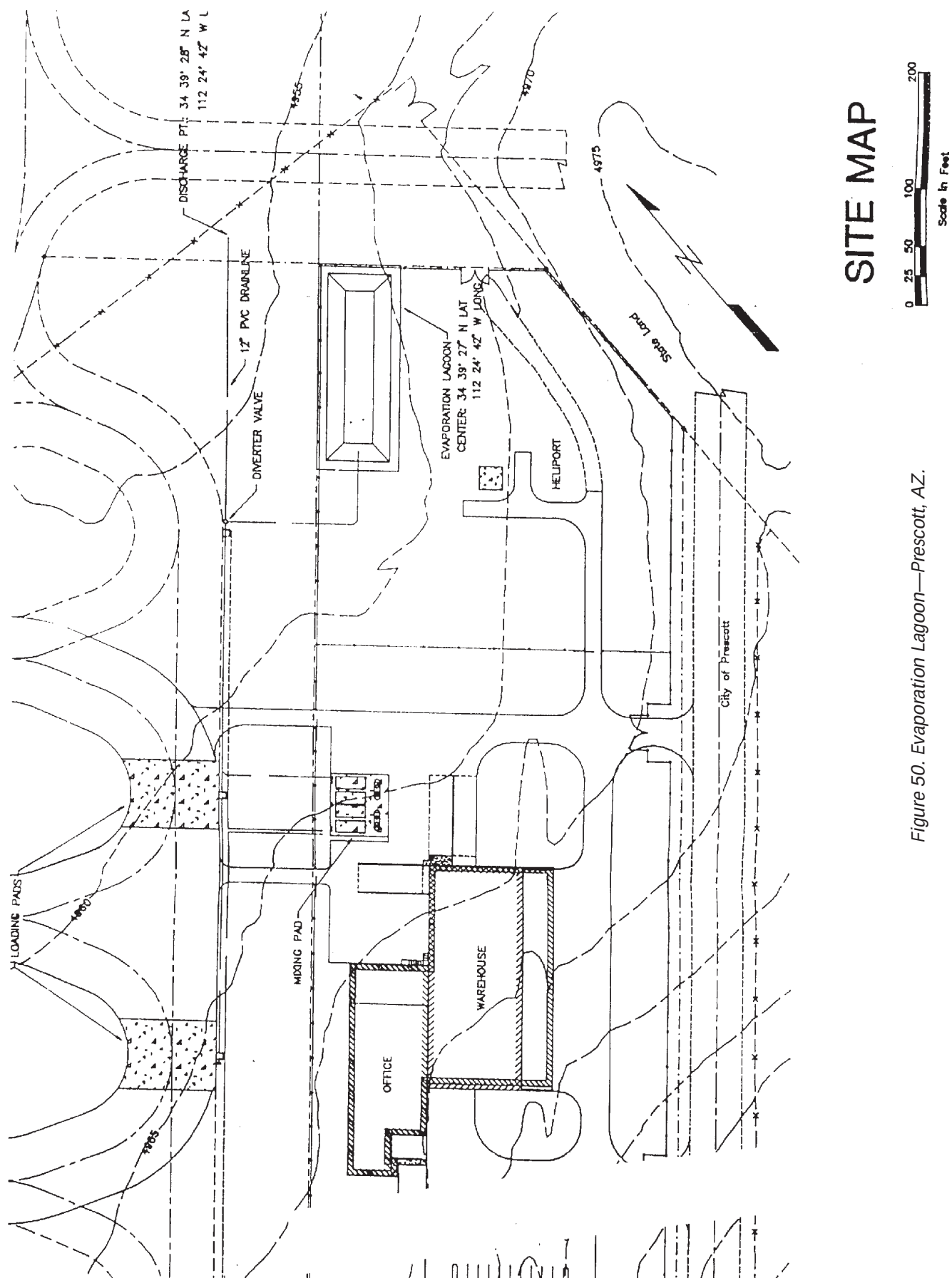


Figure 50. Evaporation Lagoon—Prescott, AZ.



Figure 51. Spreading Field—Klamath Falls, OR.



Figures 52 A&B. Storage Tank Spill Isolation Pad—Prescott, AZ.



Waste Treatment System Selection

- ◆ Consider special requirements for each alternative method, such as,
 - ◆ Land area needed
 - ◆ Soil conditions
 - ◆ Suitable climate
- ◆ What are the skills and certifications required to operate & maintain each alternative treatment method?
- ◆ Meet with local agencies to determine what would be acceptable to them.
- ◆ Determine what regulations and laws govern the use of each alternative system (EPA and other requirements).
- ◆ For each alternative system and/or method define the advantages and disadvantages in terms of all costs (longterm and immediate).

Management of Waste Residues

Based on the SDTDC stated objective the following is a proposed waste management plan for each of the elements and their respective subdivisions.

Aircraft Washdown Residues

Two sources of aircraft washdown residues are those created by washing of aircraft and those created by washing off the aircraft loading ramp.

The first consideration is to provide for proper ramp drainage. A gentle sheet flow of residues to a properly located drainage trench along the edge of the ramp is desirable. If residues are allowed to spread during washdown operations over a wide area of the ramp evaporation is encouraged and eliminates some of the fluid volume before it reaches the drainage trench (figure 53).



Figure 53. Drainage Trench—Santa Barbara, CA.

Water conservation is the next consideration. If water conservation is practiced by using a pressure washer to wash aircraft and to clean the ramp, very little fluid volume should reach the drainage trench. It is estimated that the use of a pressure washer reduces residues volume by ninety percent. If washing a C-130 aircraft with a conventional hose creates up to 3,000 gallons of liquid waste,



then a pressure washer becomes a good investment. The washer can be purchased with a variety of nozzles and is suitable for all base cleaning operations (appendix A-1).

The design and location of the ramp drainage trench is critical to the final handling and treatment of washdown residues. The trench should be located so that all the ramp created residues will sheet flow into it. If possible, utilize existing runway slopes adjacent to the base to provide the proper drainage slope for the trench bottom. Ideally the trench should be flat bottomed and gently drain towards a collection sump located at its downstream extremity. It is recommended that the trench be 3-feet wide by a minimum of 1-foot deep with a drainage slope of 1% or less on the bottom. The longer the better. The trench should be able to contain 5,000 gallons of spilled retardant in the event of an accident. The reasoning for this is discussed later. A properly designed trench is 3-feet wide by 1-foot deep and 200 feet long with a 500 gallon sump located at its downstream end can store approximately 5,000 gallons of spilled retardant. This allows for some freeboard in the trench.

The sump at the end of the drainage trench should be fitted with a pump that allows the residue to be pumped to an above ground residues storage tank (10,000 gallon tank is recommended) whenever the sump fills up. Below ground collection or separation tanks are not recommended because of higher cost, possibility of leakage, and the higher probability of improper or lack of maintenance. With this type of trench most of the residues resulting from ramp and aircraft washdown will evaporate before they reach the sump. At the end of the season the trench can be washed down with a pressure washer and the contents of the sump pumped into the residues collection tank for later treatment or removal from the base. The sump pump should be plumbed with a storm bypass to allow rain waters to be pumped out. It is recommended that the sump pump be used year round to keep the drainage trench as dry as possible. Allowing the trench to remain filled with storm runoff during the winter and spring causes algae buildup on the walls and bottom. Final treatment or disposal of the residues collected in the storage tank depends on what local government authorities allows. The disposal issue is discussed later in this section. The residues collection tank should be monitored and cleaned (pumped) whenever it becomes half full; this provides the base the capability to handle an accidental retardant dump.

Spillage during aircraft loading operations can be minimized by hanging a small pail on the end of the loading hose or, placing a small trash container under the hose during loading operations. This partially prevents retardant from dripping onto the ramp when the hose is removed from the aircraft.

Retardant Storage & Delivery Facility Maintenance

Residues are created in the retardant storage tank area (pad) and in and around the tank and base plumbing. These residues are created by plumbing maintenance, tank cleaning, base winterization (pipe flushing, etc.) and retardant delivery operations. It is recommended that the storage tanks and the associated equipment and plumbing be surrounded by a block wall high enough to contain the contents of all the tank storage on the base (or as in the case of the Phoenix Airtanker Base a spill isolation pit shown in figure 1). For example a 25-foot by 50-foot pad sealed by a 3-foot high block wall can contain 25,000 gallons of spilled residues.

The tanks and all their associated plumbing should be located on top of a concrete pad that is isolated (sealed) by the wall discussed above from the rest of the base. The pad should be designed with a drainage slope that focuses all residues to a 200 gallon sump inside the enclosure, or to a drain point that allows drainage into the base treatment facility. The sump should be fitted with a pump that can remove normal maintenance residues to the trench collection tank discussed earlier, or a similar tank if this is not feasible. Again, storm bypass provisions should be provided with this pump for the same reasons as discussed earlier.

All maintenance cleanup except tank and pipe flushing should be performed with a pressure washer to limit the amount of volume produced. The large volumes produced from tank or pipe flushing and accidental leaks or spills should be pumped into the residues collection tank(s) on the base for later removal or treatment. If the base arrangement makes it feasible the storage tank pad could be provided with a drain to the ramp collection trench for controlled conveyance of residues to the storage tank. The drain needs to have an isolation valve which would be normally closed. This is to prevent a possible overflow in the ramp drainage trench if a major retardant tank spill occurs.

The retardant delivery area should consist of a concrete pad large enough for the delivery vehicle to park while it is off-loading retardant. It should be adjacent to the tank enclosure and sloped so all accumulated spilled retardant and vehicle fuel and oil leakage can be washed into a drain connected to the ramp drainage trench. The pad must be located at an elevation high enough above the drainage trench to facilitate good drainage into the trench.

Excessive amounts of spilled fuel and oil should be covered with adsorbent sand for removal. The sand should be swept up and properly disposed of prior to washing the delivery pad.

Accidental Spills

Accidents do happen and will happen. Accidental spills occurring in the areas of the airport that the Forest Service can control should be managed as an expected event. Provisions can be made for the most common accidents by having the right equipment on hand to deal with the problem and properly training base personnel how to use it.

The accidental spillage of retardant due to tank leakage or plumbing problems has been partially discussed in the previous sections. By having the containment wall around the storage tanks and the ramp drainage trench the volume of residues created by an accidental retardant spill can be handled in the immediate area of the base facilities. If a spill occurs due to an aircraft accident outside the controlled areas of the facility containment of the fluid is the first issue. Also, be sure to have the phone number of the local hazmat spill contractor or agency and call them. A supply of containment tools should be kept on hand and personnel trained in their use. One of the simplest methods of containment is to surround the spill with a pressurized fire hose and try to move the liquid to a location where it can be pumped or vacuumed into a truck for removal. Finally, wash any remaining residue off the runway with a pressure washer or hose.

If a aircraft spill occurs inside of the controlled areas of the base the fire hose idea still works. Use brooms and squeegees to move the spilled retardant to the ramp drainage trench and then wash the runway and ramp with a pressure washer. Remove the residues from the drainage trench by pumping them into the residues storage tank. This should be done as soon as possible to clear the trench for use in the event of another accident. The use of sand bags and adsorbent pads or chemicals to contain and cleanup retardant is impractical.

Aircraft Maintenance

When performing aircraft maintenance on the base there is always the potential for spillage of hydraulic fluids and engine oil. The best policy is to require that all maintenance be performed off site, if possible. The occasional maintenance that must be done on the ramp should be done with an adequate number of drip pans located under the aircraft to minimize spillage onto the ramp. A simple method is to make some 4' x 4' plywood boxes with common 2 x 4 sides, nailed on, for use as drip pans. These shallow wooden boxes can be filled with sand or adsorbent pads (see appendix B) or material (kitty litter was suggested) and placed at strategic locations under the aircraft to collect drippings.

If a major spill occurs from an aircraft component or engine failure, the base should have adsorbent pads and sand on hand to clean it up. Again, a pressurized fire hose can be used to temporarily contain the spill. After the bulk of the spilled fluids have been removed by use of sand and/or pads, the area can be cleaned with detergent and then rinsed with a pressure washer directing the residues into the ramp drainage trench. Approved containers for the storage of the sand or pads used to pick up the spill should be used to contain these materials until they can be properly removed from the base. The aircraft contractor should be charged for the cleanup including the materials used to accomplish the task as well as for the cost of proper disposal of the residues.

Final Treatment of and/or Disposal of Residues

The best way to treat residues is to off-load them from the storage tank into a truck and haul them offsite to an approved disposal site. The contractor used to perform this function must be approved and licensed by the governing local authority. A receipt from the disposal site must be returned to the base by the contractor to assure that each load removed was received by the pre-approved disposal site. If this method is not feasible the next best alternative would be to meet with the local sanitation agency and determine if the residues (if metered in the amounts specified by that agency) can be disposed of in the local sewage treatment plant. Oil separation tanks are usually required upstream of the sewer outlet (appendix C). This method may also require that a large sump be furnished by the Forest Service to the local sanitation agency for waste dumping (appendix A-3), from which, the agency can meter the residues into their plant at a rate that will not harm their treatment process. This method may not be feasible in small communities because of the relatively small throughput of their plants.

If neither of the alternatives discussed above are feasible, then the use of an evaporation tank or a lagoon similar to that used at the Prescott, Arizona base is possible. The special issues concerning the design and use of this method can be obtained from Region 3 Engineering.

The last consideration should be methods involving on-site treatment by use of soil adsorption. These methods include sprinkler spreading (now in common use), adsorption pits (such as used at La Grande and Medford), septic tanks with leach fields, and dry wells. The results of using these procedures were observed and felt to have a high environmental risk due to improper maintenance and management. In all cases of soil treatment, it is necessary to use a separation tank upstream of the treatment system to remove the bulk of the separated salts, oil and detergent from the residues prior to final treatment. If the local agency allows removal of these separated residues from the base for disposal they should have no objection to removing all the waste from the base. However they may require the residues to be dewatered first. If this is the case, evaporation tanks and/or lagoons are probably the best alternative.

Other methods were not seriously considered because of either their cost or complexity, or both. Figure 54 is a schematic of an ideal base arrangement which shows the ideas and considerations discussed. Until experience has been gained in the actual operation of a facility that provides total residue management, it is premature to provide any final recommendations.

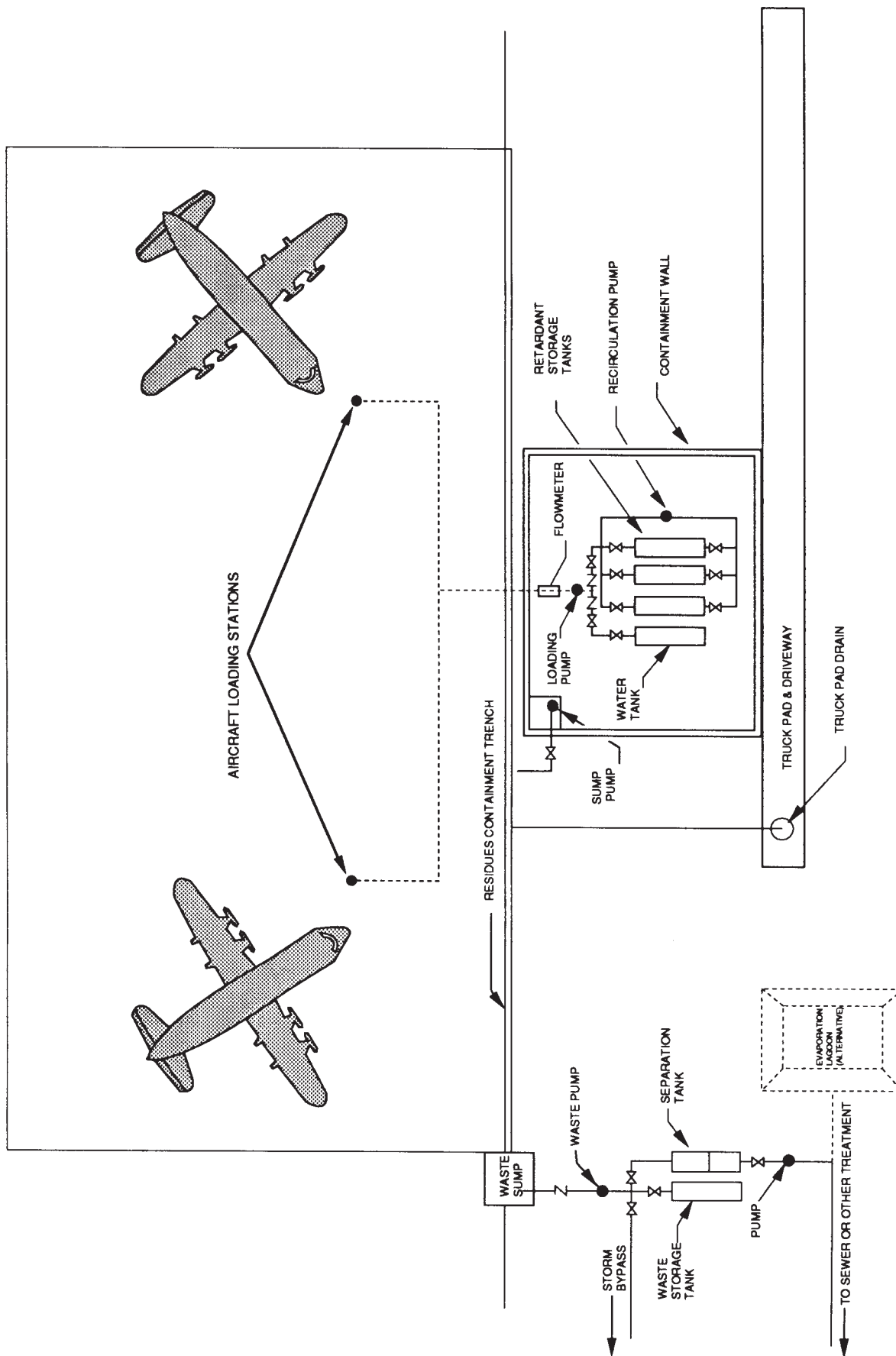


Figure 54. Ideal Base Arrangement Schematic.

CONCLUSION

The stated objective of this project was, to determine how to economically manage residues created from base operations in a manner that promotes environmentally proper treatment or disposal. That objective can be restated as, how to economically manage and separate base residues to allow for their environmentally proper disposal. The work accomplished thus far, resulted in the definition of the primary elements of a residues management plan. Methods to segregate residues from their points of origin and handle them in a manner that should reduce their volume and their impact on the immediate environment surrounding a base were discussed in this report. To accomplish the stated project objective requires that the findings and ideas discussed be implemented at an existing base. This step is required to perfect the discussed methods and develop standard operating procedures. Ideally, if a Region is willing, a model base would be built where the ideas can be tried and standards for waste handling and treatment developed for all Forest Service bases. Prior to making any final recommendations this is a requirement.

NOTES: