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Water and Wastewater Management Plan

Upper Valley Disposal Service P16-00180
Planning Commission Hearing March 7, 2018

Water and Wastewater Management Plan for
Upper Valley Recycling Facility, Saint Helena, California

Prepared for Upper Valley Disposal Service
1285 Whitehall Lane
Saint Helena, CA 94574

Prepared by CB&I Environmental and Infrastructure
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Project No. 154343
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CERTIFICATION PAGE

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information.

Please feel free to call the undersigned if you have any questions or comments.

Sincerely,

CB&I Environmental and Infrastructure, Inc.

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I. INTRODUCTION

This Water and Wastewater Management Plan (Plan) describes how water and wastewater associated with compost operations will be managed at the Upper Valley Recycling Center, Solid Waste Facility Permit (SWFP) 28-AA-0026 (Facility) in Saint Helena, California, in accordance with General Order WQ 2015-0121-DWQ, General Waste Discharge Requirements for Composting Operations (General Order). Specifics include descriptions of:

- Site grading
- Precipitation controls and containment structures for controlling run-on and runoff from the working surfaces
- Site detention basins and a water balance demonstrating compliance with the Design, Construction and Operation Requirements section of the General Order
- Maintenance and operation of the precipitation controls and containment structures
- Collection and use of water and wastewater in the compost process
- Best management practices to reduce and control wastewater
- A contingency plan for water and wastewater control failure or inadequacy

The Facility discharges clean stormwater in accordance with the existing site Stormwater Pollution Prevention Plan (SWPPP) WDID number 2 28I000730, in accordance with California's General Permit for Stormwater Discharges Associated with Industrial Activities, Order No. 2014-0057-DWQ (Stormwater General Permit). Pollution controls presented in the SWPPP are referenced throughout this Plan. See the SWPPP for detailed guidance on preventing contaminant discharges.

This Plan was updated in January 2017 to include considerations for a proposed 15,000 square foot blending barn, Compressed Natural Gas (CNG) refueling station, and truck stalls that were not included in the original July 2016 release. This Plan was further updated in April 2017 to reroute Area 5 to the Wastewater Pond (discussed below) and address comments by Napa County.

Site Description

A vicinity map of the Facility is presented in Figure 1. The Facility is located at 1285 Whitehall Lane, Saint Helena, California, designated as assessor parcel number 27-450-27 and operates under Solid Waste Facility Permit 28-AA-0026. The Facility comprises approximately 44.2 acres and includes industrial activities consisting of recycling and composting operations, experimental vineyards, equipment storage, and an 8.3 million gallon Wastewater Pond. Composting operations and the associated Wastewater Pond total approximately 13.8 acres. A solid waste recycling facility is located adjacent to the composting operations with a footprint of approximately 8.5 acres. Access to the composting operations is off the Saint Helena Highway, located approximately 2,000 feet southwest, through an access road passing between vineyards and a winery, across a bridge over an unnamed surface tributary to Bale Slough.

The Facility is generally flat with the surrounding area sloping from west to east. The natural elevation of the site is approximately 180 to 160 feet. Surface tributaries to Bale Slough run south-eastwardly on the northeastern and southwestern boundaries of the Facility. Bale Slough runs eastwardly and discharges into the Napa River approximately 1.5 miles to the east of the Facility.

The recycling operation is located to the west of composting operations and includes indoor and outdoor material sorting and recovery, and outdoor equipment storage. To the west, north, northeast, and southeast are vineyards, with a winery located to the east. Additional wineries and vineyards are located in the immediate area. Directly to the southwest of the Facility is the Cottage Garden Nursery.

Operations Background

Composting operations have been ongoing since 1974 and, after environmental review, received a solid waste facility permit in 1995. Conference and office facilities, vehicle maintenance and storage, and equipment storage supporting vineyard, recycling, and composting operations are located throughout the site.

Composting operations occur seasonally with a currently permitted capacity of 34,000 tons per year. Incoming feedstock is generally delivered and processed from mid-August to mid-October. The Facility now conducts composting operations in one main working area, has an adjacent amendment and finished product area, and has a third area for soil, amendment, and equipment storage.

Incoming green waste is ground and added to compost feedstock and amendments. Aerated static pile composting is used at the facility, under tarps, with forced air piped under the piles. Once composting is complete for a pile, the tarp is removed and the material is further screened to achieve a final product. Larger, rejected material is sent for disposal at a municipal solid waste landfill.

Compost and amendment piles are covered with plastic low-permeability tarps prior to rain events to prevent contamination of stormwater runoff. As a general rule, tarps are typically installed by December 1 and removed in early April to prevent the need to repeatedly cover and uncover piles. For the purposes of this Plan, tarps are assumed installed from December 1 to April 1, and this time period is defined as “Winter”. This “Winter” designation differs from the General Order “wet season” period of October 1 through April 30. An exception to the tarp rule is future food waste composting which may not be covered prior to rain events.

For the purposes of this Plan, composting, storage, drainage, and access areas have been assigned "Area" designations which do not appear on other site documents. Area 3, the main compost working area, is separated by an interior access road (Area 2) from a southwestern storage area (Area 1), and southeastern storage and curing area (Area 5.) Area 3 is further segregated into compost piles which are covered during the winter (Area 3A) and the remaining uncovered portion of the compost area (Area 3B.) The southwestern Area 1 is used primarily to store amendments and finished product, while Area 5 also stores soil, clean roll-off boxes, and additional items as required by site operations. Two additional areas are the Wastewater Pond (Area 4) and a water retention basin for clean stormwater runoff (Area 6.) A proposed 15,000 square foot blending barn, CNG refueling station, and truck stalls (Area 7) are not yet constructed but are included in this Plan for consideration. Areas 1 through 7 are shown on Figure 2.

Future food waste composting is proposed to occur in Area 7, in a portion of Area 3 which is currently used for green waste processing and composting. When food waste composting is begun at the Facility, food waste will be initially received and processed in an organics building before being placed in the northern quarter of Area 3. The organics receiving and processing building, currently in the design and permitting phase, consists of a 15,000 square-foot, concrete-floored, covered organics blending building. Misters installed inside the building will supply moisture during blending. The incorporation of this new organics blending building will alter the types of feedstocks used without increasing total site tonnage. Food waste will be added to other incoming materials, in accordance with new site permits, and composted under intermittent carbonaceous bio filter cover in the northern quarter of Area 3. The carbonaceous bio filter cover will consist of finished compost or other similar alternatives.

Table 1 summarizes the feedstock utilized at the Facility.

Table 1: Feedstock

Current Feedstock and Amendments Used in Composting	Feedstock and Amendment Use After Incorporation of Organics Blending
Grape Pomace (34,000 ton/year permit maximum)	Grape Pomace (34,000 ton/year permit maximum)
Bulking Agents: Green Material (8,500 ton/year permit maximum)	Co-Collected Green Waste/ Residential Food Waste, and Source-Separated Green Waste (8,500 ton/year permit maximum)
	Commercial Food Waste (8,000 ton/year permit maximum)
Total: 34,000 ton/year permit maximum	Total: 34,000 ton/year permit maximum

Other amendments and products are potentially temporarily stockpiled on site for resale and use to fulfill special orders. These amendments and products are stored in areas segregated from compost operations, typically Area 5, and are typically covered during the winter. These other amendments and products may include:

- Wood shavings
- Gypsum
- Limestone
- Mulch
- Other custom blended products

Site Updates for the General Order

The Facility is currently operating according to solid waste facility permit number 28-AA-0026 and has adopted General Order WQ 2015-0121-DWQ. With the incorporation of this Plan into the 2016 Technical Report, and acceptance of the Technical Report by the appropriate regulatory authorities, the Facility will operate under the new General Order WQ 2015-0121-DWQ.

Three minor upgrades to Facility drainage are proposed to ensure Facility compliance with the new General Order. An earthen berm, constructed of local clays meeting the hydraulic conductivity requirements stipulated in the General Order, will be constructed as a run-on barrier for Area 1. The earthen catchment for compost runoff in Area 3 will be concrete-lined to aid water removal and act as an impermeable barrier to groundwater. Drainage from Area 5 will be rerouted from the retention basin to the Wastewater Pond. Upgrades are discussed in detail in the following sections.

II. PRECIPITATION CONTROLS AND CONTAINMENT

In accordance with the new General Order and SWPPP, the Facility grounds will continue to be graded and maintained as necessary to provide adequate drainage to runoff/wastewater conveyances. Clean stormwater will continue to be discharged into the eastern retention basin, and ultimately to the Bale Slough tributary to the east of the site in accordance with the SWPPP. Wastewater and selected clean rainwater will continue to be pumped to the 8.3 million gallon Wastewater Pond. Wastewater and clean rainwater comingled in the Wastewater Pond will continue to be used for composting operations and dust control as required by the Facility.

The Facility is partially located in a FEMA designated Zone A, with 1% annual chance of flooding and 26% change of flooding over a 30-year period. As a result, flood protection berms and a supplemental drainage pipe for the eastern Bale Slough tributary were installed at the Facility. These flood protection improvements are referenced in the following sections where applicable. Additional requirements for flood protection are called for in the Conditional Use Permit number 92061-UP and include maintaining berms around composting operations that are a minimum 1-foot above the 100-year flood level and set back a minimum 50-feet from the Bale Slough tributaries.

Stormwater and wastewater conveyances at the Facility were constructed to handle the 25-year, 24-hour design storm, which satisfies requirements of the General Order and Napa County standards. Further, Napa County requires the Wastewater Pond has the capacity to receive wastewater flows and stormwater runoff for the 100-year, 24-hour design storm from new and reconstructed impervious areas (Area 7) in addition to the existing contributing areas. As part of this Plan, CB&I evaluated the existing conveyances and water storage and determined they are expected to meet the requirements of the new General Order and Napa County's requirements. Wastewater/runoff conveyances, site drainage, and the Wastewater Pond are presented in Figure 2 and discussed in the following sections.

Working Surfaces

The working surfaces for Areas 1, 3, and 5 are constructed of minimum 1-foot compacted local clayey soils to resist damage from equipment and pile weight as discussed in the *Report of Composting Site Information*, Emcon Associates, June 1994, which is presented in the Technical Report. The exception to the soil working surface design is the northern quarter of Area 3 which is constructed of 1-foot of crushed concrete rubble. The local clayey soils underlie the working surfaces in a compacted layer which is a minimum 1-foot in depth, but typically 3-feet in depth or greater, and form the low permeability layer required by the General Order.

Hydraulic conductivity of the local soils was investigated by CB&I in a May 2016 site investigation. Test results from undisturbed samples taken 1 to 3-feet below the surface comprising the low permeability layer indicate a hydraulic conductivity range of between 1.52×10^{-7} and 4.0×10^{-9} cm/s, exceeding the 1.0×10^{-5} cm/s requirement in the General Order. A map showing sample location, test results are included as part of the 2016 Technical Report, in accordance with the General Order.

Existing grading for Areas 1, 3, and 5 is sufficient for providing adequate drainage to minimize ponding and infiltration of liquids, maximize transmission of runoff to containment structures for storage or discharge, protect material piles and working areas from degradation or inundation by surface flows, and meet the additional requirements for working surfaces listed in the General Order.

Working surfaces will be maintained at a minimum of 0.5% slope, with some areas as high as 3% slope, to ensure proper drainage is maintained.

Runoff Control

Runoff from working surfaces routed differently in the winter than the summer as shown in Appendix A - Drainage Paths and Figure 2. During the summer, the southwestern storage area (Area 1) is graded to drain though sheet-flow to 2, 1-foot diameter PVC drainage pipes set in a depression and installed under the access road (Area 2). These pipes then drain into Area 3. The interior access road (Area2) largely drains via sheet-flow into Area 3. Area 3 is graded to drain through sheet-flow, or in directed flows between piles, to an eastern earthen ditch along the retention basin berm which slopes to a stormwater/runoff catchment at the northeastern corner of Area 3. This catchment is piped via gravity flow to the Compost Runoff Sump which utilizes one 7.5-horsepower pump and one 5-horsepower pump to discharge water to the Wastewater Pond (Area 4). The catchment will be concrete-lined to facilitate water flow to the Compost Runoff Sump and provide an impermeable barrier to groundwater.

The earthen ditch and catchment are constructed of compacted local clay soils, as verified in a 2016 May site investigation by CB&I. The hydraulic conductivity of an undisturbed soil sample obtained during the site investigation from the catchment displayed a hydraulic conductivity of 2.1×10^{-8} cm/s, exceeding the General Order requirement for conveyances of 1×10^{-5} cm/s. Soils used to construct the earthen ditch were obtained from the same location as the soils used to construct the catchment and are expected to exhibit similar hydraulic conductivity properties. A map showing sample locations and test results for the site investigation are included as part of the 2016 Technical Report, in accordance with the General Order.

During the winter between December 1st and April 1st, storage piles in Area 1 and compost piles in Area 3A are covered with low-permeability tarps. The low-permeability tarps installed on compost, finished product, and amendment piles prevent contamination of runoff and ensure proper moisture conditions in the piles is maintained. Pile tarps are fitted to prevent run-on of contaminated water from the surrounding working surfaces.

During the winter, runoff from Area 1 is piped under the interior access road to discharge onto pile tarps in Area 3A. The combined runoff from Areas 1 and 3A is treated as clean stormwater runoff and is fed directly into the retention basin through PVC pipes attached to the pile tarps which pass through the basin sidewall. Water in the retention basin is then pumped via two 25-horsepower pumps into the Bale Slough tributary as clean stormwater from a centrally located sump. In the case contaminated water enters the retention basin, the basin can instead be emptied into the compost runoff drainage system by opening short PVC pipes which extend through the basin side wall. Runoff from Area 2 and the remaining un-tarped portion of Area 3 drainage is pumped to the Wastewater Pond as during the summer.

Materials in the southeastern curing and storage area (Area 5) are covered during the winter and prior to rain events. Despite materials being covered, the entirety of Area 5 runoff is proposed to be re-routed from the retention basin to the Wastewater Pond during site upgrades. The western portion of Area 5 currently drains eastwardly internally, then toward an earthen ditch on the southeastern edge. The earthen ditch is constructed of the same 1-foot minimum compacted clay soils as the Area 5 working pad, exhibiting a hydraulic conductivity range between 1×10^{-8} cm/s and 4.0×10^{-9} cm/s as identified during the May 2016 CB&I investigation. Adjacent vineyards to the south are positioned several feet in elevation above Area 5's surface and further restrict runoff or overtopping of the earthen ditch. The earthen ditch flows toward the northeast where it discharges into a concrete-lined ditch, then drains through an 18-inch corrugated HDPE pipe under the access road. This 18-inch pipe will be re-routed from flowing into the retention basin (Area 6) to the Wastewater Pond. A pumping station will be installed near the access road to provide sufficient head to discharge the Area 5 flow to the earthen ditch on the edge of Area 3, then the sump and ultimately the Wastewater Pond.

The proposed Area 7 will consist of a 15,000 square foot barn, CNG refueling station, and truck parking. Roof downspouts will be installed on the barn, and grading and drainage channels will be constructed for the CNG station and truck parking, to drain completely into Area 3 and ultimately the Wastewater Pond. Drop inlets located in the proposed truck parking portion of Area 7 will be capped to prevent runoff entering the existing site stormwater transmission system and bypassing the Wastewater Pond.

Run-On Control

Run-on to Areas 1, 2, 3, and 5 is controlled to the north by the recycling operation's dedicated stormwater system and site grading. The recycling operation's runoff drains locally to drop-inlets which feed into an underground stormwater transmission system and bypass composting operations. The transmission system drains to the supplemental drainage pipe for the Bale Slough tributary which runs underground along the eastern edge of the Facility. Alternatively, the transmission system pipe can be capped to direct flows to the earthen catchment and Compost Runoff Sump at the northeastern corner of Area 3.

Run-on to the proposed Area 7 will be controlled by altering the parking area grading and/or installing grade breaks, as needed. Run-on diverted by the altered grading and/or grade breaks will enter the Facility's stormwater transmission system.

An earthen berm comprised of local clay soils will be constructed at the northern edge of Area 1 to provide additional protection from run-on. The earthen soils used will be sampled prior to construction to verify they meet the hydraulic conductivity requirements for design listed in the General Order.

Run-on from the east and west is controlled by 100-year flood protection berms and tributaries for Bale Slough. Run-on from the east is further prevented by a supplemental drainage pipe for the eastern tributary, permitted in 1994, which increases the transmission capacity of the tributary. Documents describing flood protection berms and the supplemental drainage pipe, titled *Request for 401 Water Quality Certification Waiver for Installation of 36-inch Pipeline and Inlet and Outlet into the Waters of the U.S.*, is included in Appendix B - Water Quality Certification Waiver.

Run-on from the south and southeast is controlled by the adjacent vineyard surface grading and elevation. The vineyard is several feet higher than the working surface and slopes away from the Facility to a downstream portion of the Bale Slough tributaries.

Minor run-on from the access road (Area 2) sheet flows onto Area 3 and becomes part of the managed runoff from Area 3.

Groundwater at the facility maintained at a maximum elevation of approximately 5-feet below ground surface for the majority of the site and 2-feet below ground surface at the extreme low point of the northeastern corner of Area 3. Percolation to the surface is controlled via the retention basin, located between the Bale Slough tributary and Area 3, which has a permeable base to allow percolation of groundwater to the surface. This groundwater is then pumped into the Bale Slough tributary via two 25-horsepower pumps located at the basin center.

Water Detention

Runoff from the compost working pads, storage areas, and interior access road are directed to the Wastewater Pond and retention basin as discussed in earlier sections of this Plan. Runoff from the proposed Area 7 and re-routed Area 5 will also drain to the Wastewater Pond. The original Wastewater Pond design and construction documentation are presented in Appendix C - True Engineering Wastewater Pond Documentation. Aerator design for the Wastewater Pond is included in Appendix D - Summit Pond Aeration Design. An as-built figure which assesses the current operational capacity of the Wastewater Pond is presented in Figure 3. As-built information on the Wastewater Pond is based on 2015 field measurements by CB&I.

The Wastewater Pond is constructed of compacted local clay soils as discussed Appendix C and in the *Report of Composting Site Information*, Emcon Associates, June 1994. The bottom surface of the pond is lined with a minimum of 1.5-feet of compacted clay, and 1.5 to 2-feet of compacted clay line the sides. Clay was compacted during construction to 90 percent of optimum and demonstrates hydraulic conductivities ranging from 2.24×10^{-5} to 2.97×10^{-8} cm/s. Local soils underlying the compacted clay layers are of the same clay material and are expected to exhibit similar hydraulic conductivity characteristics.

Two primary 25-horsepower aeration pumps and four secondary 7.5-horsepower aeration pumps are installed in the Wastewater Pond to maintain a minimum 1.0 milligram per liter dissolved oxygen concentration in the upper 1-foot to prevent the water from becoming anoxic and causing detrimental microbial growth and harsh odors. In accordance with the General Order, the Wastewater Pond will continue to be kept clean and free of plant growth to prevent areas where water may become stagnant and provide mosquito breeding opportunities. Retained water samples required by the General Order will be obtained from the lower side of the Wastewater Pond, as shown on Figure 2.

The existing Wastewater Pond design has adequately prevented subsurface releases of contaminants from contained wastewater as demonstrated through ongoing monitoring and sampling of adjacent groundwater monitoring wells, in accordance with Napa County Use Permit No. 92061-UP. Therefore, CB&I endorses the existing clay-lined pond design and groundwater monitoring well system as an equivalent engineered alternative to the detention pond liner and lysimeter leak detection design requirements stated in the General Order. Groundwater monitoring wells located adjacent to the Wastewater Pond are shown on Figure 2. The most recent quarterly monitoring report at the time of this Plan for the Facility is presented in the Technical Report. The quarterly monitoring report shows no contamination to groundwater has been observed as a result of composting operations at the Facility.

The retention basin located at the eastern extent of Area 3 will accept and temporarily retain clean stormwater from the covered compost piles in Areas 1 and 3A. Appendix E - EMCON Retention Basin Design contains the original design for the retention basin, which currently also accepts clean stormwater runoff from Area 5 until site upgrades are complete. The western sidewalls of the retention basin bordering Area 3 are equipped with PVC pipes which are opened and connected to tarps coving piles in Area 3A during the winter. The floor of the retention basin is constructed to be permeable to groundwater to prevent groundwater from impacting the lower-elevation portions of the eastern edge of Area 3. A sump equipped with two 25-horsepower discharge pumps is located in the center of the detention basin for discharging clean stormwater and groundwater to the adjacent Bale Slough tributary's supplemental drainage pipe. The retention basin is pumped to dry or near-dry whenever water is present.

As the retention basin does not contain or transmit wastewater, the permeability design requirements for wastewater conveyances in the General Order do not apply. However, according to best management practices, the retention basin sidewalls were constructed of compacted local clay soils with low hydraulic conductivities to prevent infiltration of wastewater from the adjacent working areas. The basin sidewall soils were sampled in May 2016 during a site investigation by CB&I and tested for undisturbed hydraulic conductivity. The basin side walls were found to have a hydraulic conductivity of 1.7 x 10^{-8} cm/s, exceeding the 1.0 x 10^{-5} cm/s requirement in the General Order for wastewater conveyances.

Water Balance

Appendix F - Water Balance and Pond Sizing Analysis contains an assessment of the Wastewater Pond's and retention basin's capacities, and a water balance for the Facility. Table 2 summarizes the Wastewater Pond's and retention basin's characteristics.

Table 2: Wastewater Pond and Retention Basin Characteristics

Characteristic	Wastewater Pond	Retention Basin
Primary Use	Runoff/wastewater storage for use	Clean runoff retention for discharge; Groundwater French Drain
Full Top Surface Dimensions	2.22 acre	0.33 acre
Depth	16 ft (includes 2 ft freeboard)	8 ft (includes 2 ft freeboard)
Volume	21.52 acre-ft / 7 million gallon (25.50 acre-ft / 8.3 million gallon including freeboard)	0.98 acre-ft / 320,000 gallon (1.57 acre-ft / 512,000 gallon including freeboard)
Contributing Drainage Area	Areas 1, 2, 3, 4, 5, 7 (13.66 acres, summer) (9.08 acres, winter)	Areas 1, 3A, 6 (0.54 acres, summer) (5.11 acres, winter)
25-Year, 24-Hour Storm Runoff Volume and Percent Full from Empty[1]	5.78 acre-ft; 26.9% (summer) 3.99 acre-ft; 18.5% (winter)	0.30 acre-ft; N/A[1] (summer) 2.87 acre-ft; N/A[1] (winter)
100-Year, 24-Hour Storm Runoff Volume and Percent Full from Empty[1]	7.12 acre-ft; 33.1% (summer) 4.91 acre-ft; 22.8% (winter)	0.37 acre-ft; N/A[1] (summer) 3.53 acre-ft; N/A[1] (winter)
Maximum Possible Storm Retained from Drainage Area, from Empty[1]	500-Year, 10-Day (summer) 500-Year, 30-Day (winter)	N/A[1] (Will actively discharge)

[1]Retention basin is designed to actively discharge, see Appendix H.

The existing Wastewater Pond provides excess storage over that necessary to contain the 25-year, 24-hour storm for the compost areas contributing to wastewater runoff as required by the General Order. Further, the Wastewater Pond provides excess storage for stormwater runoff over that necessary to contain the 100-year, 24-hour storm as required by Napa County. From an empty state, the Wastewater Pond is capable of containing the 500-year, 10-day event during the summer, while maintaining 2-feet freeboard. During the winter, when compost piles are covered and runoff from tarps is piped to discharge from the retention basin, the Wastewater Pond is capable of containing the 500-year, 30-day event with 2-feet freeboard.

The water balance contained in Appendix F analyzes the Facility stormwater runoff storage under three main scenarios. The first scenario is the average monthly rainfall for a typical year where approximately 6.96 acre-feet of rainwater are retained at the end of the year. The second scenario is the 25-year, 24-hour storm occurring during the height of the winter when the Wastewater Pond is expected to be at maximum capacity. In this scenario, the Wastewater Pond is able to contain the Facility-wide runoff from the 25-year, 24-hour storm with 2-feet freeboard, during March, in addition to average annual rainfall through March. The third scenario has the 25-year, 24-hour event occurring during the summer when compost piles in Areas 1 and 3A are uncovered. In this third scenario in April, the Wastewater Pond will exceed capacity when containing runoff for the 25-year, 24-hour storm, in addition to average annual rainfall through April, and maintain approximately only 1.64-feet of freeboard. The water balance assumes stormwater and wastewater is retained from compost and storage areas that are not draining to the retention basin. Table 3 summarizes the Wastewater Pond's performance for each scenario

Table 3: Wastewater Pond Performance for 25-Year, 24-Hour Storm with Annual Rainfall

Scenario	Percent Full After Storm	Remaining Volume Available, Maintaining 2-feet Freeboard	Volume Retained at End of Year
Average Monthly Rainfall	N/A (78% maximum full level from average rainfall)	N/A (4.80 acre-ft remaining at maximum full level)	6.96 acre-ft
25-Year, 24-Hour Storm During Winter	96%	0.89 acre-ft	10.44 acre-ft
25-Year, 24-Hour Storm During Summer	104% (0.92 acre-ft over capacity)	0 acre-ft (1.64 ft freeboard remaining)	12.04 acre-ft

The remaining estimated volume retained at the end of each analysis year is expected to be used as process water, approximately 10.76 acre-feet, and/or properly disposed of in accordance with site permits. See Section III.

The methods and calculations used in the water balance and basin sizing are contained in Appendix F. Storm precipitation depth for the 25- and 100-year, 24-hour design storm events (6.73-inches and 8.29-inches) and average monthly rainfalls were obtained from the NOAA Atlas 14, Volume 6, Version 2 for the Helena station. Pan evaporation values used in calculating evaporation from basins was obtained from the Western Regional Climate Center list of Evaporation Stations for Markley Cove

(61.67 annual inches). A pan evaporation coefficient of 0.7 was applied to provide more realistic evaporation data for calculations (Kohler et al. 1955, 1958).

Verification of Site Stormwater System Sizing

The stormwater management system at the Facility was sized for the 25-year, 24-hour prior to construction, according to original design documents presented in Appendix G - EMCON Surface Drainage Assessment. The original drainage design was altered to satisfy Facility operations. CB&I conducted a rational method analysis of the updated site drainage to determine if runoff and wastewater conveyances are adequate in meeting the requirements of the 25-year, 24-hour storm event. The rational method analysis was based on rain data from the NOAA Atlas 14, Volume 6, Version 2 data set for the nearby Saint Helena station and is presented in Appendix H - Rational Method and Conveyance Sizing Analysis.

CB&I determined that the pipe culverts under the interior access road draining Area 1, and in the concrete ditch in Area 5 (to be rerouted with existing characteristics to drain to the Area 3 sump), will adequately drain runoff from the 25-year, 24-hour rain event. Both pipe culverts are capable of transmitting flows in excess of the anticipated design storm flow.

CB&I determined that the sump pumps are adequately sized to discharge the 25-year, 24-hour storm event. Pumps in the Compost Runoff Sump will discharge runoff from the design storm within 21.9 hours of storm initiation for a storm occurring in the winter (within the 24-hours over which the storm occurs.) The Compost Runoff Sump will discharge the design storm runoff within 31.7 hours of storm initiation for a storm occurring in the summer, with excess runoff will retained in the earthen catchment in the northeast corner of Area 3 as intended.

Pumps in the retention basin will drain the entire runoff volume within 3.1 hours for a storm occurring in the winter and have a discharge rate greater than the design storm flow. No areas will drain to the retention basin during the summer. Minor excess runoff is expected to be retained in the retention basin for contributing events until pumps are initiated and runoff is discharged to the Bale Slough tributary.

Table 4 summarizes the current pumping capability at the Facility. Manufacturer pump curves are presented in Appendix H.

Table 4: Facility Sump Pumps

Location	Size	Model	Head	Capacity
Compost Runoff Sump to Wastewater Pond	7.5 HP	Barnes 4SE7534L	25 feet	540 GPM
	5 HP	Goulds WS5032D4	25 feet	450 GPM
Retention Basin to Tributary	25 HP	Ebara Model 300DL(F)U6184	8 feet	2,500 GPM
	25 HP	Ebara Model 300DL(F)U6184	8 feet	2,500 GPM
Groundwater Sump to Tributary OR to Compost Runoff Sump	3 HP	Goulds WS3032D3	14 feet (to tributary) 0 feet (to sump)	400 GPM

The stormwater conveyance system design for Area 7 has yet to be finalized, but is expected to consist of building down spouts and a single concrete channel discharging to Area 3. The building down spouts and concrete channel will be sized, at a minimum, for the 25-year, 24-hour storm based on the final design of the proposed organics blending barn, CNG refueling station, and truck parking.

Maintenance and Operation

All stormwater conveyances, the stormwater sump, the retention basin, and the Wastewater Pond will be inspected regularly and maintained in good working order. Piping, culverts, and ditches will be cleaned of debris and inspected regularly to ensure proper function. Any damage will be repaired in accordance with the General Order. Stormwater conveyances will be kept clear of debris which could impede stormwater flow.

Working surface grading will be repaired as needed on an ongoing basis. Any instances of rutting, ponding, or other indications of surface damage will be repaired to ensure proper drainage of the working surfaces.

Site grading adjacent to working surfaces will be maintained to prevent run-on. Soil mounds will be placed as necessary to repair ruts or depressions.

Pumps located in the sump, retention basin, and Wastewater Pond will be regularly inspected and maintained in good working order per site maintenance procedures. Damaged pumps will be repaired or replaced as necessary.

The water retention basin and Wastewater Pond will be maintained to prevent the creation of breeding grounds for mosquitos and other pests. Pumps in the Wastewater Pond will be operated to prevent the upper zone dissolved oxygen concentration from dropping below 1.0 milligram per liter.

Low-permeability tarps will be replaced as necessary when they develop punctures or tears which could cause stormwater contamination. Newer tarps with less wear will be placed in high-volume flow areas while older tarps will be placed on storage piles.

The Wastewater Pond will be operated to maintain liquid levels at or below depths needed to supply sufficient available volume to contain the 24-hour, 100-year storm event. Excess liquid will be disposed of according to site permits as discussed in Section V: Contingency Plans. Table 5 shows the required operational liquid levels. Level calculations are presented in Appendix F.

Table 5: Wastewater Pond Operational Levels to Contain 100-Year, 24-Hour Event

Season	Maximum Operational Liquid Depth	Note
Winter (December 1 – March 31)	11.8 ft.	Maximum fluid depth when compost piles are tarped and discharging to the retention basin.
Summer (April 1 – November 30)	10.5 ft.	Maximum fluid depth when compost is not tarped.

III. WATER AND WASTEWATER USE IN COMPOST OPERATIONS

Wastewater from the Wastewater Pond is used as necessary for composting operations and dust control. Water is pumped from the Wastewater Pond through PVC piping to a discharge port in an adjacent paved loading area. A water truck drives under the discharge port for filling, and then sprays water on compost piles to maintain moisture in the composting material. Leachate and run-off from the compost piles is minimized by controlling the volume of water applied to each pile.

According to site operator statements, the Facility typically uses half of the Wastewater Pond's total available volume each year for compost wetting and dust control. Conservatively, the water use volume is estimated at 10.76 acre-feet per year. Water application is expected to occur mainly March through October when compost piles are uncovered. Additional water is used during dry months for dust control as necessary. Water use is minimal during the rainy season when compost has already been processed and placed under tarps.

IV. BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) for controlling stormwater runoff and pollutant discharge used at the Facility are described in detail in the site SWPPP. A summary of these BMPs are included in this Plan but the SWPPP should be referenced during implementation.

Minimum BMPs described in the Stormwater General Permit are implemented at the Facility as described in the CASQA Stormwater BMP Handbook Portal: Industrial and Commercial Fact Sheets. These minimum BMPs include:

- Good housekeeping
- Preventative maintenance
- Spill and leak prevention and response
- Material handling and waste management
- Erosion and sediment control
- Employee training
- Quality assurance and record keeping

Specific CASQA BMP Fact Sheet numbers for implemented BMPs are listed in the SWPPP. The specific Fact Sheets are chosen based on Facility processes, materials, and site characteristics.

Additional advanced BMPs are enacted at the Facility to prevent discharge of contaminated runoff from the compost areas, as discussed in the SWPPP. These additional advanced BMPs include:

- Covering compost and amendments during the rainy season
- Storage of lubricants and other fluids used in equipment maintenance in a designated maintenance building
- Washing of vehicles in a covered wash bay

V. CONTINGENCY PLANS

In the event of a significant storm event, run-on and/or runoff to the Compost Runoff Sump may back up into the earthen catchment located in the northeastern corner of Area 3 and be retained until pumped to the Wastewater Pond. In the event the site becomes inundated by water or the operational level of the Wastewater Pond reaches maximum depth, large tanks similar to 22,000-gallon baker tanks will be used to temporarily store water on-site as necessary. Water will be stored in the tanks until placed in the Wastewater Pond, transported to a local publicly-owned treatment works for treatment, or used in site operations. Wastewater from the Pond may also be directly pumped into tanker trucks for off-site disposal as needed.

If the two 25-horsepower pumps located in the retention basin are unable to immediately discharge surface flows into the Bale Slough tributary, the excess clean water will back into Area 3 for retention. All waters retained in Area 3 will be treated as wastewater and either pumped to the Wastewater Pond or sent offsite to a local publicly-owned treatment works for proper treatment and disposal.

Two pumps are present in the Compost Runoff Sump, and two pumps present in the central retention basin sump, to provide redundancy in the case of equipment failure. If a single pump fails, the other pump will continue to operate until site maintenance personnel are able to complete repairs. If a pump is unable to be repaired, or both pumps in a sump fail, then a temporary portable pump and tubing will be used to bypass the inoperable equipment.

VI. LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

References

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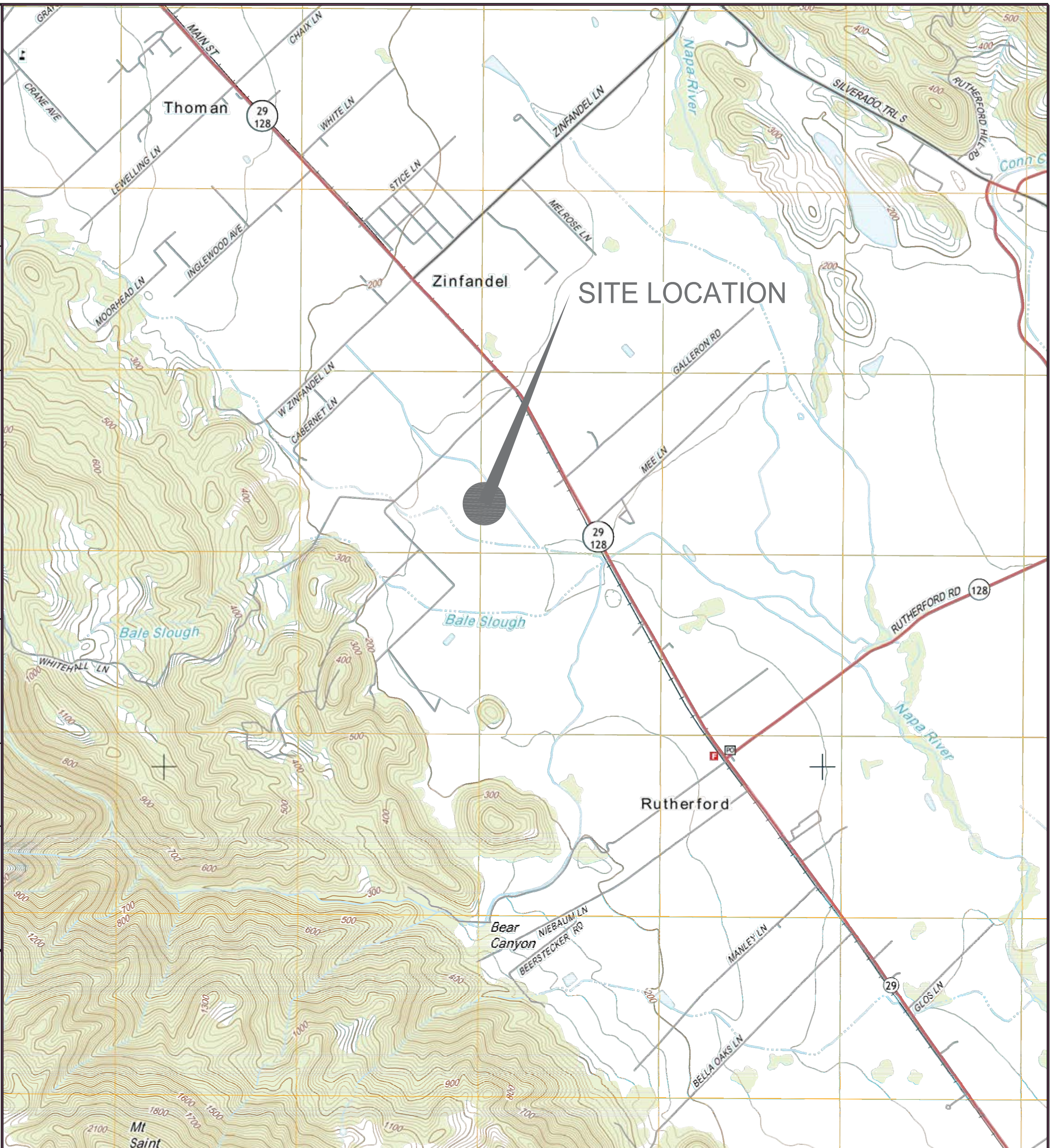
FIGURES

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	PROJECT NUMBER
Sacramento, CA	*7/22/16*	*N/A*	*JJ*	*MA*	*MA*	154343



NOTE:

1. SOURCE OF IMAGE IS USGS 7 1/2 MINUTE RUTHERFORD QUADRANGLE, RUTHERFORD, CALIFORNIA.

CB&I Environmental & Infrastructure, Inc.

UPPER VALLEY RECYCLING

FIGURE 1

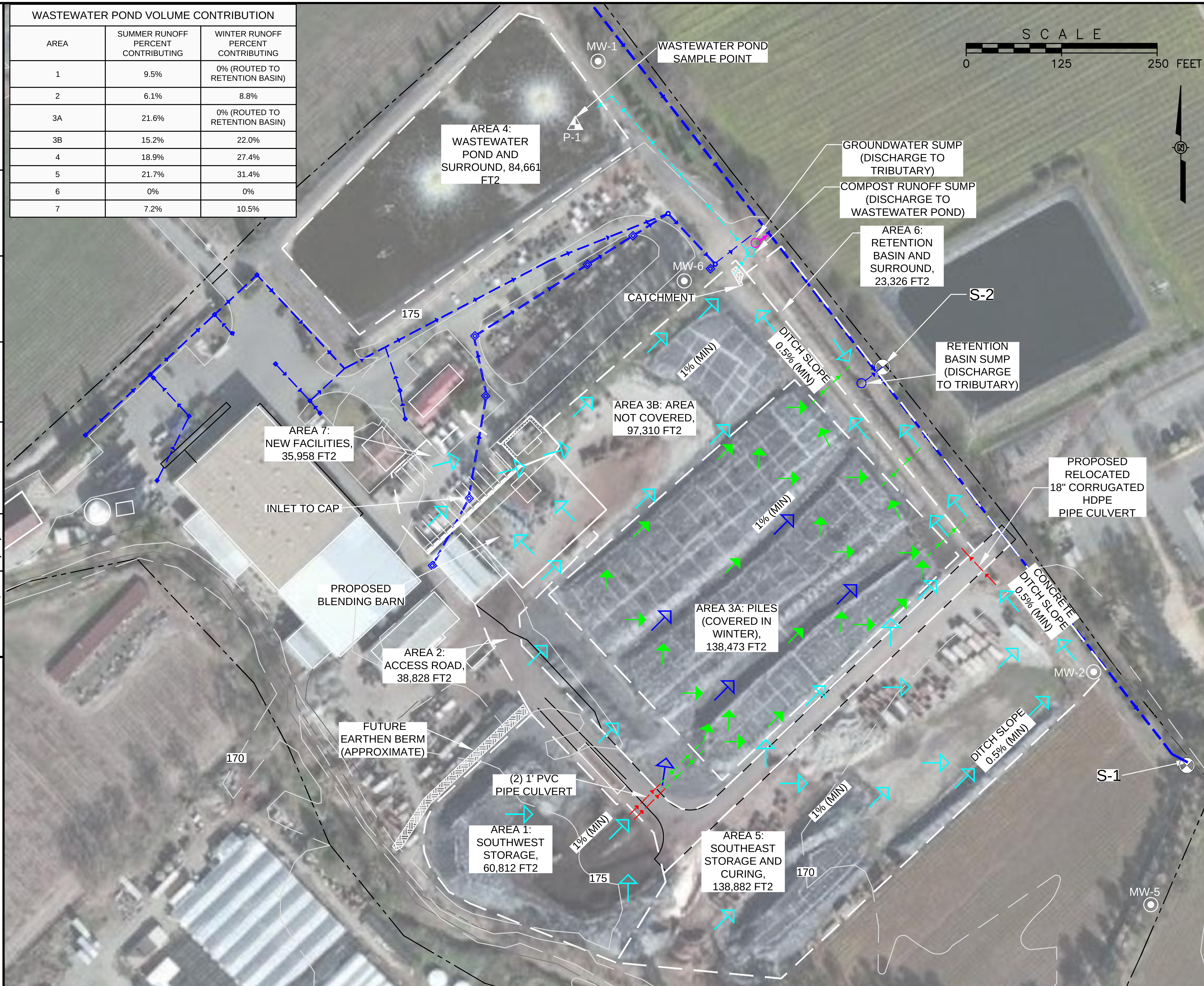
SITE VICINITY MAP

UPPER VALLEY RECYCLING FACILITY
1285 WHITEHALL LANE, SAINT HELENA, CALIFORNIA

File: UVR-Fig1-VicinMap-7-22-16.dwg
Plot Date/Time: Jul 26, 2016 - 11:00am

WASTEWATER POND VOLUME CONTRIBUTION

AREA	SUMMER RUNOFF PERCENT CONTRIBUTING	WINTER RUNOFF PERCENT CONTRIBUTING
1	9.5%	0% (ROUTED TO RETENTION BASIN)
2	6.1%	8.8%
3A	21.6%	0% (ROUTED TO RETENTION BASIN)
3B	15.2%	22.0%
4	18.9%	27.4%
5	21.7%	31.4%
6	0%	0%
7	7.2%	10.5%



LEGEND:

GROUNDWATER MONITORING WELL	MW-1
SURFACE WATER MONITORING POINT	S-1
POND SAMPLING POINT	P-1
RUNOFF FLOW DIRECTION (YEAR-ROUND)	
RUNOFF FLOW DIRECTION (SUMMER)	
RUNOFF FLOW DIRECTION (WINTER)	
CLEAN WATER SUMP	
COMPOST RUNOFF SUMP	
STORMWATER INLET	
CLEAN STORMWATER PIPING	
COMPOST SUMP PIPING	
GROUNDWATER SUMP PIPING	
RUNOFF CULVERT PIPING	
WINTER TARP PIPING	
PROPERTY BOUNDARY	

NOTES:

1. TOPOGRAPHY SHOWN IS APPROXIMATE.
2. AREAS 1 THROUGH 7 AS SHOWN ARE FOR DRAINAGE ANALYSIS ONLY.
3. DRAINAGE PATHS ARE APPROXIMATE.
4. WORKING SURFACES MAINTAINED AT MINIMUM 1% SLOPE BUT MAY BE STEEPER DEPENDENT ON MAINTENANCE ACTIONS.
5. DRAINAGE DITCHES MAINTAINED AT A MINIMUM 0.5% SLOPE.
6. AREA 1, 3A TARPS/PIPES INSTALLED IN WINTER (DECEMBER 1 TO APRIL 1.) NUMBER VARIES DEPENDENT ON SITE REQUIREMENTS.
7. WINTER AREA 1 PIPING TIES INTO AREA 3A PILE TARPS. WINTER AREA 3A PIPING DISCHARGES TO RETENTION BASIN.
8. SUMMER AREA 3 DRAINS WITHOUT TARPS OR PIPES TO CATCHMENT AS SHOWN.
9. CATCHMENT WILL BE CONCRETE-LINED AND AREA 5 ROUTED FROM RETENTION BASIN TO CATCHMENT DURING FUTURE SITE UPGRADE.
10. AERIAL IMAGERY SUPPLIED BY USGS, 2014.

CB&I Environmental and Infrastructure, Inc.

UPPER VALLEY RECYCLING

FIGURE - 2

SITE MAP

UPPER VALLEY RECYCLING FACILITY
1285 WHITEHALL LANE, SAINT HELENA, CALIFORNIA

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	PROJECT NUMBER
Sacramento, CA	4/27/17	JJ	JJ	MA	MA	154343

File: C:\Users\john.jowers\Desktop\ProjectInfoAndDocs\UpperValley\2016-TechnicalReport\WWMP\Final\Figures\154343-WWMP-4-25-17.dwg
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Plot Date/Time: Jan 17, 2017 - 10:39am

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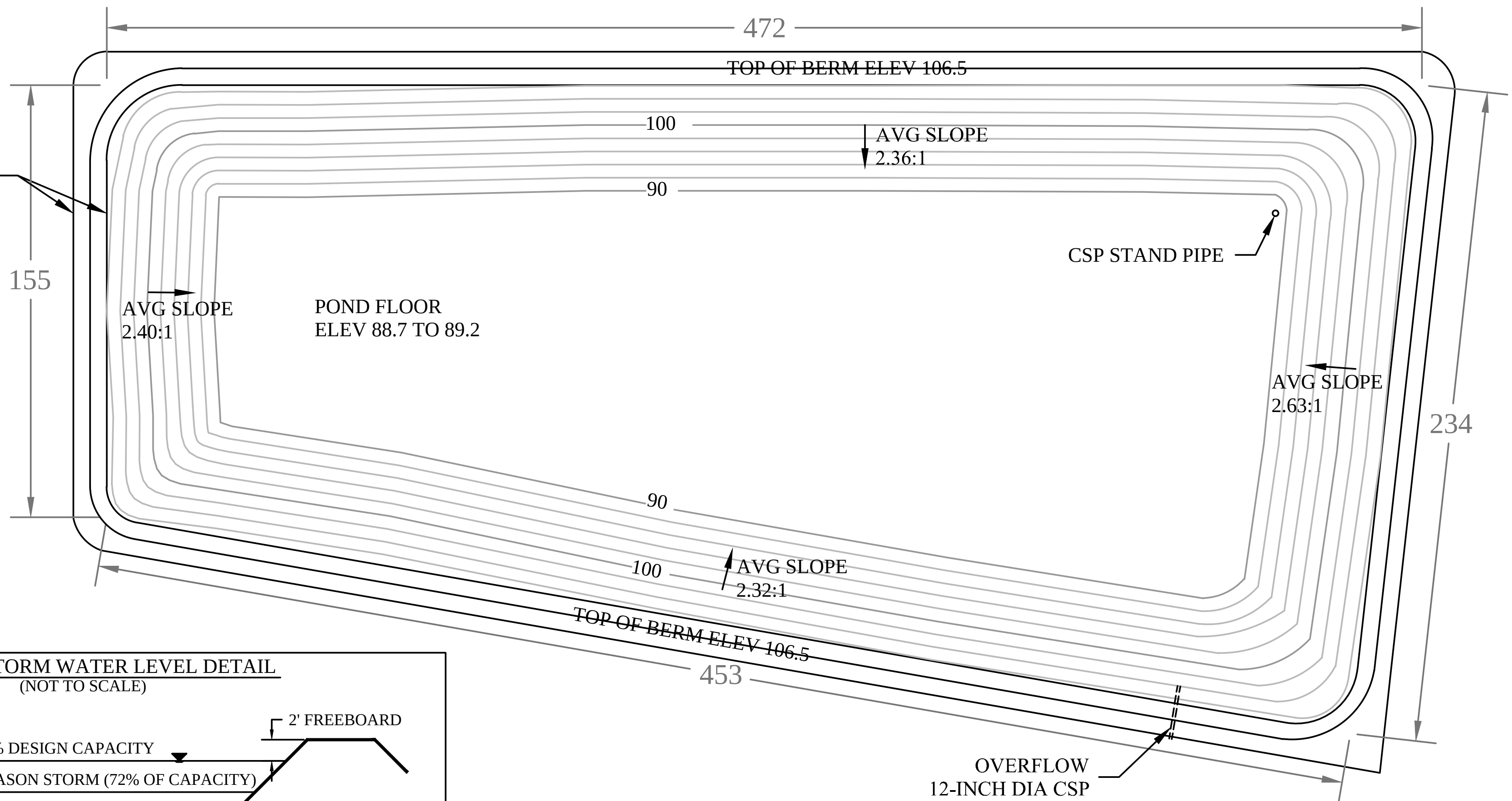
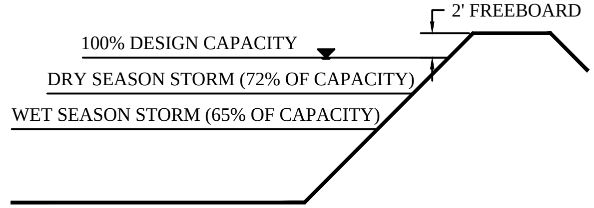
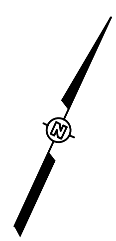


DESIGN STORM WATER LEVEL DETAIL
(NOT TO SCALE)



NOTES:

1. ESTIMATED POND STORAGE CAPACITY:
   - 1.a. AT ELEV 106.5 (TOP OF BERM)= 25.5 ACRE-FT
   - 1.b. AT ELEV. 104.5 (2-FT FREEBOARD)= 21.5 ACRE-FT
2. POND MEASURED 8/14/15 BY CB&I.
3. ALL ELEVATIONS ARE BASED ON AN ARBITRARY COORDINATE SYSTEM AND DO NOT TRANSLATE TO ANY OFFICIAL COORDINATE SYSTEM.
4. WET SEASON STORMS CONTRIBUTE LESS WATER RUNOFF VOLUME TO THE POND THAN DRY SEASON STORMS AS COMPOST PILES ARE COVERED AND DRAIN TO THE RETENTION BASIN DURING THE WET SEASON.



SCALE

CB&I Environmental and Infrastructure, Inc.

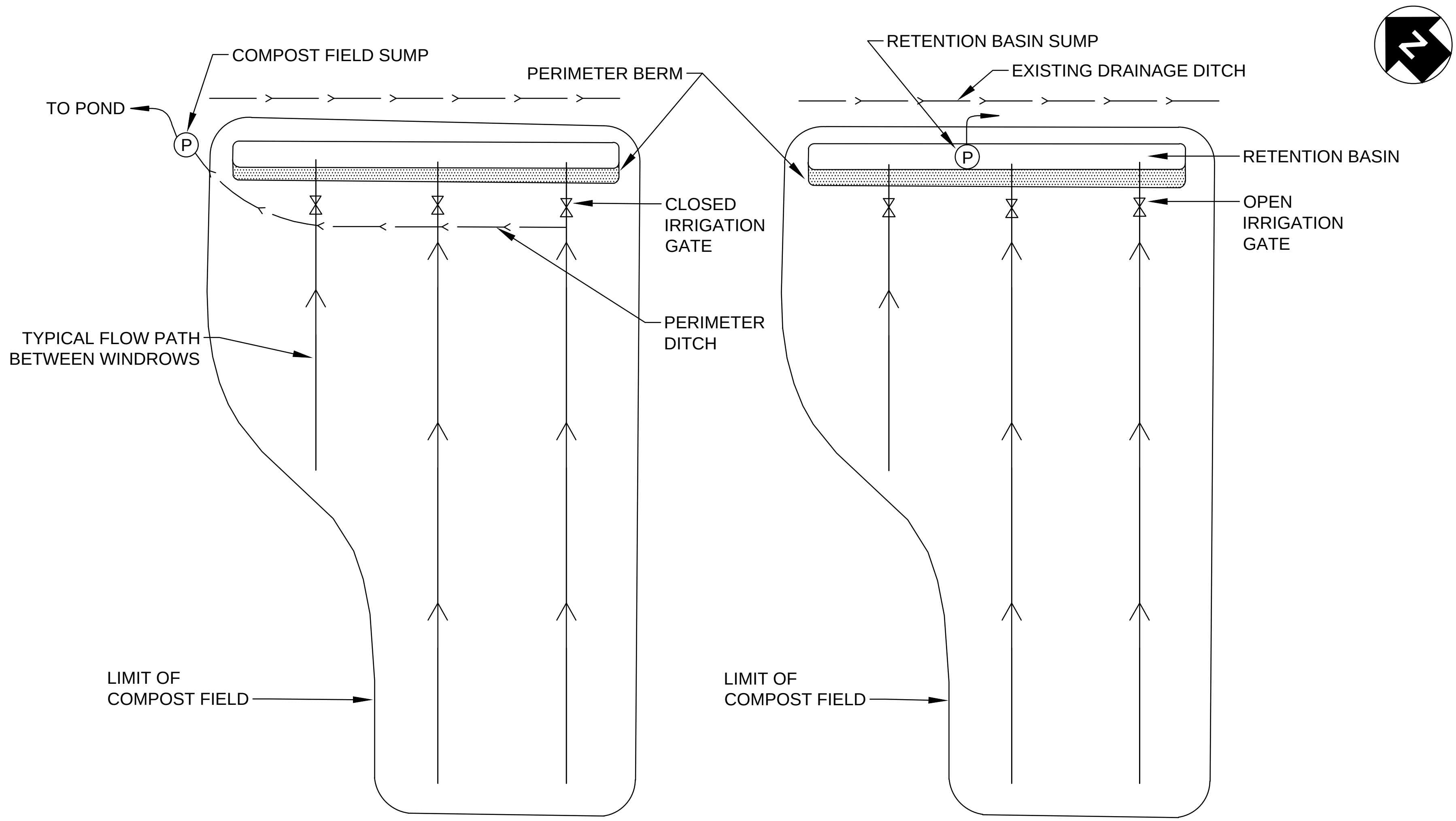
UPPER VALLEY RECYCLING

FIGURE - 3

AS-BUILT OF WASTEWATER POND

UPPER VALLEY RECYCLING FACILITY
1285 WHITEHALL LANE, SAINT HELENA, CALIFORNIA

APPENDIX A – Drainage Paths



UNCOVERED COMPOST WINDROWS
RUNOFF FLOWPATH SCHEMATIC

COVERED COMPOST WINDROWS
RUNOFF FLOWPATH SCHEMATIC

NOTE:
DRAWING NOT TO SCALE

CB&I Environmental &
Infrastructure, Inc.

UPPER VALLEY RECYCLING AND DISPOSAL SERVICE
COMPOST FACILITY
NAPA COUNTY, CALIFORNIA

FIGURE 3
RUNOFF FLOW SCHEMATIC

DRAWN BY: NV	APPROVED BY: MRA	PROJ. NO.: 154343	DATE: JULY 2016

APPENDIX B – Water Quality Certification Waiver

E I P Associates

Other Offices:
San Francisco
Los Angeles

June 3, 1994

Department of the Army
U.S. Army Corps of Engineers
District Engineer
211 Main Street
San Francisco, Ca 94105-1005

Attention: Regulatory Branch (Carin High)
and District Engineer

SUBJECT: **SUBMITTAL OF DOCUMENTATION OF COMPLIANCE WITH NATIONWIDE PERMIT CONDITIONS**

Dear District Engineer:

EIP Associates is pleased to submit the subject report documenting compliance with the terms and conditions of the Department of the Army nationwide permit program for the installation of a utility line, as defined by nationwide permit 12, within a water of the U.S. on the Upper Valley Recycling and Disposal property. The attached report has been prepared in accordance with 33 CFR, Part 330. This information is being provided in follow up to a telephone conversation between the Regulatory Branch and Ms. Cheryl Shields of Emcon Associates, at which time Ms. Shields informed your office of the proposed activity and pending submittal of this report.

Upper Valley and Recycling and Disposal Service currently has a request for an after-the-fact Nationwide Permit 7 authorization that was submitted to your office on July 28, 1993. Upper Valley is awaiting notification of compliance for that work[1]. The current work includes installation of an inlet and outlet into a water of the U.S. The attached report provides details regarding the project, impacts, and compliance with the nationwide permit program.

---

[1] During a field meeting with the Corps in August, 1993 the Corps indicated that the after-the-fact work was in compliance with nationwide permit 7, however, issues raised at that time by neighbors regarding a wastewater pond has delayed a final decision from the Corps on the after-the-fact request. All information requested by the Corps regarding the wastewater pond was submitted to the Corps on August 25, 1993.

kc\upper\nwp.ltr

The applicant has contacted the California Department of Fish and Game and is preparing a streambed alteration agreement pursuant to Section 1601 to 1603 of the California Fish and Game Code for the proposed work.

In accordance with 33 CFR, part 330.4(c) compliance with nationwide permit 12 requires issuance of a 401 water quality certification or waiver thereof before the activity is considered authorized. A concurrent application is being made for a 401 water quality certification or waiver thereof to the California Regional Water Quality Control Board, San Francisco Bay Region (copy of letter included in attached documentation).

If you have any questions, please feel free to call me at (916) 325-4800.

Very truly yours,

Kathy R. Carps
Project Manager

Attachments - 2

kc\upper\nwp.ltr

E I P Associates
Comprehensive Environmental and Planning Services
1401–21st Street
Suite 400
Sacramento
CA 95814
916/325-4800
FAX 325-4810
Other Offices:
San Francisco
Los Angeles

June 3, 1994

California Regional Water Quality Control Board
San Francisco Bay Region
2102 Webster Street, Suite 500
Oakland, California 94612

Attention: Ade Fagurala
Water Quality Specialist

SUBJECT: **SUBMITTAL OF REQUEST FOR 401 WATER QUALITY CERTIFICATION OR WAIVER FOR INSTALLATION OF 36-INCH PIPELINE, INLET, AND OUTLET INTO WATERS OF THE U.S.**

Dear Mr. Fagurala:

Upper Valley Recycling and Disposal Service requests issuance of a 401 water quality certification or waiver for installation of a 36 to 42-inch pipeline into a unnamed drainage located on the eastern edge of the Upper Valley property. The activity is in compliance with the Department of the Army Nationwide Permit Program, nationwide permit 12 (33 CFR, 330), however in accordance with 33 CFR, part 330.4 (c), authorization under nationwide permit 12 requires issuance of a State 401 water quality certification.

On behalf of Upper Valley, I have attached for your review and consideration a copy of the documentation of compliance with the terms and conditions that has been submitted to the U.S. Army Corps of Engineers, San Francisco Region. The report provides details regarding the activity and compliance with the nationwide permit program. The applicant is also preparing a streambed alteration agreement application to the California Department of Fish and Game in accordance with Section 1603 of the California Fish and Game Code.

If you have any questions, please feel free to call me at (916) 325-4800. Please provide any correspondence regarding this matter to the applicant at the following address:

Mr. Robert Pestoni
Upper Valley Recycling and Disposal Service
1285 Whitehall Lane
St. Helena, CA 94575

Very truly yours,

Kathy R. Carps
Aquatic Biologist

Attachment
cc: Curtis Scott, RWQCB
George Leyva, RWQCB

kc\upper\rwqcb.ltr

UPPER VALLEY RECYCLING AND DISPOSAL FACILITY IMPACTS UPON WATERS OF THE U.S. AND COMPLIANCE WITH NATIONWIDE PERMIT CONDITIONS

Prepared for:

Upper Valley Recycling and Disposal Service
1295 Whitehall Lane
St. Helena, California 94574

Prepared by:

EIP Associates
1401 21st Street, Suite 400
Sacramento, California 95814
(916) 325-4800

June 1994

INTRODUCTION

Project Site

The Upper Valley Recycling and Disposal facility is located on approximately 50 acres located 1.8 miles northwest of the town of Rutherford, California, and 2.2 miles southeast of St. Helena, California (Exhibit 1). The site is located within an unsectioned area, shown on the Rutherford, California 7.5 minute USGS quadrangle map. The Assessor's Parcel Number for the site is 27-450-20, 21 and a portion of 06.

Upper Valley Recycling and Disposal Service operates both a recycling and composting facility at 1285 Whitehall Lane, St. Helena. The composting portion of the business, which requires approximately 10 acres of the 50 acre site, has been operating since 1974. The facility composts grape pomace from wineries located in St. Helena and unincorporated areas of Napa County. Pomace is grape waste generated as a by product of annual grape harvesting and crushing. The pomace consists of grape skins, stems, and seeds. The finished compost is used on vineyards throughout Napa and Sonoma Counties and in vegetable crops in Yolo County.

Proposed Action

Upper Valley proposes to install a 36 to 42-inch pipe adjacent to a jurisdictional waters of the U.S. (unnamed drainage). The purpose of the pipe is to provide additional capacity, in combination with the existing channel, so that imporovements on the Upper Valley's property will not adversely impact neighboring properties during a 100-year flood event. A HEC-2 analysis shows the proposed activity will reduce the predicted water surface from the 100-year storm event by 0.1 foot on agricultural property located immediately east of the unnamed drainage. An inlet and outlet to the pipe will also be installed in the unnamed drainage (location shown on attached exhibits). The pipeline will be placed in a trench excavated in upland habitat and will be located approximately 7-16 feet from the unnamed tributary.

Permits and Environmental Documentation

In 1992 the Napa County Department of Environmental Management, which is the local enforcement agency for the California Integrated Waste Management Board (CIWMB), determined that Upper Valley's compost facility is a solid waste facility. As a result of this determination, Napa County issued a notice and order on February 27, 1992, directing Upper Valley to take certain actions to bring the facility into compliance with state regulations. As part of the notice and order, the County required Upper Valley to installed a culvert into the unnamed drainage. In 1993, Upper Valley applied to the USACOE for an after-the-fact

Nationwide Permit Authorization for installation of the culvert. The information concerning the nature of the outfall and impacts associated with that actions were presented in a report submitted to the USACOE.[1]

Subsequent to that action, Napa County requested preparation of a drainage plan and compliance with Section 10228 of County Ordinance 627 (Amended Order 885) for design and drainage improvements. Implementation of the drainage plan will require installation of berms on a portion of the Upper Valley property and a 36 to 42-inch pipe (and inlet and outlet) to reduce on- and off-site flooding. A HEC-2 analysis was performed as part of the drainage plan. Installation of the 36 to 42-inch pipe and inlet and outlet will complete the extent of modification and changes that need to be performed in the unnamed drainage in order to comply with County requirements.

Installation of the berms will not affect any jurisdictional waters of the U.S. Installation of the 36 to 42-inch pipe will, however, requires localized modification and placement of an inlet and outlet within the inner west bank of an unnamed drainage. Existing nationwide permit (NWP) 12 authorizes impacts upon jurisdictional waters of the U.S. such as those that would result from the proposed action. Under NWP 12, discharge of material for "backfill or bedding for utility lines, including outfall and intake structures, provided there is no change in preconstruction contours." A "utility line" is defined in NWP 12, but the term does not include "activities which drain a waters of the United States, such as a drainage tile, however, it does apply to pipes conveying drainage from another area."[2] The proposed installation of a "utility line," as defined by NWP 12 is in conformance with the provisions and restriction of the nationwide permit because the unnamed drainage will not be drained, rather, a portion of the storm event flow will be captured and routed approximately 1400 feet downstream. No net diversion of flows is proposed or would result from the proposed action.

This report documents the nature of impacts the proposed will have on jurisdictional waters of the U.S. and describes mitigations and other respects in which the actions is in compliance with the nationwide permit's general conditions.

---

1 EIP Associates. August 1993. Request for After-the-Fact Authorization and Documentation of Compliance with The Terms and Conditions of Department of the Army Nationwide Permits.

2 Department of Defense. 1991. 33 CFR Part 330: *Final Rule for Nationwide Permit Program Regulations and Issue, Reissue, and Modify Nationwide Permits.* Federal Register 56 (226): 59110-58147.

JURISDICTIONAL WATERS TO BE AFFECTED

The project site lies within an area for which a wetland delineation has recently been performed and formally verified.[3,4] The unnamed tributary to Bale Slough was determined to be a realigned historic waters of the U.S.

Methods

Information provided by the project engineer (Summit Engineering Inc.) was reviewed and the previously prepared and verified wetland delineation was reviewed to verify the location and extent of modifications that will be made as a result of installation of the 36 to 42-inch pipe. No additional field verification was necessary because no modification to this portion of the site have been made since verification of the wetland delineation. All locations and characteristics of previously mapped jurisdictional waters of the U.S. on the site are still currently accurate.

Habitats of the Site

Uplands

The upland habitat to be affected by installation of the pipe is located within the active portion of the Upper Valley composting operations. The upland habitat is subject to recurring disturbance associated with the composting activities. A few planted landscape trees have been planted by the owners of Upper Valley along the top of the bank above the unnamed drainage; otherwise, the upland area is devoid of vegetation with the exception of a few weedy species.

Waters of the U.S.

The unnamed drainage is approximately five to eight feet in width at the top of the incised drainage and approximately four feet in depth The bottom of the drainage, which is roughly three feet wide, supports numerous emergent plant species. A few willows grow within the incised drainage and some larger trees are present along the drainage north of the site. Some riparian vegetation is also present in and adjacent to the eastern side of the unnamed drainage. The properties adjacent to the drainage, with the exception of a portion of the Upper Valley site, are vineyards.

The unnamed drainage appears to begin north of the Whitehall Lane, passes under the lane, and continues south, eventually draining into the channelized and maintained section of the tributary to Bale Slough. According to the owner of Upper Valley, the unnamed drainage is part of a small creek that has been present since the his family bought the property in the 1940's. During

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3 EIP Associates. July 1993. Preliminary Wetland Delineation Report. Upper Valley Recycling and Disposal Service.

4 U.S. Army Corps of Engineers, San Francisco, Regulatory Branch. August 20, 1993. Letter to Robert and Marvin Pestoni, Upper Valley Recycling and Disposal Service. USACOE File Number 20210E87.

some years, the drainage supports perennial flows and it is likely that the perennial flow is the result of a combination of agricultural drainage, surface runoff from more developed areas north near St. Helena, and seeps.

IMPACTS AND MITIGATION

Proposed Fills

In order to install the inlet and outlet of the 36 to 42-inch pipe, Upper Valley proposes excavating the left (west) bank of the incised channel to a depth of approximately 1 foot above the normal flow level, placing the pipe inlet and outlet, backfilling the trenchs, and placement of riprap. No fill, other than rip-rap will be placed within bottom of the channel, only along the channel bank. Pre-construction contours and elevations will be maintained. A trench will also be excavated parallel to the unnamed drainage approximately 7 to 16 feet west of the top of channel bank. Approximately 1,000 square feet (less than 0.1 acre) of jurisdictional waters of the U.S. would be filled as a result of this action. Performance of this work under the auspices of NWP 12 does not require the formal notification process.[5] Digrams showing the location of the proposed pipe and details of the work are shown in the attached exhibits.

Other Potential Impacts

Fills in jurisdictional waters of the U.S. can have impacts on downstream water quality and quantity. The pipeline, inlet, and outlet installation have been designed to minimize any impacts on downstream water quality and quantity. The installation will be performed during the dry season (summer of 1994) when the water level in the unnamed drainage is below the elevation of the pipe inlet and outlet elevation. The culvert is designed to capture a portion of the 100-year normal flow and deliver the flow back into the unnamed drainage immediately downstream of the Upper Valley site. The pipe inlet is not designed to capture low flow or normal flows. The design ensures no adverse impacts will occur to riparian vegetation present between the inlet and outlet on the unnamed drainage from capture and re-delivery of flows.

Mitigation

Sediment Control

Although the unnamed drainage flows through a heavily used agricultural area, the water quality in the unnamed drainage is assumed to be high. Because of this, care will be taken to ensure that it is not degraded by the proposed actions. Hay bales or silt fencing will be installed

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[5] Department of Defense. 1991. 33 CFR Part 330: Final Rule for Nationwide Permit Program Regulations and Issue, Reissue, and Modify Nationwide Permits. Federal Register 56 (226): 59110-58147.

immediately downstream of the inlet and outlet to contain any fines released by excavation of the inlet and outlet trench. Following completion of installation of the inlet and outlet, the top of the bank (west side) and inner west bank will be re-seeded to minimize erosion. It is anticipated that some bank protection, such as rip-rap will be needed immediately adjacent to the inlet and outlet pipes to prevent erosion near the pipes during high flows.

COMPLIANCE WITH GENERAL CONDITIONS

The following list specifies how the proposed action is in compliance with each of the general conditions pertaining to all NWPs and the 404-only conditions pertaining to NWP 12.

General Conditions

1. **Navigation**

   No navigable waters will be affected

2. **Proper Maintenance**

   All activity sites and structures in and around the unnamed drainage will be maintained to ensure the drainage remains confined to the designed area and that erosion in excess of that which normally occurs within existing drainages does not occur.

3. **Erosion and Siltation Controls**

   No heavy equipment or other vehicles will be driven within the unnamed drainage; all work will be performed from upland areas west of the unnamed drainage. Disturbance to areas to be excavated will be limited to the width of the required trench. Hay bales or siltation fencing will be installed prior to excavation within the drainage channel. Existing vegetation will be left intact wherever possible, sidecast material will be immediately removed from the channel and the banks of the unnamed drainage will be restored to the original configuration to the extent practicable. The construction will be performed during the summer months when the unnamed drainage is dry or at low flow. The upland area will be restored and revegetated to minimize erosion into the channel. Rip-rap will be placed at the base of the outfall to prevent erosion and siltation, as required by the provisions of NWP 12.

4. **Aquatic Life Movement**

   Construction will occur when there is low flow, or possibly no flow in the unnamed drainage. At that time, presence and activity of aquatic species are at a minimum. The culvert will be sized to maintain normal flows to preserve the existing continuity of the drainage and flows. No disruption to the movement of aquatic life will result from the inlet, pipeline, or outlet structures.

5. **Equipment**

Trenching and installation of the inlet and outlet will be performed from the left (west) side of the unnamed drainage. Vehicles and other equipment will not be driven across or within the unnamed drainage or other wetlands. See other limitations stated under general condition number 3.

6. **Regional and Case-By-Case Conditions**

The proposed activity will comply with any regional or site-specific conditions imposed by the District Engineer, however, none have been specified to date.

7. **Wild and Scenic Rivers**

Waters to be affected are not components of the Natural Wild and Scenic river system nor designated study rivers.

8. **Tribal Rights**

The proposed action will not impair any reserved tribal rights.

9. **Water Quality Certification**

A 401 Water Quality Certification or waiver thereof is being requested from the California Regional Water Quality Control Board, San Francisco Bay Region (See attachment).

10. **Coastal Zone Management**

Since the project site does not lie within the coastal zone, consistency with state coastal zone management is not required for this project.

11. **Endangered Species**

No known listed species or their habitat are present on the site. According to a certified (February 1994) EIR for operation and expansion of the Upper Valley composting activities, no endangered, threatened, or candidate species for listing are present on the site or within the unnamed drainage. Based on this information, and a site investigation conducted of the unnamed drainage as part of the verified wetland delineation work, no endangered or special status species will be affected by construction of the outfall.

12. **Historic Properties**

According to the above described EIR no cultural or historic properties are present on the site. The installation of the pipeline, inlet, and outlet would not affect historic properties.

13. **Notification**

Predischarge notification is not required for NWP 12.

Section 404 Only Conditions

1. **Water Supply Intakes**

No public water supply intakes are located on the project site.

2. **Shellfish Production**

No shellfish production occurs on the project site.

3. **Suitable Material**

Suitable materials, including galvanized piping, rock bedding, and cemented rip-rap will be used in construction of the outfall.

4. **Mitigation**

All construction activities were designed to minimize the amount of fill inadvertently placed into the unnamed drainage, to the extent practicable given engineering and topographic constraints.

5. **Spawning Areas**

The unnamed drainage is not known to support an anadromous fishery and no impacts to spawning ground will from construction of the utility line.

6. **Obstruction of High Flows**

When completed, the pipeline will not permanently restrict or impede the passage of high flows within the waters to be affected. The pipline will allow a portion of the high flows to be routed immediately downstream of the site. The HEC-2 analysis indicates that project will reduce the potential for flooding onsite and offsite, including downstream.

7. **Adverse Impacts From Impoundments**

The outfall has been designed to pass flows and will not created any permanent impoundment in the channel that would results in adverse impacts on the aquatic system due to accelerated or restricted flows. The pipeline system will be design and installed to ensure the activity does not result in ponding of water in the pipeline thereby creating a misquito breeding problem.

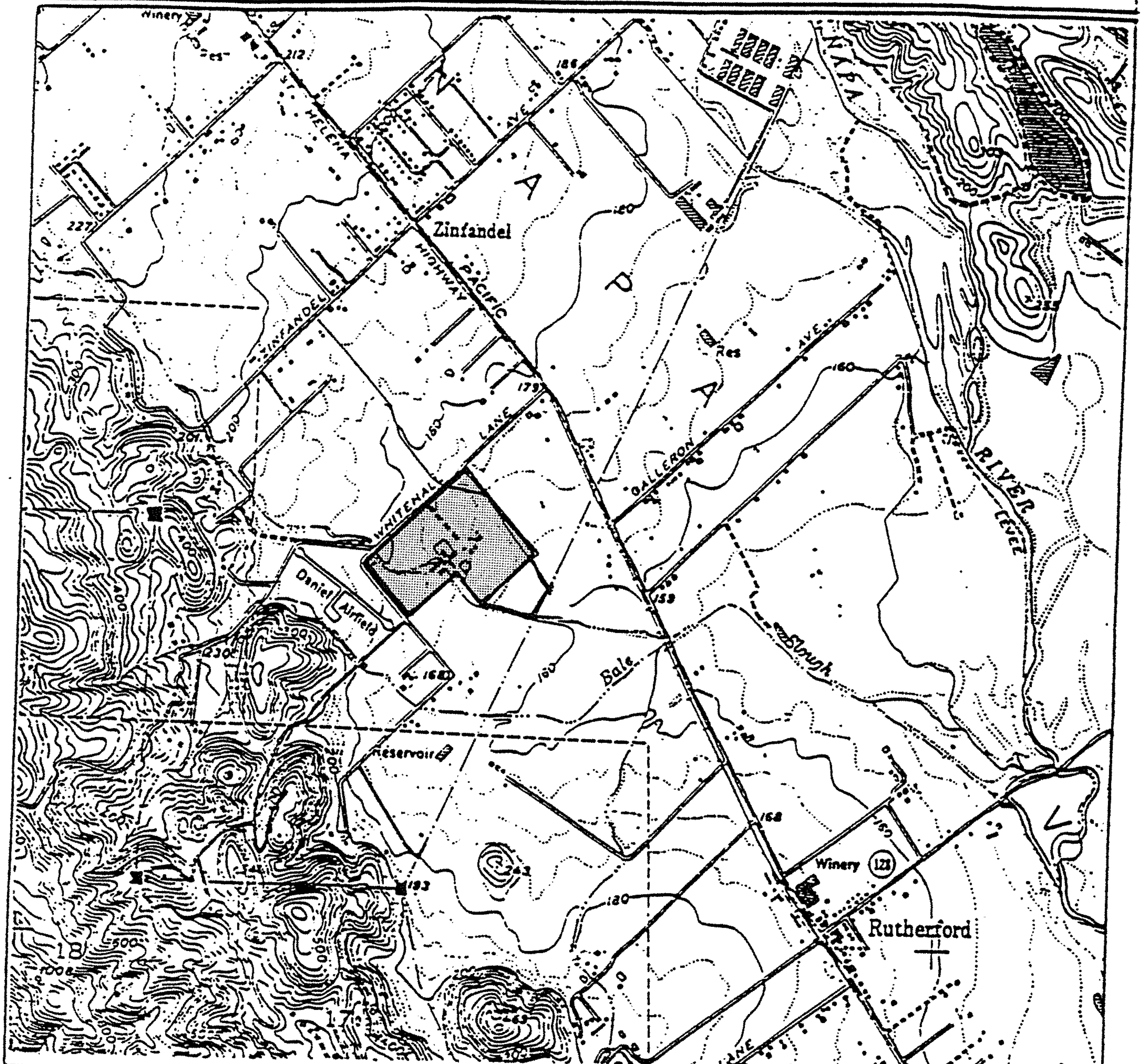
8. Waterfowl Breeding Areas

The unnamed drainage does not support a significant waterfowl breeding area. It is anticipated that some waterfowl nesting may occur along the drainage, but not necessarily near the project site.

9. Removal of Temporary Fills

Sidecast material, if any, will be immediately removed from any area other than the proposed fill area. All disturbed areas will be returned as close as practicable to pre-existing contours.

GEOLOGICAL SURVEY
QUADRANGLE TITLE: *Rutherford* FILE NO.

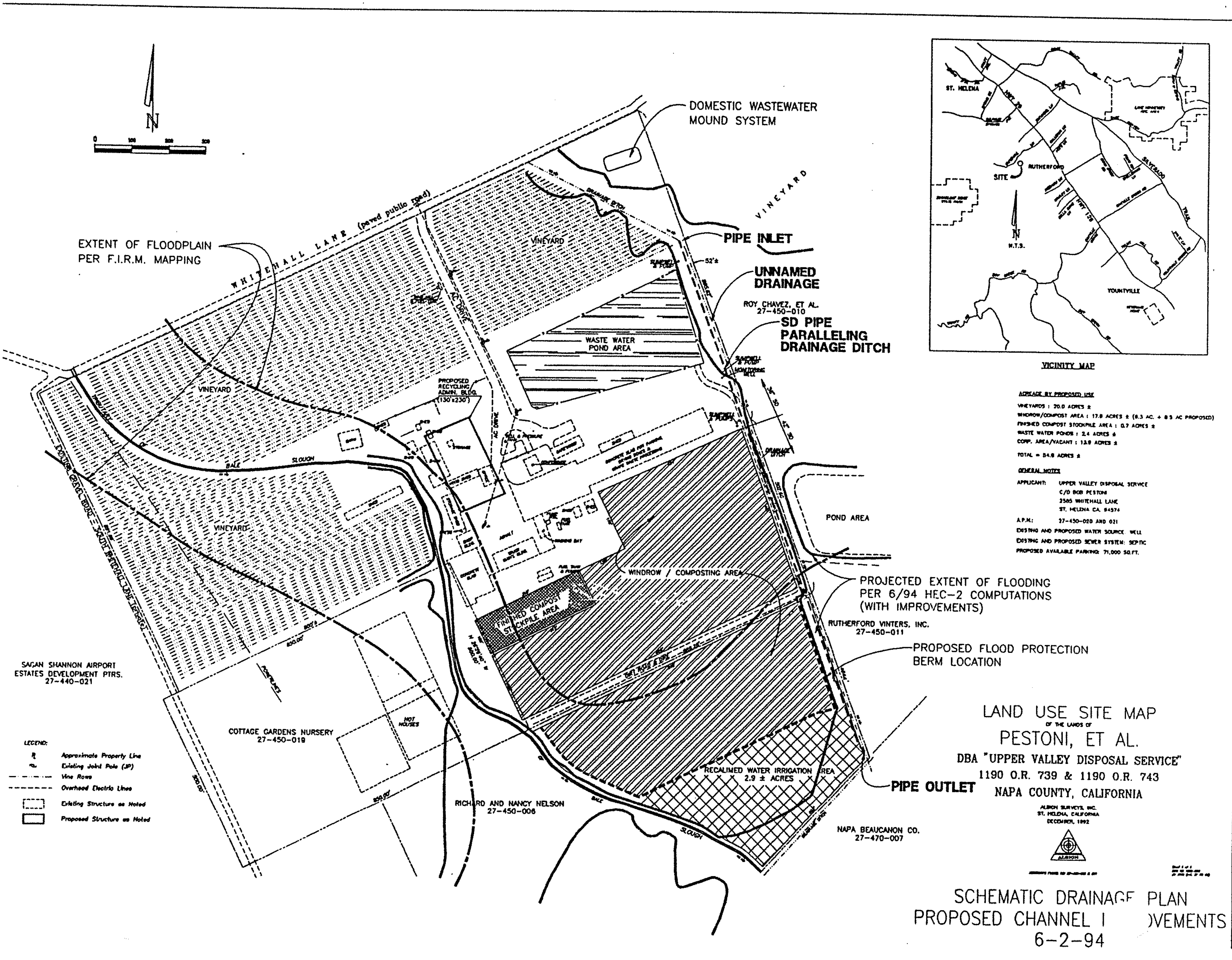


LEGEND

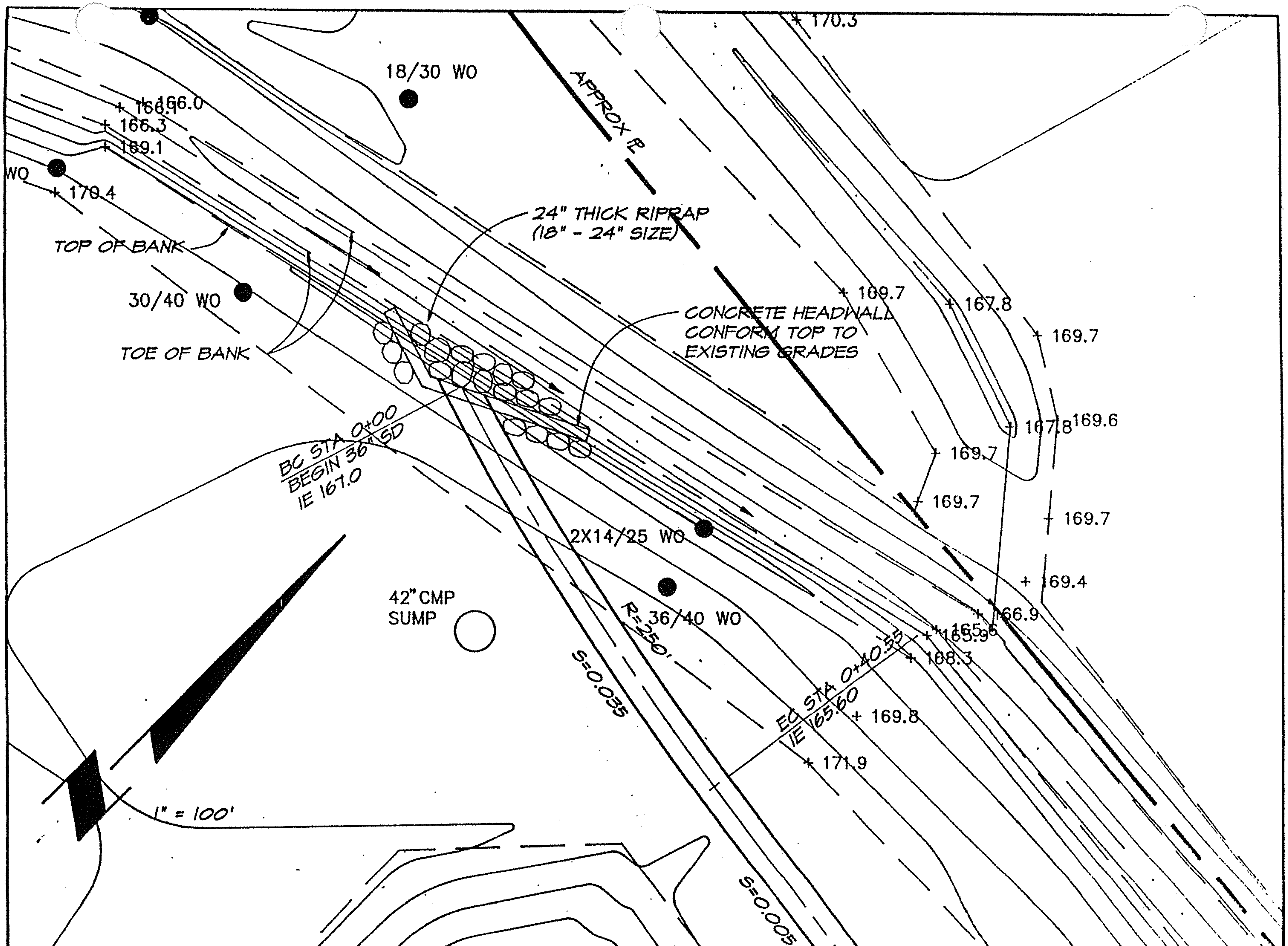
The following information shall be shown on the topographic map:

	Existing	Proposed
Parcel Boundary		
Structure		
Septic System		
Well		
Spring		
Reservoir		
Road		
Parking Lot or Outdoor Storage Area		

EXHIBIT 1
TOPOGRAPHIC MAP

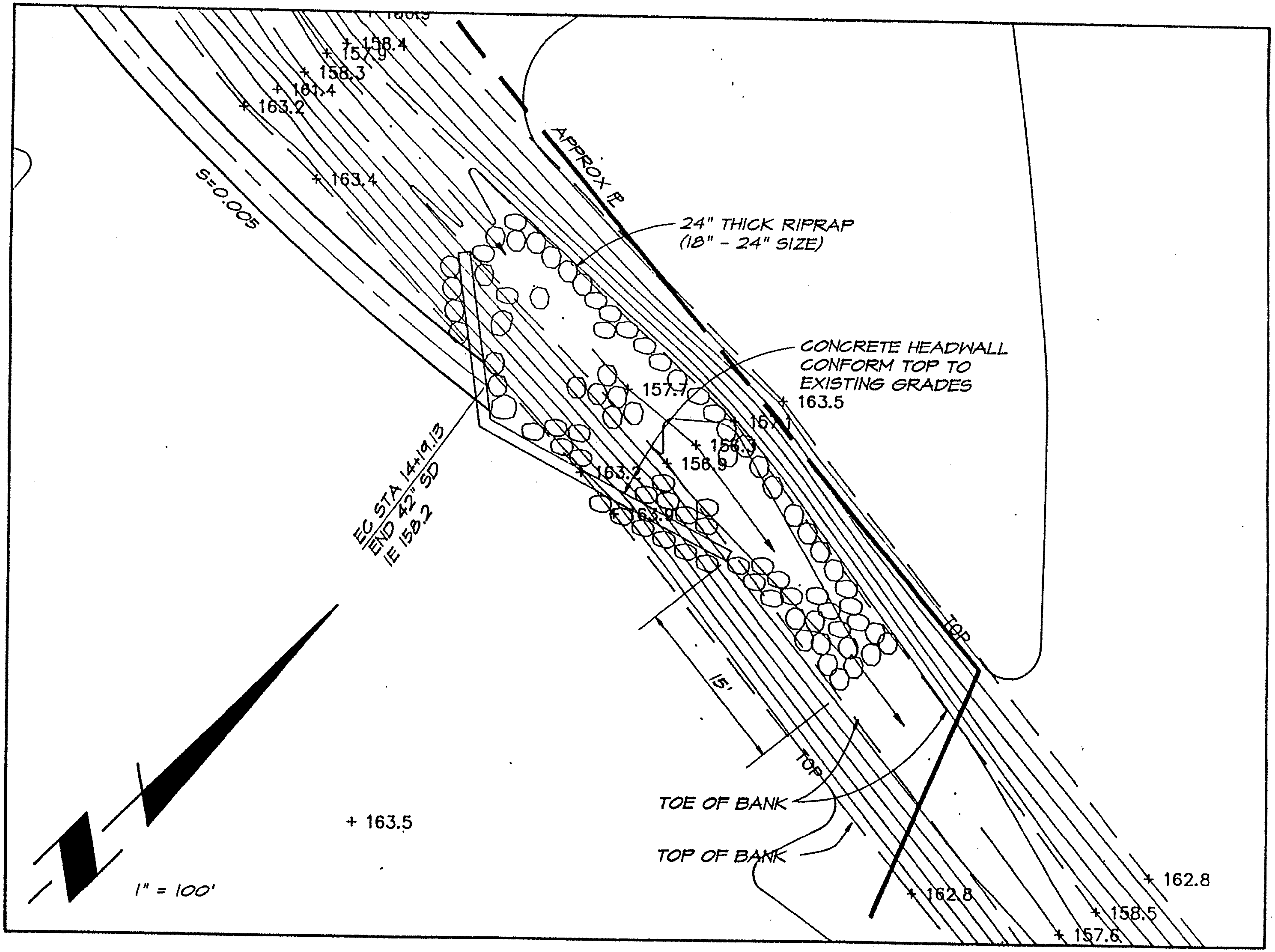


DOMESTIC WASTEWATER MOUND SYSTEM
EXTENT OF FLOODPLAIN PER F.I.R.M. MAPPING
WHITEHALL LANE (paved public road)
VINEYARD
PIPE INLET
UNNAMED DRAINAGE
ROY CHAVEZ, ET AL. 27-450-010
SD PIPE PARALLELING DRAINAGE DITCH
WASTE WATER POND AREA
PROPOSED RECYCLING ADMIN. BLDG. (130'x230')
AC DRIVE
DRAINAGE DITCH
SLOUGH
BALE
POND AREA
WINDROW / COMPOSTING AREA
FINISHED COMPOST STOCKPILE AREA
PROJECTED EXTENT OF FLOODING PER 6/94 HEC-2 COMPUTATIONS (WITH IMPROVEMENTS)
RUTHERFORD VINTERS, INC. 27-450-011
PROPOSED FLOOD PROTECTION BERM LOCATION
RECALIMED WATER IRRIGATION AREA 2.9 ± ACRES
PIPE OUTLET
NAPA BEAUCANON CO. 27-470-007
RICHARD AND NANCY NELSON 27-450-006
COTTAGE GARDENS NURSERY 27-450-019
HOT HOUSES
SAGAN SHANNON AIRPORT ESTATES DEVELOPMENT PTRS. 27-440-021
EXISTING GRAVEL ROAD - SOUTH WHITEHALL LANE
TRIBUTARY
LEGEND:
Approximate Property Line
Existing Joint Pole (JP)
Vine Rows
Overhead Electric Lines
Existing Structure as Noted
Proposed Structure as Noted
ST. HELENA
RUTHERFORD
SITE
HWY 29
HWY 128
SILVERADO
TRAIL
YOUNTVILLE
N.T.S.
VICINITY MAP
ACREAGE BY PROPOSED USE
VINEYARDS : 20.0 ACRES ±
WINDROW/COMPOST AREA : 17.8 ACRES ± (9.3 AC. + 8.5 AC PROPOSED)
FINISHED COMPOST STOCKPILE AREA : 0.7 ACRES ±
WASTE WATER PONDS : 2.4 ACRES ±
COMP. AREA/VACANT : 13.9 ACRES ±
TOTAL = 54.8 ACRES ±
GENERAL NOTES
APPLICANT: UPPER VALLEY DISPOSAL SERVICE
C/O BOB PESTONI
2585 WHITEHALL LANE
ST. HELENA CA. 94574
A.P.N.: 27-450-020 AND 021
EXISTING AND PROPOSED WATER SOURCE: WELL
EXISTING AND PROPOSED SEWER SYSTEM: SEPTIC
PROPOSED AVAILABLE PARKING: 71,000 SQ.FT.
LAND USE SITE MAP
OF THE LANDS OF
PESTONI, ET AL.
DBA "UPPER VALLEY DISPOSAL SERVICE"
1190 O.R. 739 & 1190 O.R. 743
NAPA COUNTY, CALIFORNIA
ALBION SURVEYS, INC.
ST. HELENA, CALIFORNIA
DECEMBER, 1992
ALBION
SCHEMATIC DRAINAGE PLAN
PROPOSED CHANNEL I VEMENTS
6-2-94



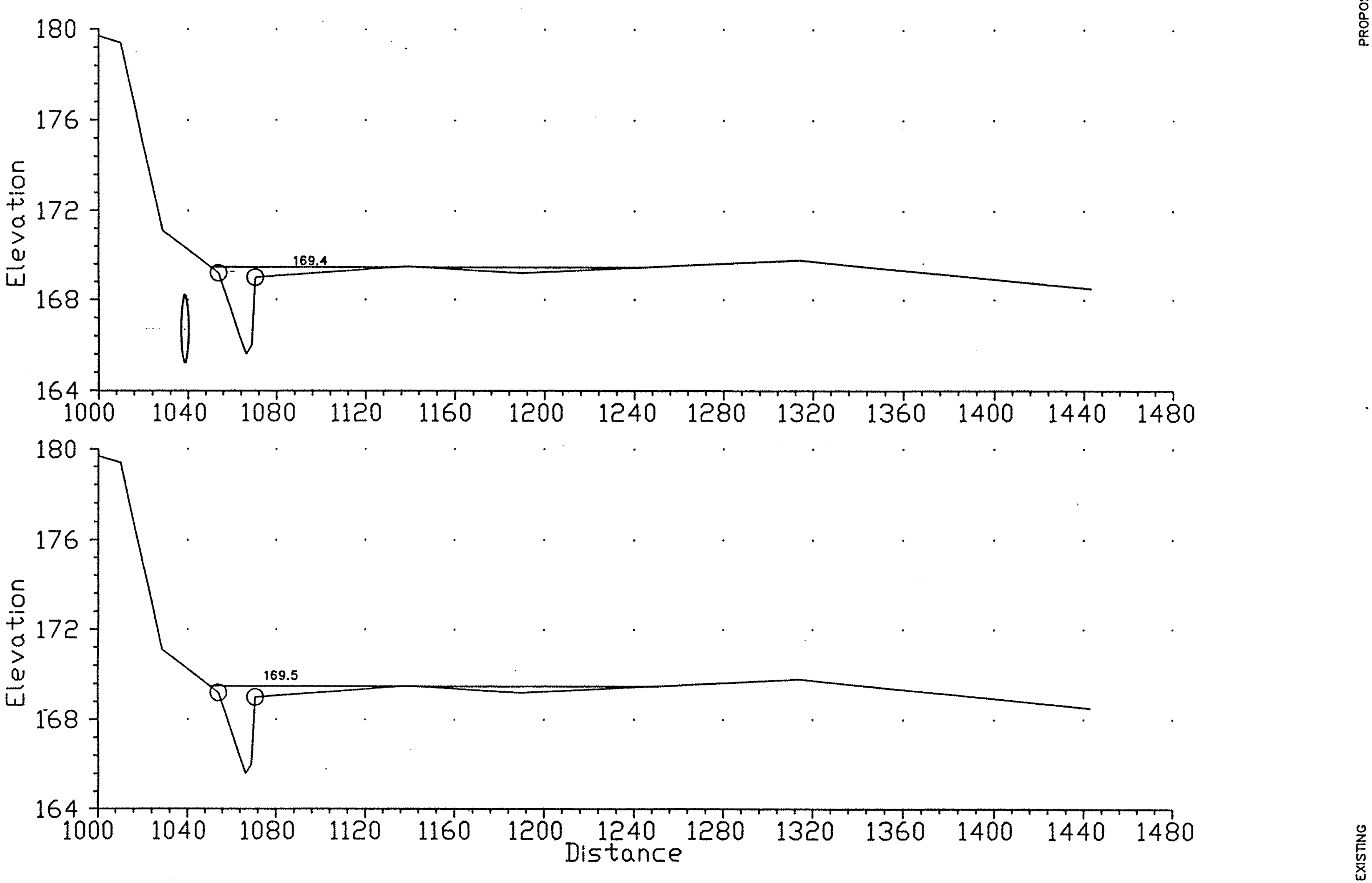
INLET DETAIL - 36" SD (1)

1" = 10'



OUTLET DET L - 42" SD (2)

UNNAMED TRIBUTARY TO BALE SLOUGH
CROSS SECTION 10
(Looking upstream near 36"pipe inlet)

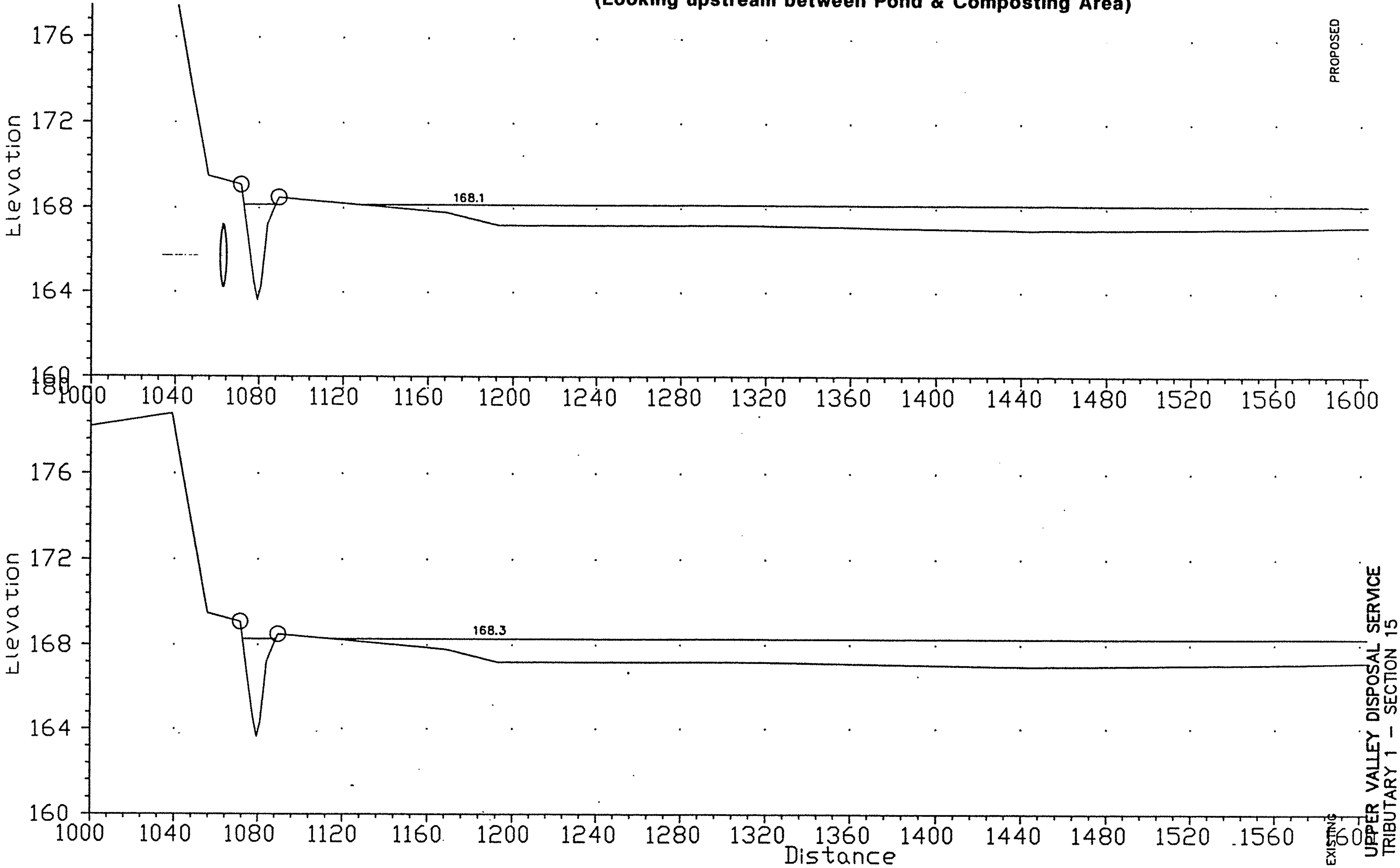


UPPER VALLEY DISPOSAL SERVICE
TRIBUTARY 1 – SECTION 10

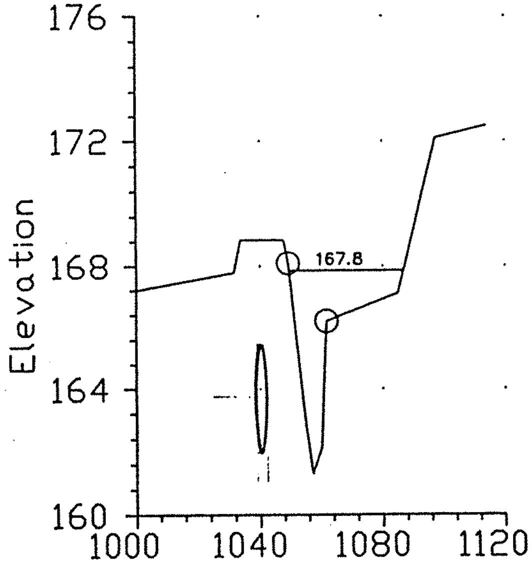
UNNAMED TRIBUTARY TO BALE SLOUGH

CROSS SECTION 15

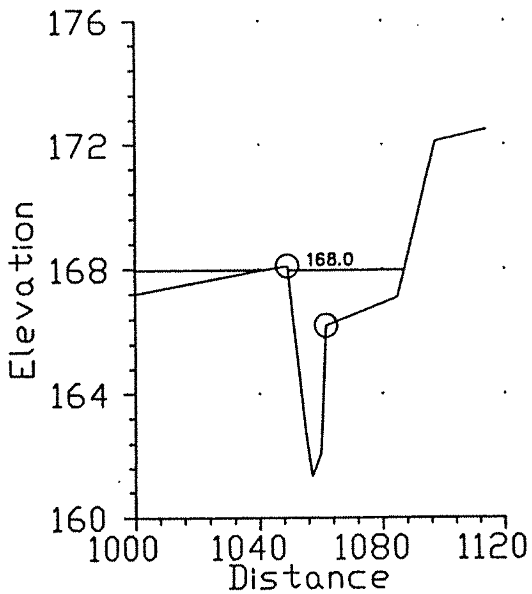
(Looking upstream between Pond & Composting Area)



UNNAMED TRIBUTARY TO BALE SLOUGH
CROSS SECTION 20
(Looking upstream at north Composting Area)



PROPOSED



EXISTING

UPPER VALLEY DISPOSAL SERVICE
TRIBUTARY 1 – SECTION 20

APPENDIX C - True Engineering Wastewater Pond Documentation

PESTONI RANCH

Irrigation Reservoir

Aug. 1989

BID SCHEDULE

Bid Item (Furnished and Installed)	Quantity	Unit Cost	Cost
Contractor mobilization/move out	1		
Volume of cut	28,600yd^3		
Volume of compacted fill	23,600yd^3		
Shaping and grading of Emergency spillway	1		
24" dia. CMP Principle spillway	1		
Controlled outlet with gate valve	1		
8" dia. PVC transport line/inlet pipe with inlet conditions	400'		
Shape and grade swale along south Embankment	1		

Total: ______________

Bid Submitted by: ______________
Firm

Signature: ______________

Date: ______________

TRUE ENGINEERING

779 FREEWAY DR APT. D • NAPA, CALIFORNIA, 74558 • (707) 253-1806

Specializing in Subsurface Drainage

BRIAN TRUE & SCOTT HUISMANN
Engineers

August 17, 1989

Mr. Bob Pestoni
Mr. Marvin Pestoni

PESTONI BROTHERS RANCH
1265 Whitehall Lane
St Helena, CA 94574

INTRODUCTION

Presented here are the construction plans and specifications for the proposed irrigation reservoir for the Pestoni Ranch vineyard development. The project is located about one mile west of Highway 29 on Whitehall Lane. The reservoirs capacity will be approximately 20 acre-feet and will cost approximately $90,000.

The reservoir was designed to retain the surface and subsurface runoff from the compost field for the storm year occurring about once in 25. It is considered undesirable to have possibly contaminated runoff water from the compost field entering the natural stream. As such, a surface and subsurface drainage design has previously been submitted which ensures

INTRODUCTION - continued

containment of the runoff and its flow concentration at a sump located in the northeast corner of the compost field. From the sump the water will be pumped into the reservoir as the primary source of water.

SOILS

The soils throughout the reservoir site are typically dense clays. They are quite suitable for building reservoir embankments. Unfortunately, in between clay layers, gravely water bearing stratas exist from 6 to 9 feet deep. A very solid impervious clay layer does occur about 10 feet below the ground surface. It will be necessary to build the reservoir bottom on this clay layer.

At present, the water table in the reservoir site is only 3 to 4 feet from the surface due to the impermeable qualities of the soil. Two deep dewatering drains were designed and submitted previously to combat this complication. The drains will lower the water table and allow construction of the reservoir without expensive dredging techniques.

DESIGN FEATURES

- Existing Reservoir - The present reservoir hole will be almost completely included in the reservoir excavation. This allows for a favorable cut/fill ratio of about 1.21 to 1 since the existing hole will not need to be filled.

● Embankments - The top of the embankments will be built to a constant elevation. The west bank will stand approximately 6.5 feet tall, while the east bank will stand approximately 10 feet tall. The difference in height is due to the natural slope of the ground surface. The embankment side slopes will be 2 to 1. With the percentage of clay in the soil, it is expected that the banks will be quite stable and non-erosive. There will be two feet of freeboard to allow for the maximum in settling and shrinking. A ramp was added to the north side of the reservoir to allow a simple access to the top of the bank. However its is encouraged to only drive on the bank when absolutely necessary.

● Outlets- There are three ways in which the reservoir can release water. The primary method will be the principle spillway. This spillway will have the capability of allowing a once in 25 year 24 hour storm to pass through it once the reservoir is filled to its' maximum level. It exits into the swale running along the south embankment. It is expected that the principle spillway will normally be the only one used. The remaining two water removal methods are for emergencies or unseen contingencies. A controlled outlet is provided to allow emptying of the reservoir down to the natural ground level. This outlet is a 12 inch diameter pipe laid near the natural ground surface with the compacted embankment above it. A water-tight gate valve controls the passage of any water. This controlled outlet can be used to implement any repairs on the embankment or to head off any observed imminent embankment failures. The final method of water exit is by the emergency spillway. This spillway will only be used in the worst of storms which occur when the reservoir is already full. The water is released over rock rip-rap on the embankment and thence into the swale bordering the south reservoir embankment.

- Cut-Off Trench - The cut-off trench is designed to prevent lateral movement of water into or out of the reservoir. The trench concept was chosen over the clay liner concept primarily because of ease of construction. The trench will extend from the the natural ground level to 2 feet into the impervious layer upon which the reservoir bottom will be built. The gravely water bearing soil stratas will thus be effectively prevented from interfering with the reservoir.

CLOSING

We have enjoyed working with you on this project and look forward to seeing the system installed so that the proposed vineyard will be a success and the compost field operation improved.

Sincerely,

Brian True

Brian True

ESTIMATED INSTALLED COST

Project Name: Pestoni Ranch

TRUE ENGINEERING
Date: 8/29/89
Page: ______of______

ITEM	QUANTITY	UNIT COST	COST
Contractor mobilization/move out	1	lump sum	$1.500
Volume of cut	28,600yd^3	$1.20/yd^3	$34.320
Volume of compacted fill	23.600yd^3	$1.50/yd^3	$35.400
Shaping and grading of Emergency spillway	1	lump sum	$1.000
24" dia. CMP Principle spillway	1	lump sum	$1,500
Controlled outlet with gate valve	1	lump sum	$2.000
8" dia. PVC transport line/inlet pipe with inlet conditions	400'	$7.00/ft.	$2.800
Shape and grade swale along south Embankment	1	lump sum	$750
Engineering - design, construction specifications	1	lump sum	$3.000
Engineering - construction staking, periodic supervision, "As-Built" drawings.	23.600yd^3	$0.15/yd^3	$3.540
		TOTAL	$85.8100

TRUE ENGINEERING SERVICE

GENERAL REQUIREMENTS

PROGRESS OF PIPELINE CONSTRUCTION

The work shall proceed in a systematic manner so that a minimum of inconvenience will result to the public in the course of construction. The safety conditions of open excavations shall be the contractor's responsibility. Completely backfill and clean up after each section of pipe has been approved.

EASEMENTS

Where portions of the work are located on public or private property, easements and permits will be obtained by the owner. Easements will provide for the use of property for construction purposes to the extent indicated on the easements. The contractor shall confine his construction operations to within the easement limits or right-of-way limits.

UNDERGROUND UTILITIES

Known utilities and structures adjacent to or encountered in the work are shown on the plans. Those shown are for the convenience of the contractor only, and no responsibility is assumed by either the owner or the engineer for their accuracy or completeness. If the contractor discovers utility facilities not indentified by the owner in the plans, he shall immediately notify the owner and utility.

INTERFERING STRUCTURES

The contractor shall adequately protect all private and utility property within the construction area including pipelines, structures, existing irrigation and drainage facilities, and utility facilities whether or not same are shown on the drawings. Notify the property owner of any damaged facilities. Any such facilities damaged shall be repaired or replaced to the satisfaction of the owner of the utility. There shall be no additional cost to the owner for such repair or replacement. Without additional compensation, the contractor may remove and replace in a condition as good as or better than original, such small miscellaneous structures as fences, mailboxes, and signpost that interfere with the contractors operations.

PROTECTION OF PROPERTY

Protect stored materials, crops, and other items located adjacent to the proposed work. Notify property owners affected by the construction at least 7 days in advance of the time construction begins. During construction operations, construct and maintain such facilities as may be required to provide access by all property owners to their property.

Provide for access at all times for livestock through farm areas, and no portion of farmlands in which livestock are pastured shall be cut off from ready access by the farm animals. Construct and maintain any temporary fencing required at the site to keep livestock out of the construction area.

TRUE ENGINEERING SERVICE

STANDARD CONSTRUCTION SPECIFICATIONS

FOR

IRRIGATION RESERVOIRS

CLEARING AND STRIPPING:

The sites of the borrow pits shall be stripped to sufficient depth to remove all vegetation, roots, brush, sod, and other objectionable material.

The foundation area shall be cleared of all trees, stumps, roots, brush, boulders, sod and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed. Loose earth shall not be left on foundation area to a depth in excess of 6" above approved undisturbed foundation material. The surface of the foundation area shall be thoroughly scarified before placement of the embankment materials.

EXCAVATION:

A. Conduit:

Trench excavation for installation of a conduit, where shown on the drawings, shall be made in original ground. Excavation in compacted fill may be allowed provided the bottom of the trench is at or near undisturbed foundation. The trench shall conform to lines and grades shown in the drawings.

COMPACTED EARTHFILL AND BACKFILL:

A. Material:

All material shall be obtained from selected areas as shown on the drawings. Fill materials shall contain no sod, brush, roots, or other perishable or unsuitable material. Cobbles and rock fragments over 6 inches in diameter shall be removed from the material prior to compaction.

B. **Placement:**

The placing and the spreading of the fill material shall be started at the lowest point of the foundation, and the fill shall be brought up in approximately horizontal layers of such thickness that the required compaction can be obtained with the equipment used.

Fill placed around structures will be brought up at approximately uniform height on all sides of the structure.

The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material.

C. **Moisture:**

The moisture content of the fill material shall be such that the required degree of compaction can be obtained with the equipment used.

The proper moisture content will be determined by inspection during the placement operation. Material that is too wet for proper compaction shall either be removed or allowed to dry prior to compaction. As far as practicable, the material shall be brought to the proper water content in the borrow pit before excavation. Supplemental water, when required, may be applied by sprinkling the materials in the fill. Uniform distribution of the moisture shall be obtained by discing, blading, or other approved method prior to compaction.

D. Compaction:

1. Compaction shall meet the requirements of one of the methods specified in the Construction Requirements and as described below.
   – Compaction shall meet 90 % of ASTM publication D 1556-64 or D 1557-78 requirements –

2. Pneumatic-tired equipment: The maximum layer thickness before compaction shall be 6 inches. A loaded carryall may be considered a pneumatic roller. The wheels of this equipment must pass over 90 percent of the surface of each lift before a new lift is placed.

3. Sheepsfoot Compacter: The reservoir bottom and sides shall have a compacted clay liner as shown on the drawings. The clay material shall be selected from within the reservoir excavation and approved by the engineer. The maximum layer thickness before compaction shall be 6 inches. Each lift will be compacted by a minimum of 5 passes of a sheepsfoot compacter.

E. Borrow Area:

The contractor shall obtain the fill material for construction from within the interior of the basin itself. The contractor shall remove the borrow uniformly from across the entire pond bottom. The contractor shall exercise reasonable care during earthmoving operations to produce a reasonably level (± 0.2 feet) surface when borrow operations are completed.

TOPSOIL PLACEMENT

Topsoil shall be stripped to a depth of 1.5 feet from the reservoir area and is to be stockpiled. After the excess subsoil is removed from the reservoir and placed in the swale southwest of the reservoir, the stockpiled topsoil shall be placed on top of the swale fill to a minimum depth of 1.5 feet.

TRUE ENGINEERING SERVICE
STANDARD CONSTRUCTION SPECIFICATIONS
FOR
HIGH PRESSURE UNDERGROUND PLASTIC PIPELINE

GENERAL:

The pipe and fittings shall conform to applicable provisions of ASTM D 1784.

JOINTS AND CONNECTIONS:

All joints and connections shall be made so as to withstand the design maximum working pressure for the pipeline without leakage and shall leave the inside of the line free of any obstruction that may tend to reduce its capacity below design requirements.

All fittings, such as couplings, reducers, bends, tees and crossings shall be made of material that is recommended for use with pipe and shall be installed in accordance with the recommendations of the pipe manufacturer.

Fittings made of steel or other metals subject to corrosion shall be adequately protected by wrapping with plastic tape or coating with high corrosion preventation qualities. Where plastic tape is used for corrosion protection, all surfaces to be wrapped shall be thoroughly cleaned and then coated with a primer compatible with the tape prior to wrapping.

PLACEMENT:

The pipe shall be allowed to come to within a few degrees of the temperature that it will have after complete covering prior to any backfilling beyond shading. The pipeline shall be installed at sufficient depth below the ground surface to provide protection from hazards imposed by traffic crossing, farming operations, freezing temperatures, or soil cracking.

Where rock, hardpan, boulders or any other material which might damage the pipe are encountered, the trench shall be undercut a minimum of 4 inches below final grade. The material used to establish final grade shall be sand or fine graded stable soil.

TESTING:

The pipeline shall be thoroughly and completely tested for pressure strength and leakage before backfill operations are undertaken. The line shall be filled with water, taking care to bleed all entrapped air in the process. The pressure shall be slowly built up to the maximum design working pressure. The line shall be inspected in its entirety while the maximum working pressure is maintained. Where leaks are discovered they shall be promptly repaired and the line shall be retested. In some cases, it may be necessary to partially backfill the line before testing in order to hold the line in place. Where such is the case, the partial backfill shall be undertaken in covering only the body of the pipe sections and leaving all joints and connections uncovered for inspection purposes.

TESTING - continued

It shall be demonstrated by testing that the pipeline will function properly at design capacity. At or below design capacity, there shall be no objectionable surge or water hammer. Objectionable flow conditions shall include continuing unsteady delivery of water, damage to the pipeline, or detrimental overflow from control valves.

BACKFILLING:

The pipeline shall be uniformly and continuously supported. Blocking or mounding shall not be used to bring the pipe to final grade.

The initial backfill shall be of selected fine grained material free from rocks or stones greater than approximately 2 inches in diameter. The initial fill shall be compacted firmly around and above the pipe to achieve a soil density equal to or exceeding the natural density of the undisturbed sidewalls of the trench. Care shall be taken to avoid deformation or displacement of the pipe during this phase of the operations.

When water packing is used, the pipeline first shall be filled with water. The initial backfill, before wetting, shall be of sufficient depth to insure complete coverage of the pipe after consolidation has taken place. Water packing is accomplished by adding water in such quantity as to thoroughly saturate the initial backfill without inundation. After saturation, the valves shall be closed and the pipeline shall remain full until final backfill is made. The wetted fill shall be allowed to dry until firm before final backfill is begun.

The remainder of the backfill shall be placed and spread in approximately uniform layers in such a manner as to completely fill the trench so that there will be no unfilled spaces in the backfill. Final backfill material shall be free of rocks or boulders greater than 3 inches in diameter and shall be added and compacted in a manner that will leave the fill at ground level after settlement has taken place. Rolling equipment shall not be used until a minimum of 18 inches of backfill material has been placed over the top of the pipe.

All special backfilling requirements of the manufacturer shall be strictly observed.

At low places on the ground surface, extra fill may be placed over the pipeline to provide the minimum depth of cover. In such cases, the top width of the fill shall be no less than 10 feet and the side slopes no steeper than 6 horizontal to 1 vertical.

MARKING:

The pipe shall be adequately marked at intervals of not more than 5 feet. Marking shall include the following:

MARKING - continued

1. The nominal pipe size and the size system that applies (IPS or PIP); e.g., 4-IPS or 4-PIP.
2. The type of plastic pipe material in accordance with the designation code; e.g., PVC 1120.
3. The pressure rating in p.s.i. for water at 73.4 degrees F; e.g., 200 p.s.i.
4. The SCS or ASTM specification designation with which the pipe complies for IPS-sized pipe, or the designation PIP for pipe in this size system.
5. The manufacturer's name (or trademark) and code.

GUARANTEE:

The installing contractor shall certify that his installation complies with the requirements of this specification. He shall furnish a written guarantee designed to protect the owner against defective workmanship and materials over a period of not less than 2 years.

AUG 21 1990

PPI Agricultural Engineers, Inc.

A Subsidiary of Provost & Pritchard, Inc. Engineers

1716 Jefferson Street • Napa, California 94559
Telephone (707) 253-1806 • FAX (707) 253-1604

Irrigation System Design & E...
Water Supply & Distribution
Subsurface Drainage

August 14, 1990 8930001

Mr. Bob Pestoni
1285 Whitehall Lane
St. Helena, California

Dear Bob,

This letter is to set forth the results of our preliminary investigation into the cause of water entering your reservoir through the bottom and sides.

After initially meeting with you and Marvin the morning of August 8th, Brian True and I examined the wet areas at the base of the embankment inside the reservoir. Digging into several of these wet areas, we encountered gravel strata which are conducting the water into the reservoir. We also observed several areas of standing water on the reservoir bottom. The specific cause of these wet areas could not be determined at that time.

Several facts concerning the construction of the reservoir were discussed during the subsequent meeting with Frank Borges and Ed Bower of Harold Smith and Son. The first topic was construction of the cutoff trench. During the early phase of construction, a meeting took place between Brian True and Frank Borges to discuss the method of sealing the sides of the pond. The plans call for a cutoff trench in the approximate center of the embankment. Frank expressed concern that construction of such a trench would be more difficult than a compacted liner on the inside face of the reservoir. Since it is stated in the design report that the basis for choosing the trench was ease of construction, Brian agreed that the compacted fill for sealing the sides of the reservoir could be placed on the inside of the embankment.
He also stated that this would be acceptable only if the gravel strata that are present were sealed off by the liner.

Another topic of discussion at the meeting was the effectiveness of the dewatering system. Frank stated that they had been working in very wet conditions as they approached the bottom of the reservoir, especially in the northwest corner. He also said that the north dewatering drain was at a higher elevation than the bottom of the reservoir. This line was later excavated and found to have been installed according to design specifications. Although it was indeed higher than the reservoir bottom where we excavated it, it was placed into the heavy clay layer and the envelope material extended well above the gravel strata. Our survey also showed a proper grade on the line.

At the meeting, Frank also mentioned that the elevation of the reservoir bottom was somewhat lower than the design elevation. Upon surveying the reservoir, it was found that the average elevation of the bottom was about 87 feet. This is 1.5 feet below the design elevation of 88.5 feet.

Although the information contained in this preliminary report suggests some possibilities, I feel it is premature to speculate on specific causes at this time. I propose that another meeting be scheduled at the site to discuss the next step in securing a sound, effective reservoir for your ranch. If you agree, please call me after you have reviewed this and I can make arrangements for a meeting with the same participants as our meeting of August 8th.

It was a pleasure meeting with you, Bob. I look forward to helping solve this problem and I am confident that by working together with Frank and Ed we can obtain everyone's goal: a finished reservoir that will be an asset to your operation.

Sincerely,

Jim Bushey
Design Engineer

cc: Marvin Pestoni
Frank Borges
Ed Bower
Mike Day
Brian True

SEP - 4 1990

PPI Agricultural Engineers, Inc.

A Subsidiary of Provost & Pritchard, Inc. Engineers

1716 Jefferson Street • Napa, California 94559
Telephone (707) 253-1806 • FAX (707) 253-1604

Irrigation System Design & Evaluation
Water Supply & Distribution
Subsurface Drainage

Ed Bower and Frank Borges
Harold Smith and Son, Inc.
800 Crane Ave.
St. Helena, California 94574

August 30, 1990

Re: Pestoni Ranch Reservoir

Dear Ed and Frank,

As discussed in my letter to Bob Pestoni dated August 14, and in the subsequent meeting with you, we have investigated the cause of water entering the recently constructed reservoir.
We feel there are two major causes for the current problems. First, the compacted core trench, which was moved to the inside edge of the embankment, did not extend deep enough to cut off the gravel strata. These strata are now transporting water through the embankment at elevations up to 90.2 feet. The design called for a compacted cutoff core extending at least to elevation 88.5 feet.

The second problem is the elevation of the reservoir bottom. Our survey shows an average elevation of 97.0 feet. This is 1.5 feet lower than the designed elevation of 88.5 feet.

As discussed in our meetings, the following measures will be required to correct the situation and bring the reservoir into compliance with the specifications.

1. A dewatering drain must be installed around the inside perimeter of the embankment to permit further construction operations. The configuration of this system shall be as shown on the attached drawings and as staked in the field by the engineer.

2. The inside toe of the reservoir shall be excavated to the elevation of the existing bottom (97.0 feet) for a distance of 10 feet from the toe of the embankment. Fill will be recompacted according to specifications to an elevation coinciding with the previously existing embankment face. The embankment will then be cut down to conform to the original design slope.

3. The bottom of the reservoir shall be raised to the design elevation by compacting fill according to the original specifications.

These procedures will require a considerable amount of additional fill material. Bob Pestoni has agreed to allow the use of material scraped from the lower end of the compost field. However, this material will quickly become unavailable as the field is covered with new composting materials. If you wish to use this material, it should be removed soon and stockpiled. Also, there is some organic material present on the surface of this area. This must be removed and discarded. Bob has indicated that this waste material could be placed on a nearby road.

Care will have to be taken when removing this material to preserve the grade on the field. PPI will assist in ensuring proper removal of the fill material. Initial indications are that sufficient material is available from this source to complete the project. If this is not the case, we will explore other options.

As agreed, we will begin staking the dewatering system ~~Tuesday~~ Wednesday morning, September 5, 1990. If you have any questions or wish to discuss the project, please call me.

Sincerely,

Jim Bushey
Design Engineer

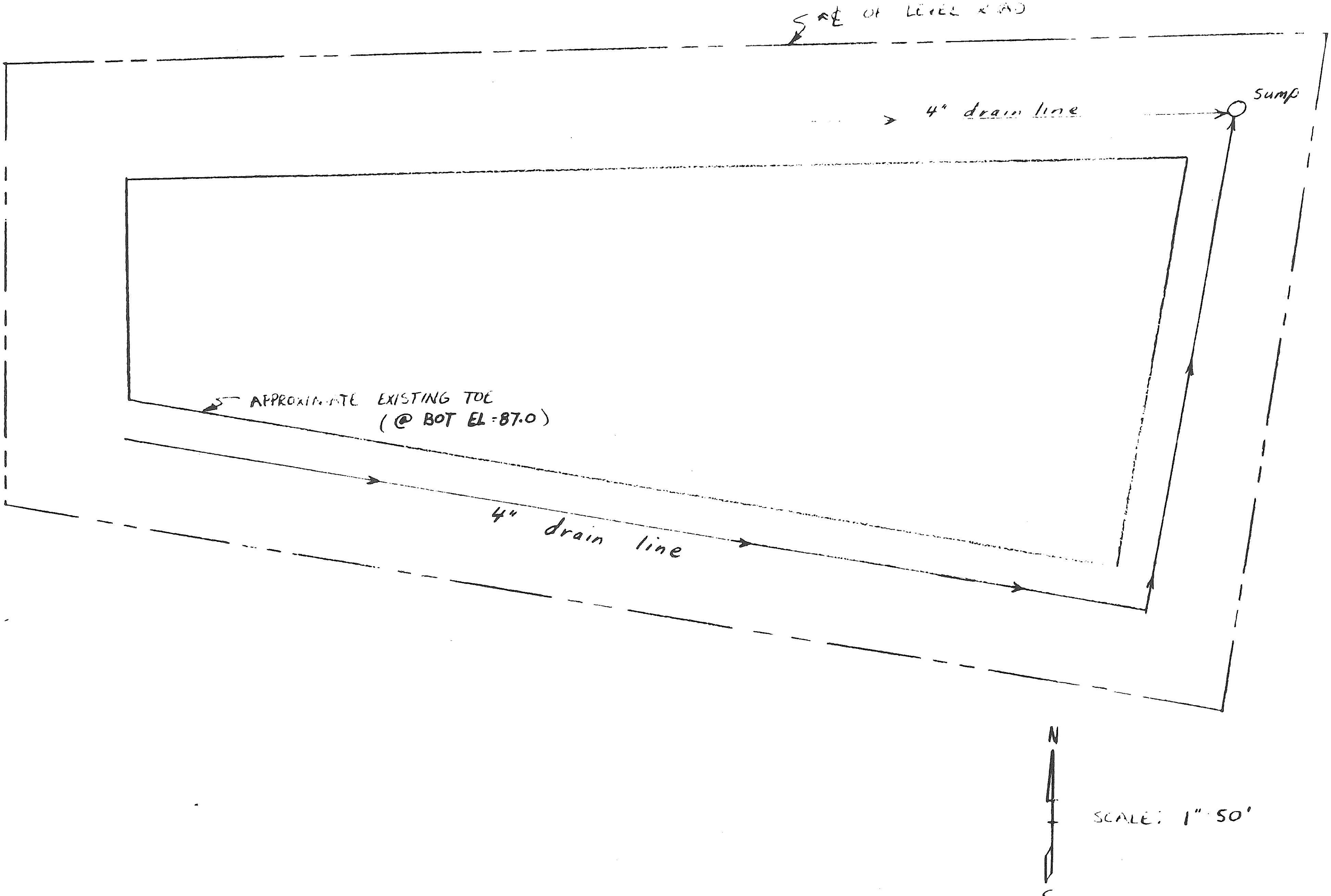
cc: Bob & Marvin Pestoni

30

August 30, 1990

Plan View

Proposed Dewatering System



Job # 8930002

August 30, 1990

Design Engineer

PPI Agricultural Engineers, Inc.

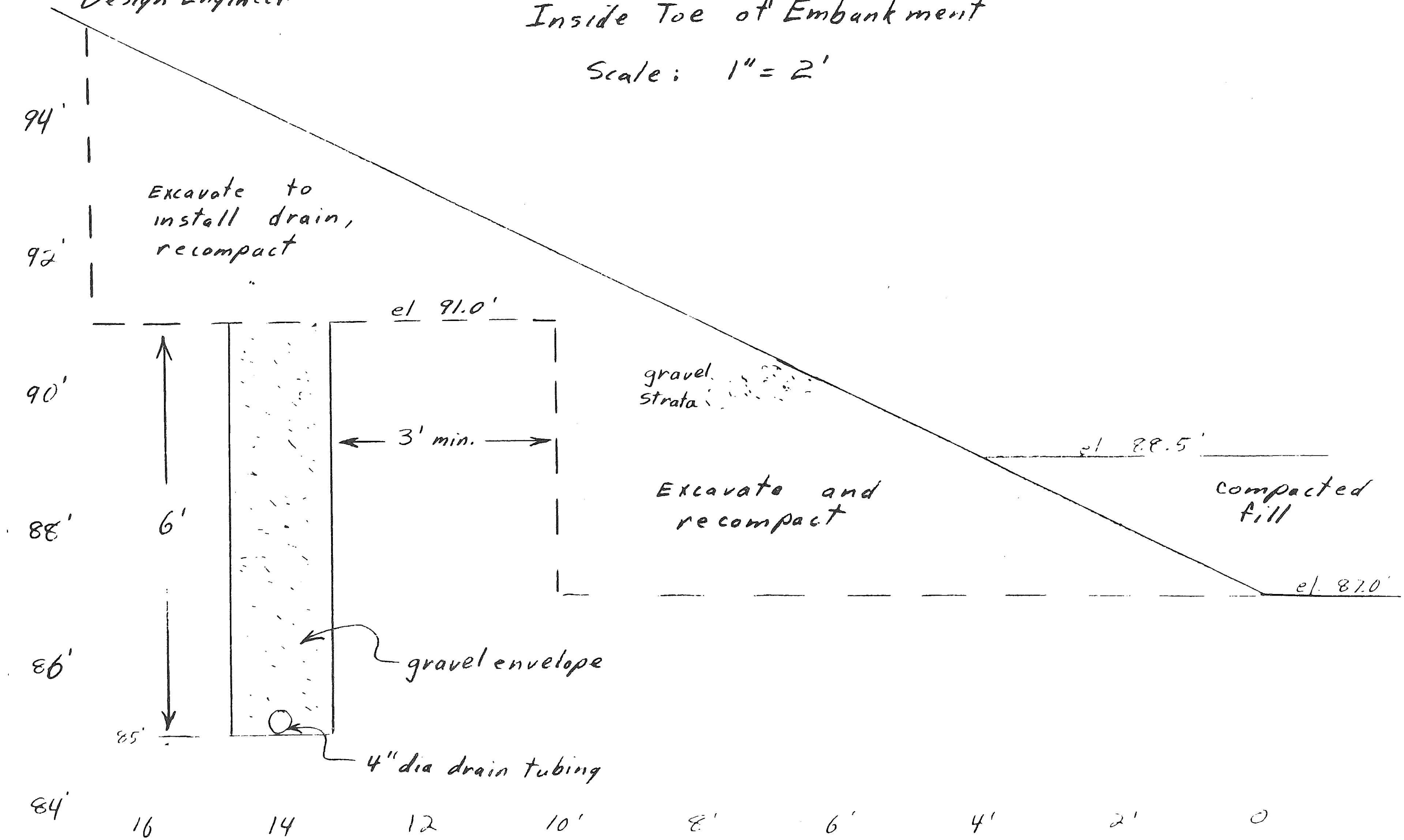
page 1 of 2

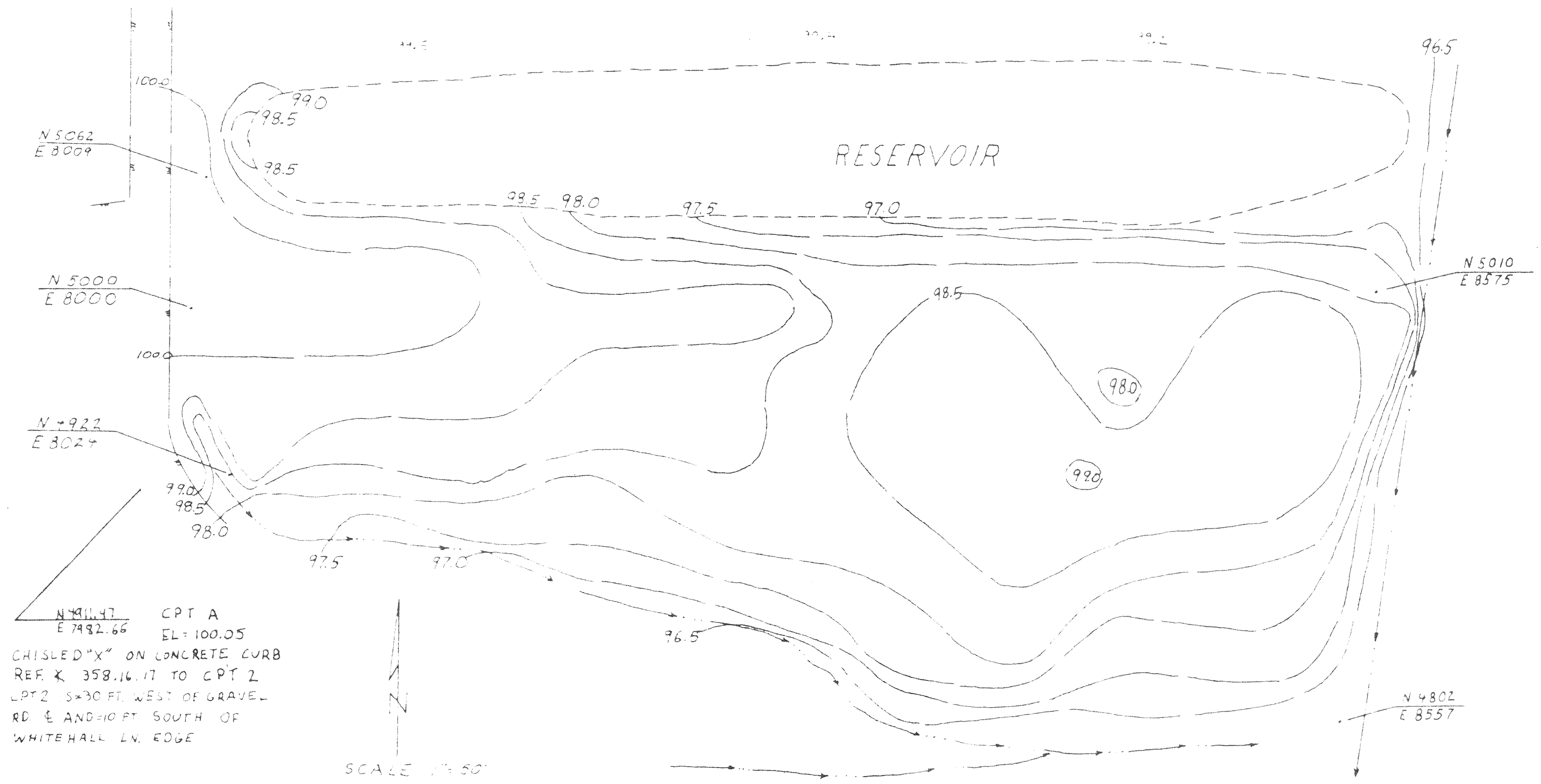
Pestoni Reservoir

Typical X-Section,

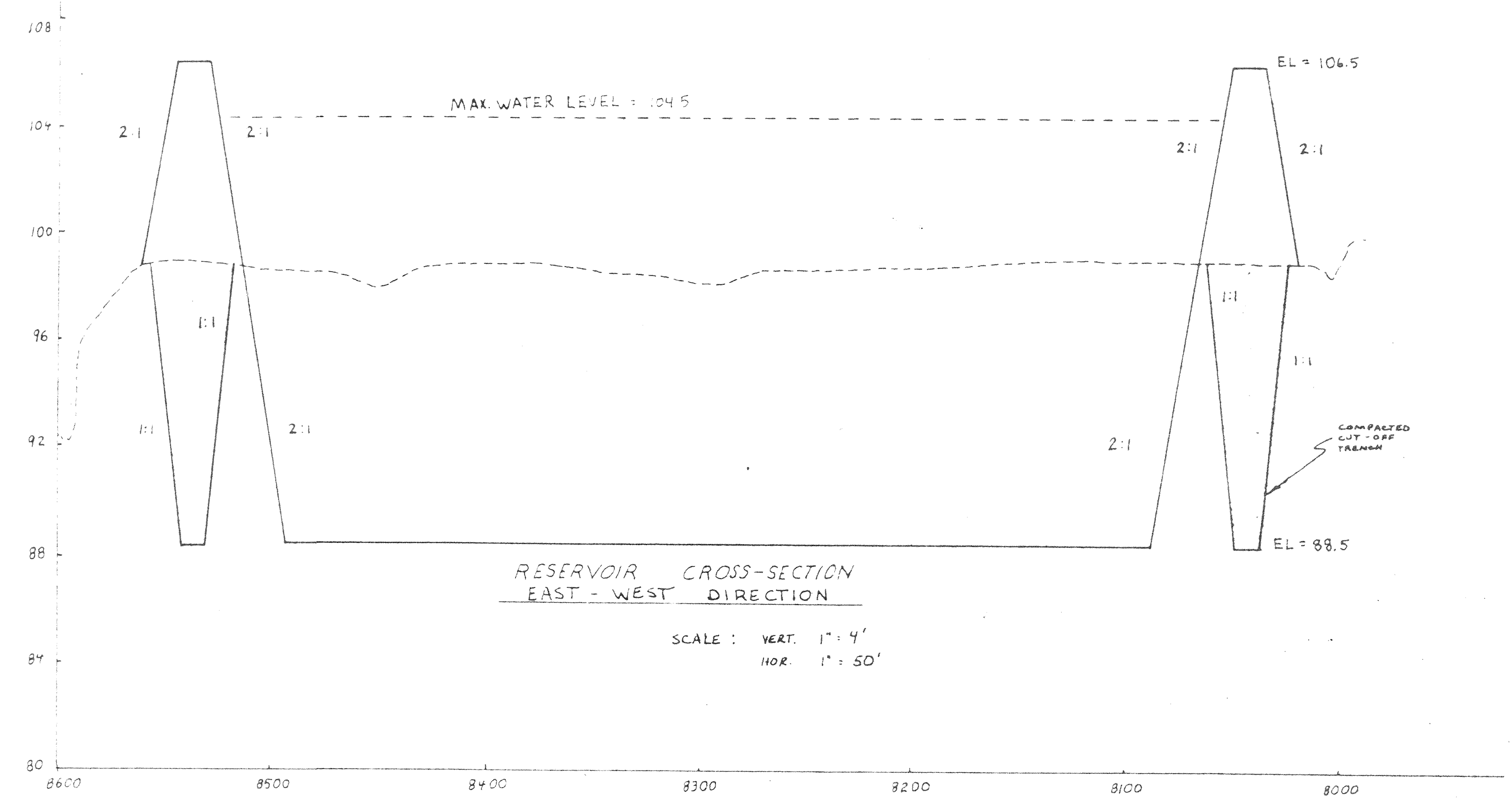
Inside Toe of Embankment

Scale: 1" = 2'

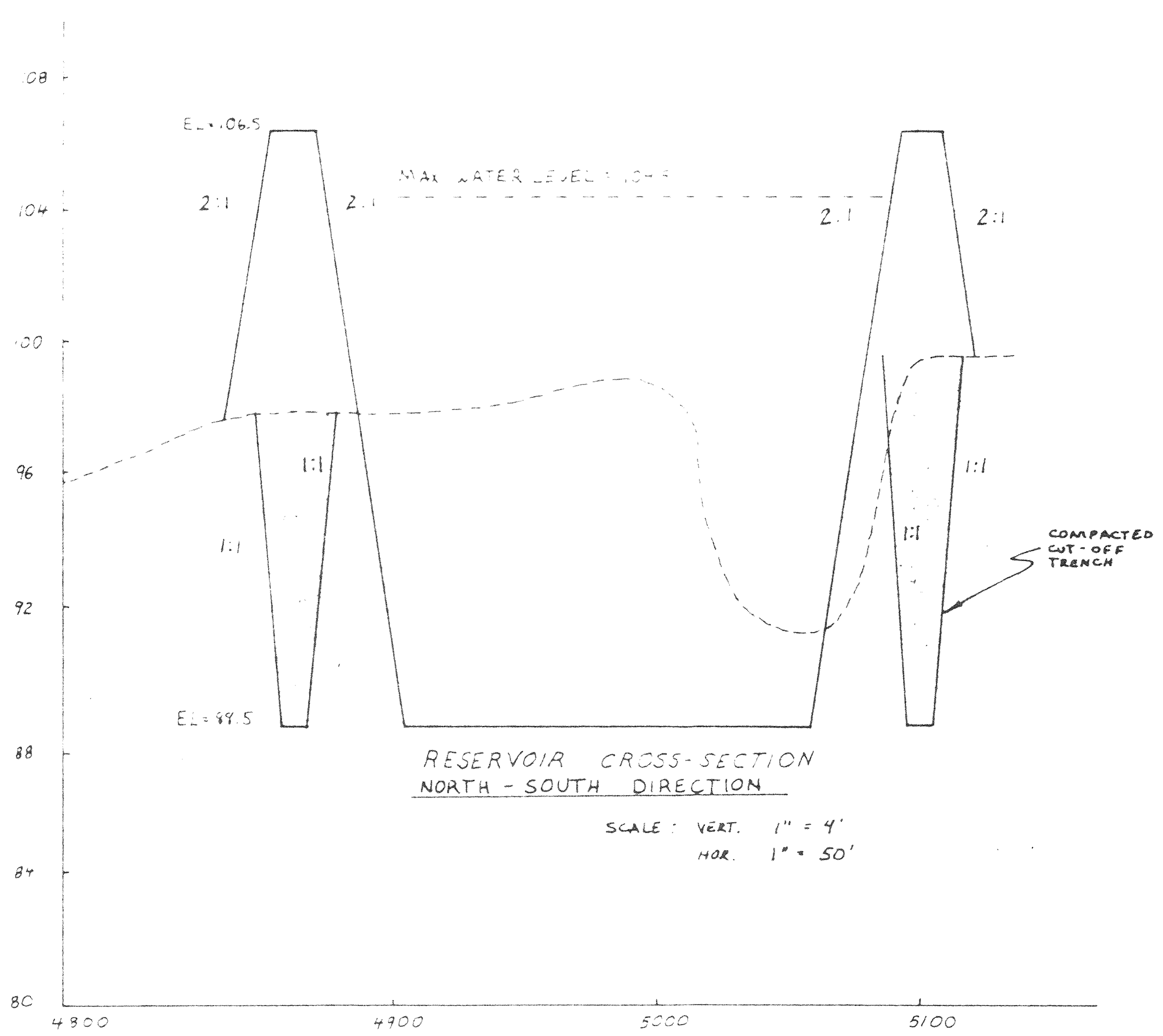




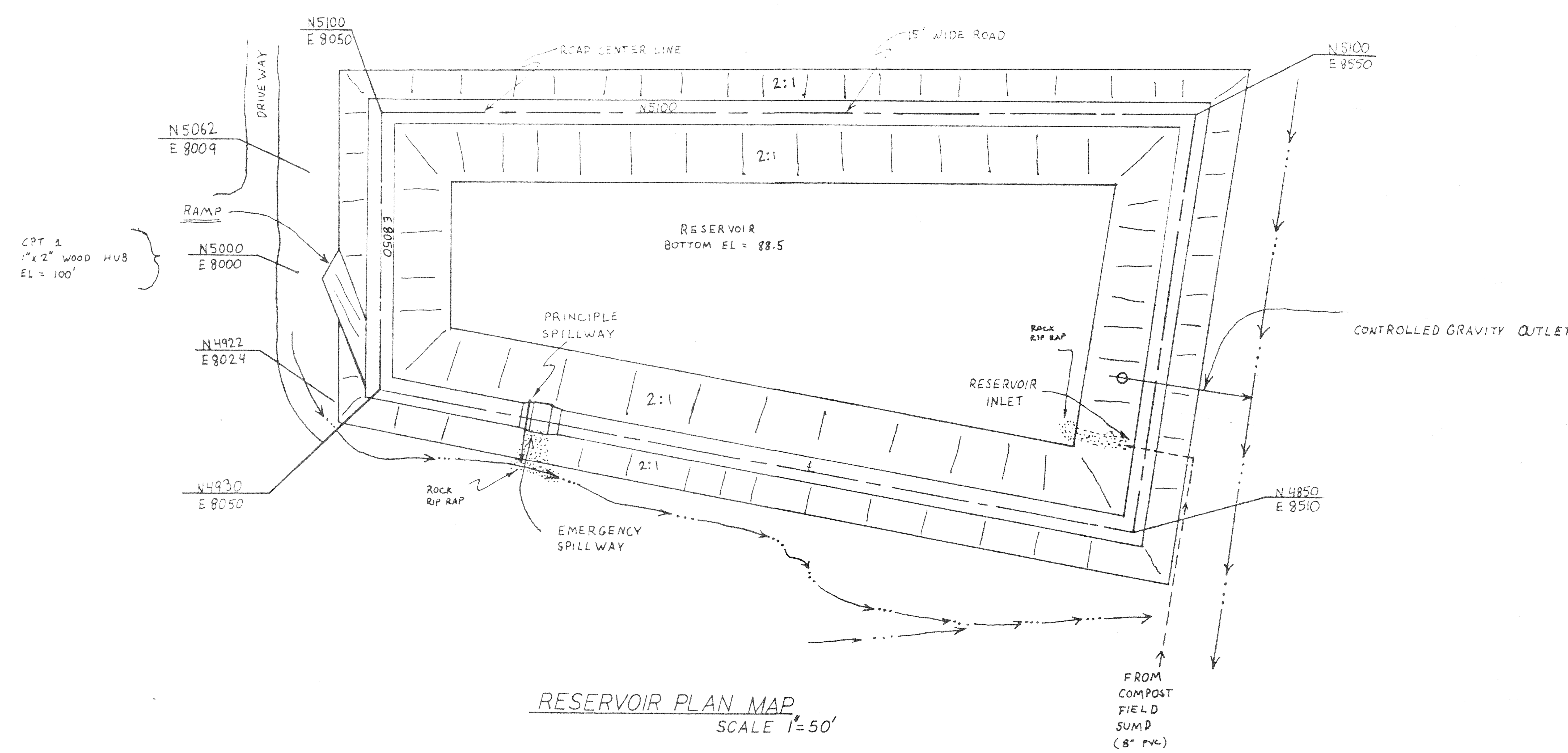
RESERVOIR TOPO. MAP
SCALE: 1"= 50'



RESERVOIR CROSS-SECTION
EAST - WEST DIRECTION
SCALE: VERT. 1" = 4'
HOR. 1" = 50'



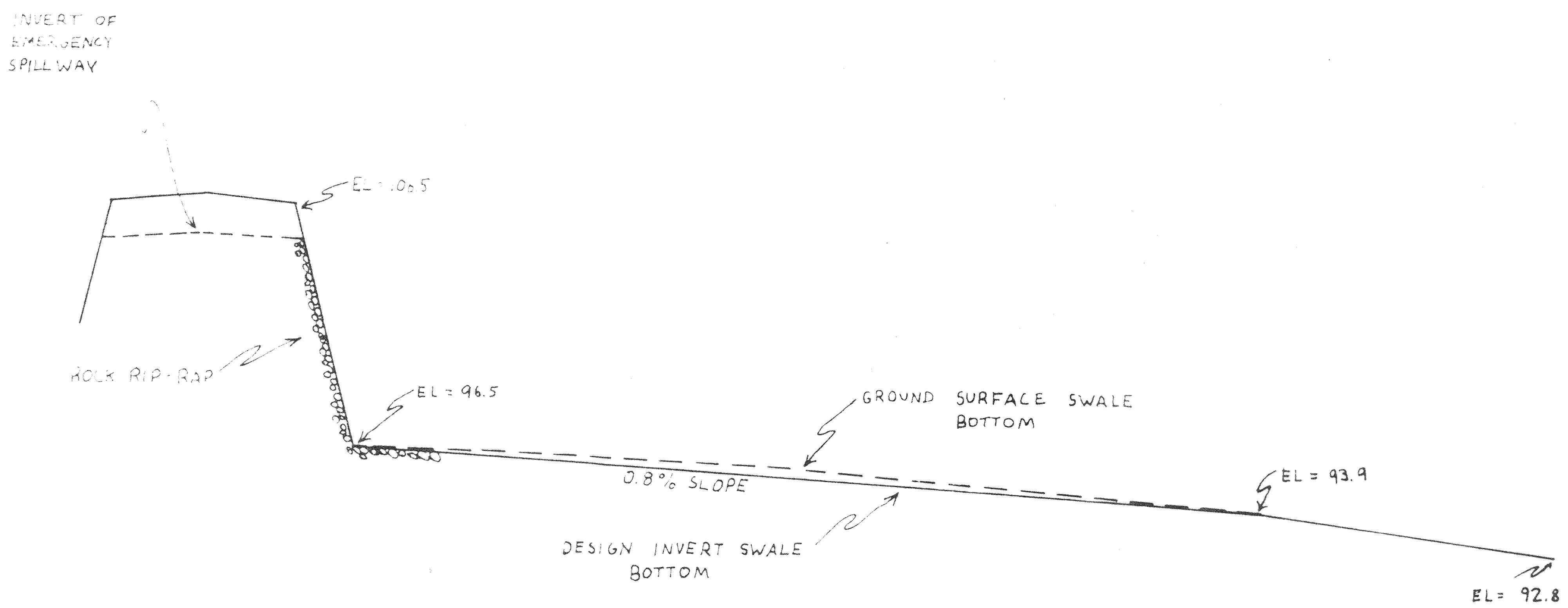
RESERVOIR CROSS-SECTION
NORTH - SOUTH DIRECTION
SCALE: VERT. 1" = 4'
HOR. 1" = 50'



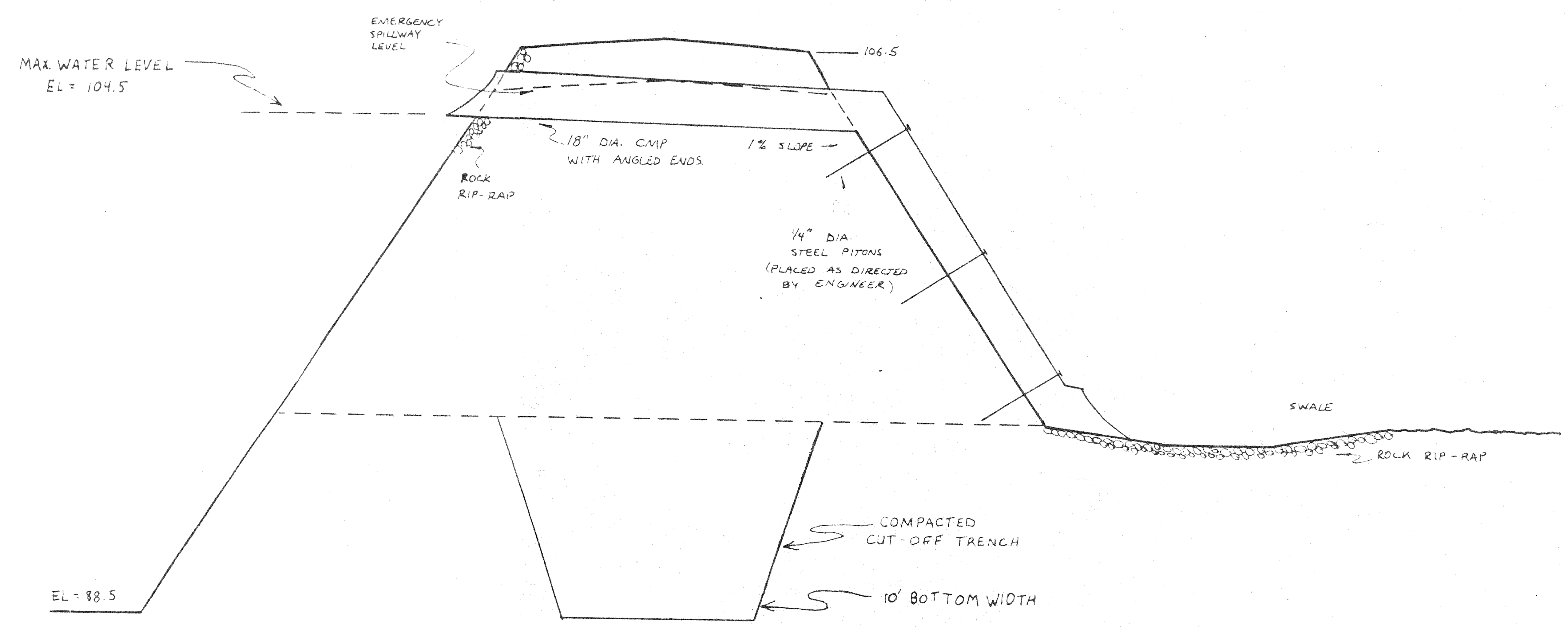
RESERVOIR PLAN MAP
SCALE 1"=50'

PESTONI RANCH		
SCALE: AS SHOWN	APPROVED BY:	DRAWN BY
DATE: AUG, 1989		REVISED
RESERVOIR PLAN MAP		DRAWING NUMBER 1 OF 2

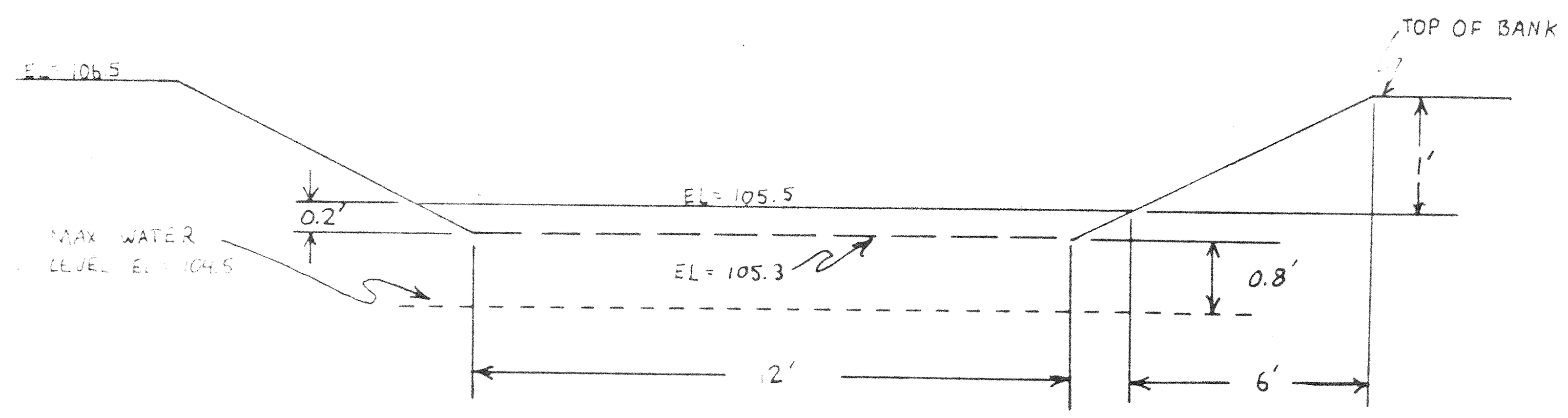
EXP 7-30-89



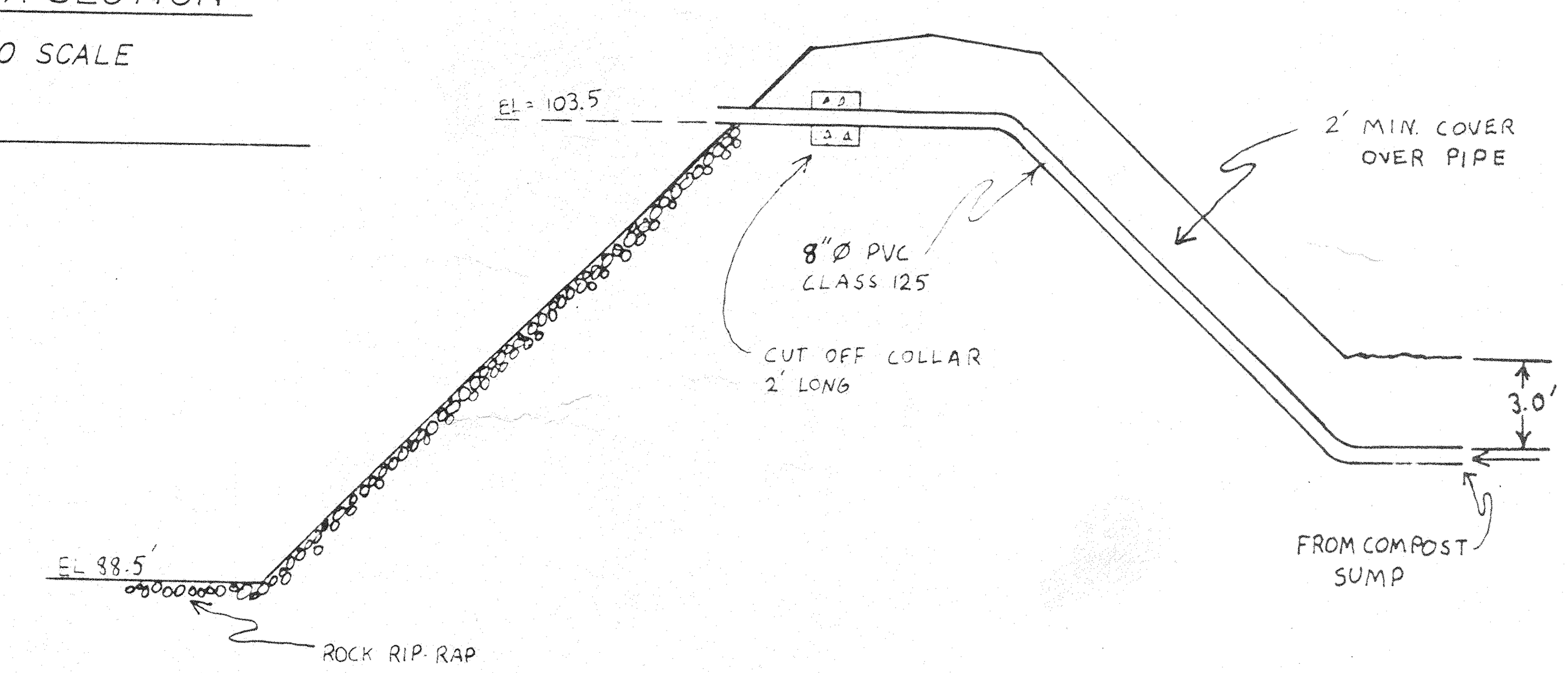
EMERGENCY SPILLWAY PROFILE
SCALE: HOR 1" = 40'
VER 1" = 5'



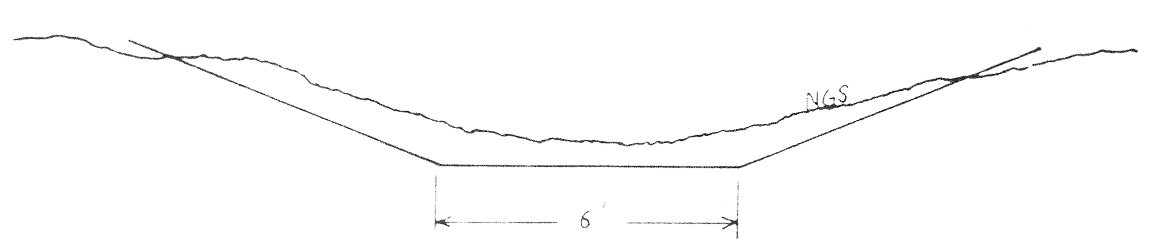
PRINCIPLE SPILLWAY X SECTION
NO SCALE



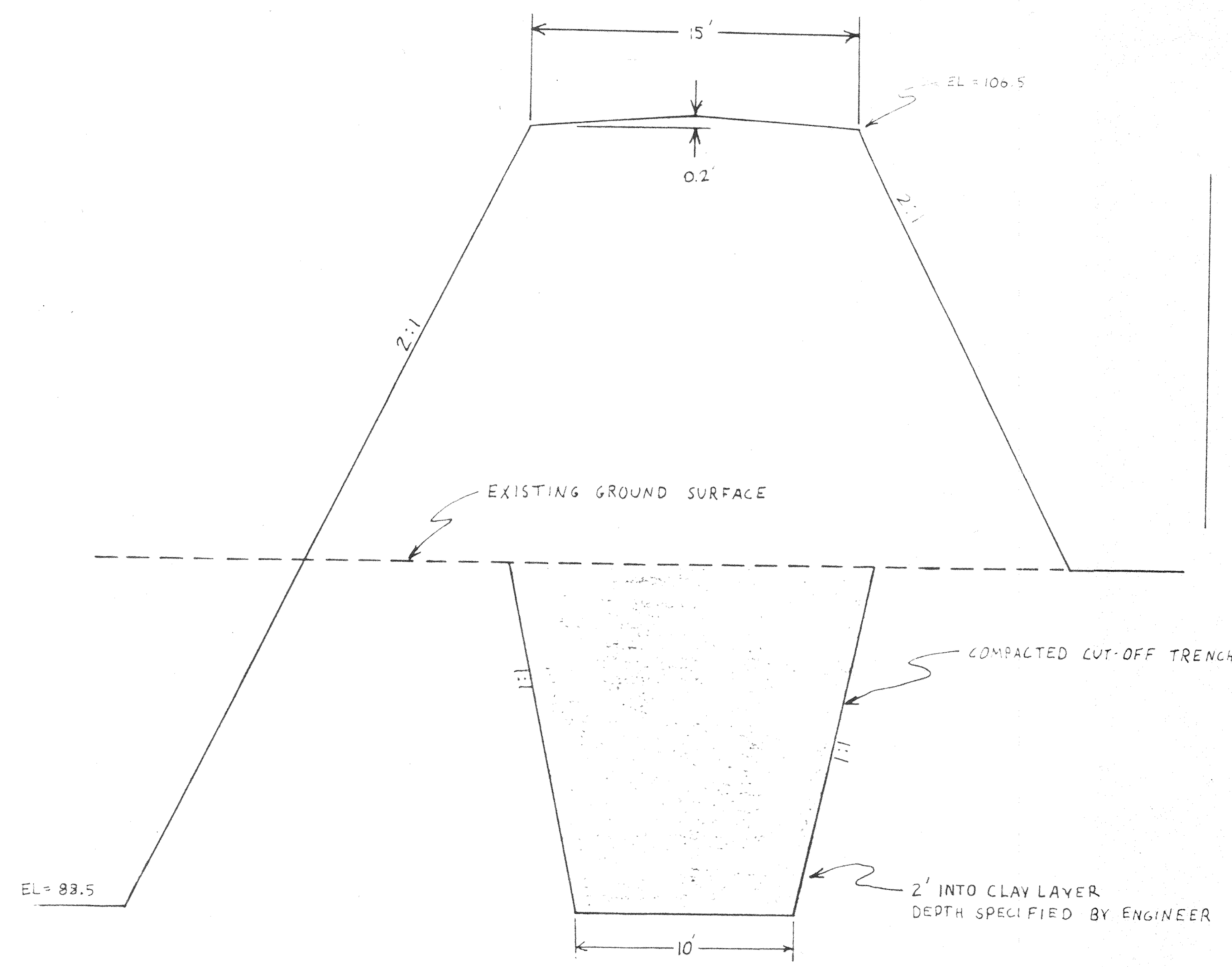
EMERGENCY SPILLWAY X-SECTION
NO SCALE



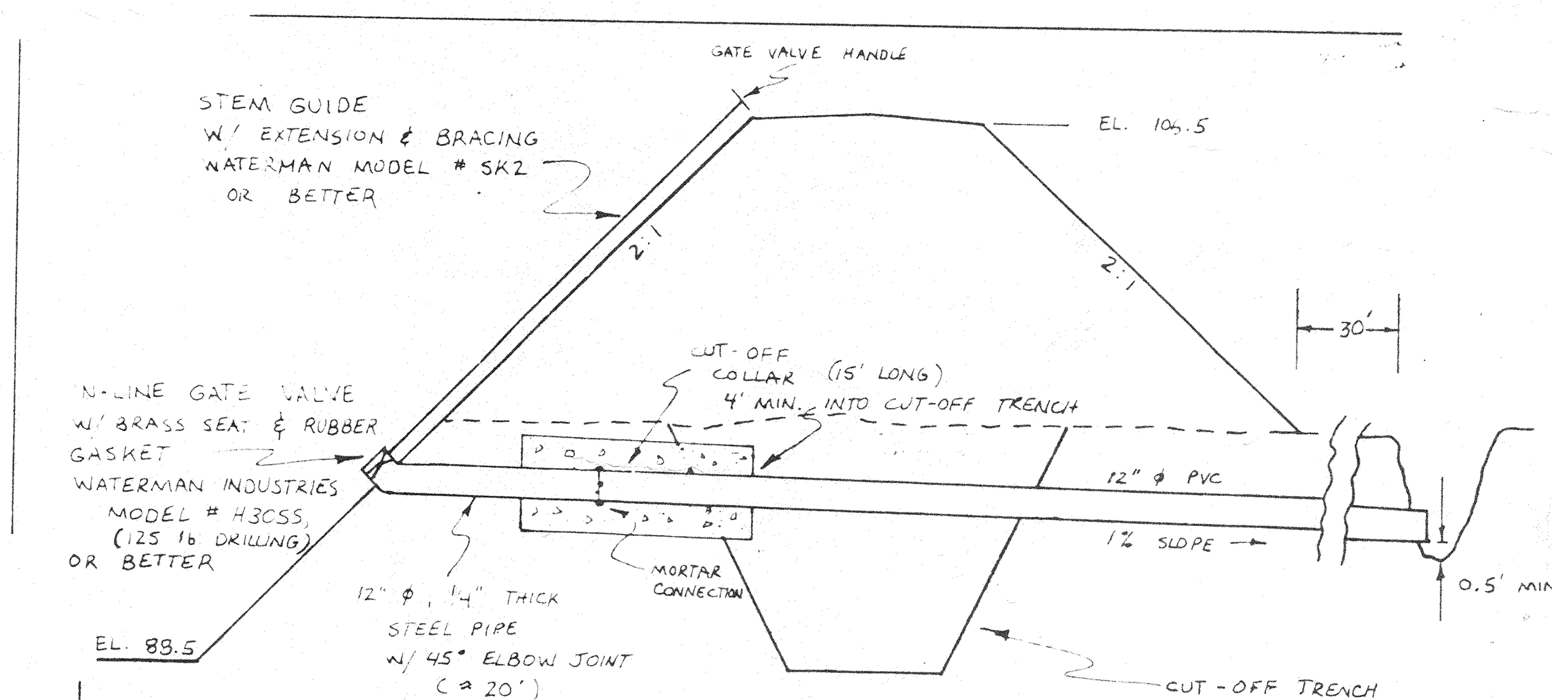
INLET X-SECTION
NO SCALE



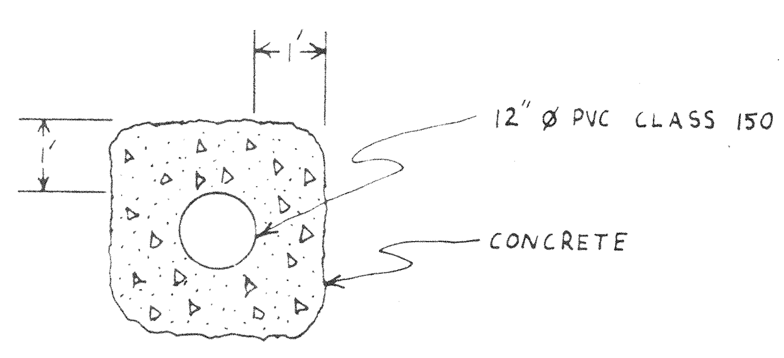
TYPICAL SWALE X-SECTION
NO SCALE



TYPICAL BANK X-SECTION
NO SCALE



CONTROLLED OUTLET
SCALE HOR 1" = 10'
VER 1" = 5'



CUT-OFF COLLAR
NO SCALE

EKP 9-30-89

PESTONI RANCH	
SCALE As Shown	DRAWN BY
DATE Aug. 1989	REVISED
RESERVOIR	
DETAILS	2 OF 2

PPI Agricultural Engineers, Inc.
A Subsidiary of Provost & Pritchard, Inc. Engineers
1716 Jefferson Street • Napa, California 94559
Telephone (707) 253-1806 • FAX (707) 253-1604

Irrigation System Design & Evaluations
Water Supply & Distribution
Subsurface Drainage

August 14, 1990 8930001

Mr. Bob Pestoni
1285 Whitehall Lane
St. Helena, California

Dear Bob,

This letter is to set forth the results of our preliminary investigation into the cause of water entering your reservoir through the bottom and sides.

After initially meeting with you and Marvin the morning of August 8th, Brian True and I examined the wet areas at the base of the embankment inside the reservoir. Digging into several of these wet areas, we encountered gravel strata which are conducting the water into the reservoir. We also observed several areas of standing water on the reservoir bottom. The specific cause of these wet areas could not be determined at that time.

Several facts concerning the construction of the reservoir were discussed during the subsequent meeting with Frank Borges and Ed Bower of Harold Smith and Son. The first topic was construction of the cutoff trench. During the early phase of construction, a meeting took place between Brian True and Frank Borges to discuss the method of sealing the sides of the pond. The plans call for a cutoff trench in the approximate center of the embankment. Frank expressed concern that construction of such a trench would be more difficult than a compacted liner on the inside face of the reservoir. Since it is stated in the design report that the basis for choosing the trench was ease of construction, Brian agreed that the compacted fill for sealing the sides of the reservoir could be placed on the inside of the embankment.
He also stated that this would be acceptable only if the gravel strata that are present were sealed off by the liner.

Another topic of discussion at the meeting was the effectiveness of the dewatering system. Frank stated that they had been working in very wet conditions as they approached the bottom of the reservoir, especially in the northwest corner. He also said that the north dewatering drain was at a higher elevation than the bottom of the reservoir. This line was later excavated and found to have been installed according to design specifications. Although it was indeed higher than the reservoir bottom where we excavated it, it was placed into the heavy clay layer and the envelope material extended well above the gravel strata. Our survey also showed a proper grade on the line.

At the meeting, Frank also mentioned that the elevation of the reservoir bottom was somewhat lower than the design elevation. Upon surveying the reservoir, it was found that the average elevation of the bottom was about 87 feet. This is 1.5 feet below the design elevation of 88.5 feet.

Although the information contained in this preliminary report suggests some possibilities, I feel it is premature to speculate on specific causes at this time. I propose that another meeting be scheduled at the site to discuss the next step in securing a sound, effective reservoir for your ranch. If you agree, please call me after you have reviewed this and I can make arrangements for a meeting with the same participants as our meeting of August 8th.

It was a pleasure meeting with you, Bob. I look forward to helping solve this problem and I am confident that by working together with Frank and Ed we can obtain everyone's goal: a finished reservoir that will be an asset to your operation.

Sincerely,

Jim Bushey
Design Engineer

cc: Marvin Pestoni
Frank Borges
Ed Bower
Mike Day
Brian True

PPI Agricultural Engineers, Inc.

A Subsidiary of Provost & Pritchard, Inc. Engineers

1716 Jefferson Street • Napa, California 94559
Telephone (707) 253-1806 • FAX (707) 253-1604

Irrigation System Design & Evaluation
Water Supply & Distribution
Subsurface Drainage

Ed Bower and Frank Borges
Harold Smith and Son, Inc.
800 Crane Ave.
St. Helena, California 94574

August 30, 1990

Re: Pestoni Ranch Reservoir

Dear Ed and Frank,

As discussed in my letter to Bob Pestoni dated August 14, and in the subsequent meeting with you, we have investigated the cause of water entering the recently constructed reservoir.
We feel there are two major causes for the current problems. First, the compacted core trench, which was moved to the inside edge of the embankment, did not extend deep enough to cut off the gravel strata. These strata are now transporting water through the embankment at elevations up to 90.2 feet. The design called for a compacted cutoff core extending at least to elevation 88.5 feet.

The second problem is the elevation of the reservoir bottom. Our survey shows an average elevation of 87.0 feet. This is 1.5 feet lower than the designed elevation of 88.5 feet.

As discussed in our meetings, the following measures will be required to correct the situation and bring the reservoir into compliance with the specifications.

1. A dewatering drain must be installed around the inside perimeter of the embankment to permit further construction operations. The configuration of this system shall be as shown on the attached drawings and as staked in the field by the engineer.

2. The inside toe of the reservoir shall be excavated to the elevation of the existing bottom (87.0 feet) for a distance of 10 feet from the toe of the embankment. Fill will be recompacted according to specifications to an elevation coinciding with the previously existing embankment face. The embankment will then be cut down to conform to the original design slope.

3. The bottom of the reservoir shall be raised to the design elevation by compacting fill according to the original specifications.

These procedures will require a considerable amount of additional fill material. Bob Pestoni has agreed to allow the use of material scraped from the lower end of the compost field. However, this material will quickly become unavailable as the field is covered with new composting materials. If you wish to use this material, it should be removed soon and stockpiled. Also, there is some organic material present on the surface of this area. This must be removed and discarded. Bob has indicated that this waste material could be placed on a nearby road.

Care will have to be taken when removing this material to preserve the grade on the field. PPI will assist in ensuring proper removal of the fill material. Initial indications are that sufficient material is available from this source to complete the project. If this is not the case, we will explore other options.

As agreed, we will begin staking the dewatering system ~~Tuesday~~ Wednesday morning, September 5, 1990. If you have any questions or wish to discuss the project, please call me.

Sincerely,

Jim Bushey

Jim Bushey
Design Engineer

cc: Bob & Marvin Pestoni

Job # 8930002

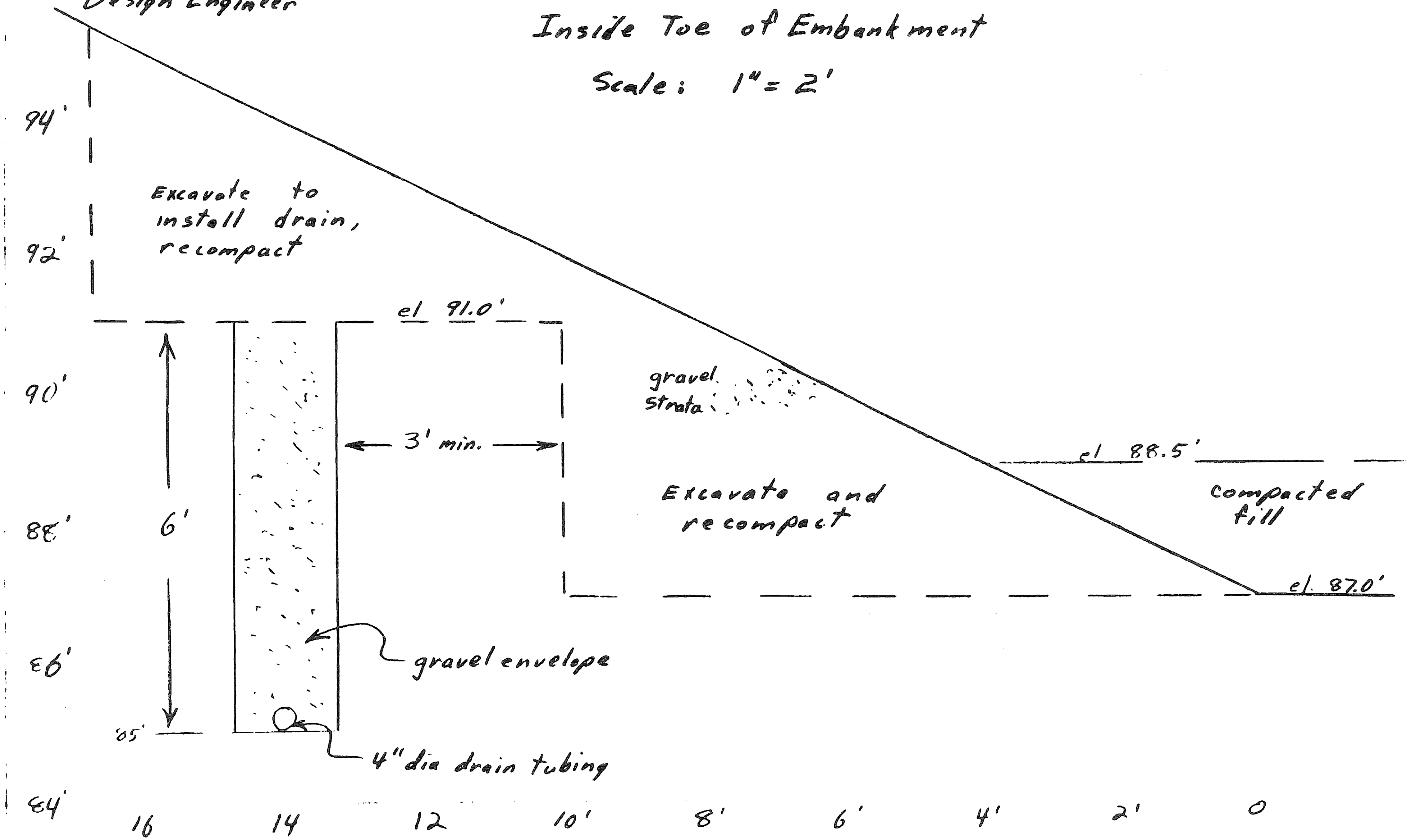
PPI Agricultural Engineers, Inc.

August 30, 1990

Jim [signature]
Design Engineer

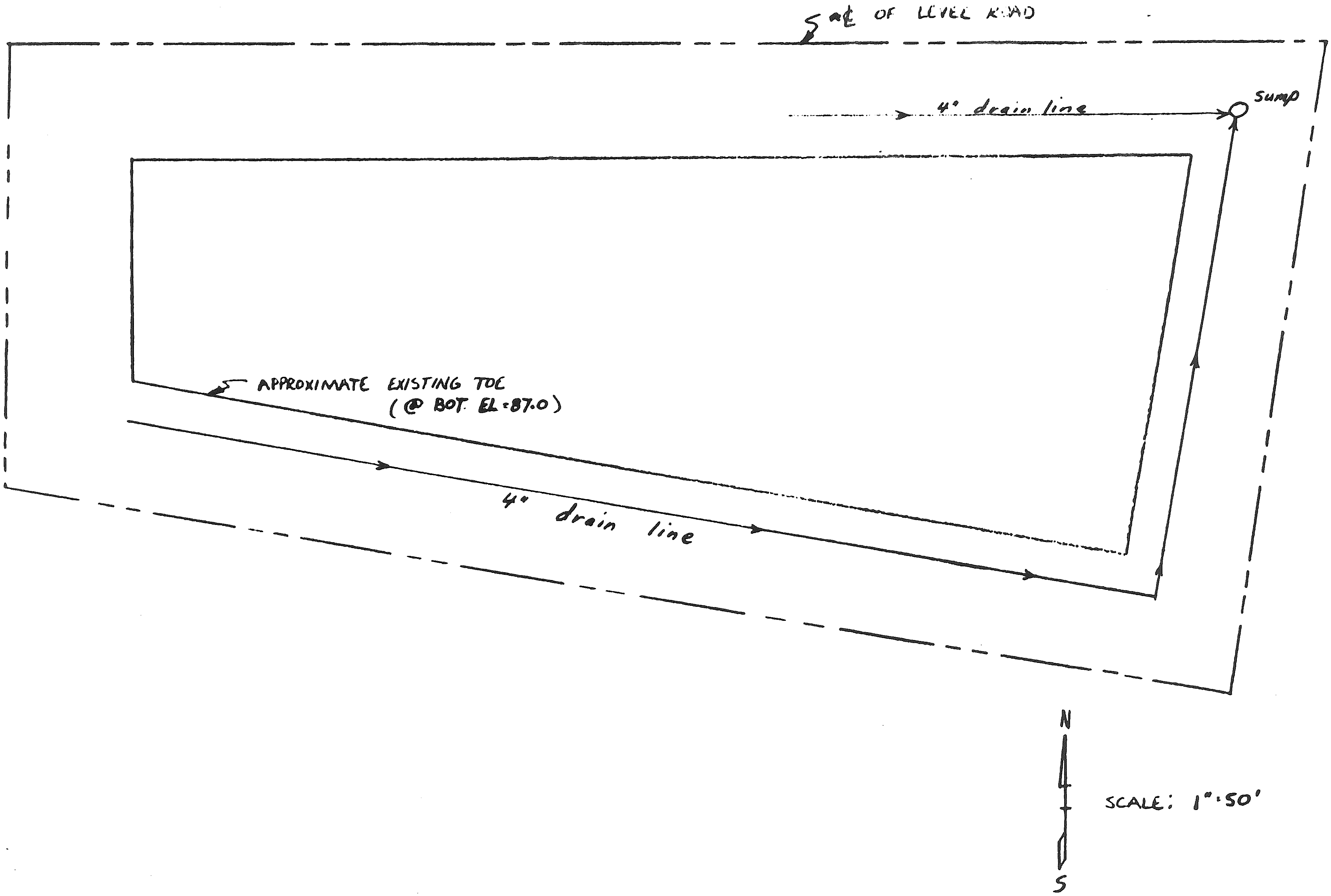
Pestoni Reservoir
Typical X-Section, Inside Toe of Embankment

Scale: 1" = 2'



August 30, 1990

Plan View
Proposed Dewatering System



89 300 02 8-8-90 BT.

Pestoni Reservoir

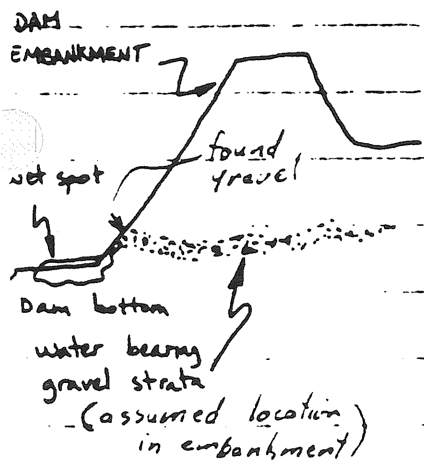
→ Notes on meetings and work of the morning of August 8, 1990 (Wedn

[Jim Bushey present @ all proceedings]

7:30 → Met with Bob & Marvin Pestoni @ Reservoir

Walked on the bottom with Bob & Marvin

Bob was unhappy with water spots on the bottom and edge of the reservoir. Standing water existed in several spots, see sketch in field notes. Further investigation led to the discovery of a known gravel layer which was unsealed and bearing water. The layer was ≈ 0'-2' above the bottom of the reservoir and was seeing its water exiting freely into the reservoir. There were some spots which had no real evident gravel. Jim and I suspected a gravel streak finger just below a clay lense was the source of water in these cases. Bob and Marvin heard our engineering solution of removing the lower portion of the embankment and recompacting past the gravel strata. Jim wondered why this wasn't done in the first place and I didnt know the answer. I told Jim of the meeting Frank Borgi?s and Don (?) had with me @ the beginning of the construction phase in which we decided to do away with the keyway in middle of the embankment. Frank and



TYPICAL X-SECT AT WET AREA

Don felt this was too difficult to build, ~~expect~~ especially in light of the moisture found in the bottom of the keyway just dug on the W. end of the reservoir. I was agreeable to any change they had just so long as the gravel layer was intercepted and compacted fill placed so that no water could enter or leave the pond. I believe that this was stressed in our meeting so I was surprised to see no extra care taken to compact some fill @ the elevation of the gravel strata.

(Harold Smith & Sons)

≈8:15 → Ed Bowers & Frank Borgias arrived about this time. Jim explained the situation to Frank & Ed. Bob mentioned that maybe the fact that the sump was turned off was contributing to the problem. Ed ~~[illegible]~~ said that the dewatering line on the North edge was useless because it was more than 1.5' above the pond ~~gr~~ bottom grade. Jim and I said we would check it out with our laser-level. We also asked if ~~that~~ we could get a backhoe to dig up the dewatering line on the north edge to check grade and invert elevation. Both Frank and Ed staunchly repeated that the area was never sufficiently dewatered. Ed said that there were areas that were nothing but gravel during excavation. Frank added that in some areas the bottom of the pond was lower than designed because they needed some material for the embankment. Jim said he

Brian Tome

NOTES (CONT'D) 8-8-90

didn't think the compaction was too good in the area of the gravel strata. Frank and Ed said that might be the case but that the soil was so saturated that good compaction could have been an impossibility. The ~~un~~suitability of the dewatering drains was questioned and discussed frequently. It took a map in the dirt to even get the locations of all the drainlines straight. Jim then proposed the plan of action as follows: shoot inverts of dewatering drains, if required dig up the dewatering drain on the N. edge, shoot various shots within the pond itself and locate wet spots, turn the sump on and let it operate, note any effects this had on the moisture. If req'd, the solutions to the problems were to dewater the pond further by installing drain tile 4' deep around the interior toe, cut away and recompact the toe, seal the pond bottom with a compacted clay layer. Frank, Ed, and Bob were in general agreement with this. We set up a tentative beginning of next week meeting and broke the meeting up.

≈ 9:15 Survey

*see field notes, shot elevations in pond, sketched wet spot locations, determined invert of dewatering drain / determined that a backhoe was required for

[illegible]

shots on the top of the embankment. We closed the survey to .01'.

≈11:15 Excavated dewatering line on N. edge
A Harold Smith and Sons employee said he was about to move the excavator of the job site and that he was to dig up the line for us first. I got him started 419.5' from the sump, giving him the ~~a~~ location & depth. As he dug, the soil profile was ~~of~~ revealed. The single gravel strata was ≈1.0' above the drain line with a dense clay just below. The gravel was plentiful and to ≈ specification. The line was too shallow (see field notes) but was sufficient to intercept the gravel strata.

Bob stated that the pump in the South sump has been off for about 2 weeks.

I have reviewed these notes and concur with them as amended.
[signature] 8/8/90

≈12:00 Bob came back out to the reservoir. He expressed his opinion on where the source of water was located. He said that it was coming from the N.W. It is possible that the dewatering drains left a gap in coverage ≈ 35' wide. The opinion bears investigations.

NOTE TO FILE:

Job #8930002
Pestoni Reservoir

August 14, 1992

Spoke with Bob Pestoni on the phone @ 9:45 a.m. Advised him that I would be sending a letter outlining our findings and probable cause of the problem. A copy of this letter is to be sent to Harold Smith & Sons. JLG

NOTE TO FILE:

Job #890002
Pestoni Reservoir

August 28, 1992

Met with Bob & Marvin Pestoni, Ed Bower, and Frank Borges at reservoir. Discussed the fact that the reservoir is 1.5' lower than design elevation. Frank stated that this was done because they ran short of fill material. However, it was agreed that they had not mentioned this fact to either Bob or Brian. I said that whatever the reason, the bottom would have to be brought up to design elevation with compacted fill suitable for maintaining a sealed bottom. I also stated that compacted layer intended to cut off the gravel strata had obviously not done its job. They maintained that it was put to the design elevation. I stated this was possible, but by lowering the bottom they had exposed other gravel strata that would otherwise have remained sealed beneath the clay.

I reviewed our survey notes following the meeting & found that the gravel strata conducting water into the reservoir are up to 1.5 feet above the designed bottom elevation of 88.5.

Frank & Ed expressed concern over a source for the fill. I stated that I may know of a source that they could truck in (Holopono) but of course they would rather have a source on site. Bob said they could use some material from the low end of the compost field. This appears to be the best option. As the meeting adjourned, it was agreed I would be out there Tuesday, September 4, with Brian to stake a dewatering drain around the inside perimeter. After Frank & Ed left, Bob & I discussed who's responsibility (financially) the extra work should be. I said that since the reservoir does not meet specs, its the contractor's responsibility to correct it. I agreed to send a letter to Frank & Ed.

NOTE TO FILE:

Job #8930002
Pestoni Reservoir

September 11, 1990

Construction review at site. The de-watering drain is partially installed, a portion of compost field scraped, part of it hasn't been touched yet. Met with Bob Pestoni and discussed this. He expressed concern that the rest of the compost field will be covered within a couple of days, and also that grading hasn't been completed to allow drainage of the field to the sump. I told him that I would call Frank and Ed and discuss this with them.

September 12th. I talked to Frank Borges at 7:00 a.m. He was under the impression that they had scraped all that would be allowed off the compost field, and I told him I would check on this and get back to him. Talked to Brian True, that portion of the field wasn't staked because there was compost on it, however now that it has been removed, we should be able to re-stake it and let them scrape some more. I will go out later today and set stakes out there.

NOTE TO FILE:

Job #8930002
Pestoni Reservoir

September 12, 1990

Construction review on de-watering system being installed at the moment. Checked an elevation on the pad at the west end of the reservoir. It's about two feet higher than what had been designed, actually about 93 feet. Talked to Bruno about this. He decided that it was easier to leave it up at that elevation and dig down further with the backhoe. I told him that was OK. Bruno stated that they had been having some trouble with the trench caving-in in certain areas. This is where the gravel strata are intercepting the ditch. At these points, ~~most of~~ they are increasing the rock close to the top of the ditch, at least above the gravel strata, but leaving less rock in the areas where there appears to be no gravel. This is OK, however, I told him I would check Friday morning and if there are any more areas that need additional rock, I will tell him then and have him put a little more rock in there. The final portion of the compost field to have additional material removed for use in the reservoir is still covered with some compost, However, Bob stated that he would have it cleared off by Friday morning. I told Bob and Bruno that I will be out here first thing Friday to set some stakes and they will have some equipment to start scalping that area Friday. This area is a little bit smaller than we had envisioned and will only be about 50 feet additional to what has already been scalped. I observed that some material had been placed at the drainage ditch at the east end of the compost field. I asked Bob about this and it is diatomaceous earth that they had placed in the ditch to be used as a filter for the water leaving the compost field. He stated that we may have to look at what elevation it's at and do some work to get it down to where the invert will drain the water to the sump.

NOTE TO FILE:

Job #8930002
Pestoni Reservoir

September 19, 1990

Made construction review. Checked dewatering drain. Drain is completely installed and bottom of reservoir is drying up very well. Checked compost field. One scraper was finishing up the material borrow. Spoke with Bob. He expressed some concern over the haul road the contractor had constructed to get the material from the compost field to the reservoir. I told him that I had spoken to Frank Borges and Frank made some mention of removing portions of that road and getting it into the configuration that Bob wanted. Bob also expressed concern over where we could put the material from that haul road. We will discuss that further at a later date.

JLV

NOTE TO FILE:

Job #8930002
October 15, 1990

I made a construction review at Pestoni Reservoir. Bruno was there running the dozer and compactor was there. Work had begun placing compacted fill in the bottom of the reservoir. The majority of the bottom had dried out very well. There was one spot in the northwest corner that had a little bit of standing water in a trench that Bruno had dug. Bruno stated that he had found this wet spot when the latest drainage was being installed and had dug a trench over to one of the laterals that extended into the center of the reservoir, however he just put gravel in it rather than extending the pipe over since he knew it was a little bit high in that area and he would have to be cutting it down before recompacting it. He felt that this small area could be mixed up with the dryer material and packed in fairly well. They will probably be working on this part tomorrow morning. I will plan on making another construction review at that time. I met with Bob after talking to Bruno and apprised him that they had begun work. He is still very concerned about who is going to pay the bills for all of this work since he did not have a signed contract with Harold Smith & Son. He stated that he had been getting invoices from them, but was having a hard time separating out which charges were incurred after the reservoir was "completed." I discussed the sump with Bob, whether we should abandon it following construction or modify it and leave it in case we need to pump some more. We finally agreed that it would be best at this time to add another section of CMP. Bob stated that he would probably have his people put on the extra section of CMP.

NOTE TO FILE:

Job #8930002
Pestoni Reservoir
October 16, 1990

I made a construction review at the site and met with Bruno. Work is progressing well. Bruno had completed excavation and recompaction in the wet area mentioned in my last note and it appears to have sealed it off fairly well, although he noted a damp spot in that area right up against the embankment this morning. There is still approximately two feet vertical and about four feet horizontal, whatever the side slopes are, that needs to be recompacted at the toe of the embankment. I believe that this will finish sealing off that area and I told Bruno to do a little bit of extra compaction in that area. JH

Note to File
JOB # 8930002
Pestoni Reservoir
October 17

I made a construction review with Bruno. Work is proceeding. Bruno showed me some Polaroid photos of some gravel areas that they had encountered which were very wet. These had to be excavated with the backhoe, however once they dug down about 3 feet, they hit another hard layer. They were able to place compacted fill over this and come back up getting close to grade. One hole was filled that way. Another one was open and I examined it. The top of these gravel areas was approximately 2 feet below design grade and they excavated another 3 feet. Therefore the bottom of the holes that were excavated were approximately 5 feet below design grade. Bruno said that the one that was filled had compacted very nicely. I examined it and it appeared to be a good job. I believe that the other ones can be filled in this manner successfully. There is water ~~we're~~ in the central north part of the reservoir. Also another damp spot in the northwest corner which I had observed on my previous visit. Again, this is close to the toe and I believe the water is coming in through another horizontal strata and intersecting the side of the reservoir above our compacted bottom. I believe when we compact the toe of the embankment in place this should effectively seal that problem. I told Bruno I would make another construction review tomorrow.

Note to File
JOB #8930002
October 19, 1990

I made a construction review at Pestoni Reservoir. Met with Bruno. He says he filled up the 3 gravel areas after cleaning up the gravel and mixing that gravel with clay material. Since the volume of the gravel was not great I think this should be fine the way he mixed it. It compacted very nicely once he got it cleaned out. They are compacting the toe around the northeast corner of the reservoir. This portion of the reservoir is not completed, however there is quite a bit of work to do on the rest of the bottom of the reservoir. Bruno said they will probably work Sunday and have at least a couple more days work after that. JB

Note to File
JOB #8930002
P[illegible]estoni Reservoir
October 23, 1990

I made a construction review at the site and they were just winding up the work and they had a little bit more compaction to do. Otherwise it's finished except for modification of the drainage sump on the interior of the reservoir. I spoke with Pee Wee who was operating the CAT today and he stated they should be wrapped up in another couple of hours and headed over to Holopono.

APPENDIX D - Summit Pond Aeration Design

SUMMIT ENGINEERING, INC.
Consulting Civil Engineers
September 11, 1992
Project No. 9239.1

UPPER VALLEY RECYCLING
Whitehall Lane, Napa Co., CA

WASTEWATER POND AERATION REQUIREMENTS

Biological Loading

Criteria: Average rainfall day during the peak month in which the compost area contributes to the pond in an uncovered condition. Peak month is November under this criteria.

Average number of days of rainfall in November = 13.36

Average Year

Total rainfall in November	= 4.11 inches
Average rainfall/day	= 0.31 inches

10-Year Winter

Total rainfall in November	= 8.93 inches
Average rainfall/day	= 0.67 inches

Aeration requirements (based on influent loading)

$$.31 \text{ inches/day} \times 7.4 \text{ acres} \times 43{,}560 \text{ ft}^2/\text{acre}$$

$$\times \frac{1 \text{ ft}}{12 \text{ in}} \times 7.48 \frac{\text{gal}}{\text{ft}^3} \times 0.8$$

= 49,830 gpd

.05 MGD x 8.345 x 3,000 mg/l
= 1252 lbs BOD/day
x 1.5 lbs O_2/lb BOD
= 1878 lbs O_2/day
÷ 24 hrs/day
= 78 lbs O_2/hr
÷ 2.2 lbs O_2/HP-hr
= 36 HP

10-Year Condition

$$.67 \text{ inches/day} \times 7.4 \text{ acres} \times 43,560 \text{ ft}^2\text{/acre}$$

$$\times \frac{1 \text{ ft}}{12 \text{ in}} \times 7.48 \frac{\text{gal}}{\text{ft}^3} \times 0.8$$

= 107,697 gpd

.11 MGD x 8.345 x 3,000 mg/l
= 2424 lbs BOD/day
x 1.5 lbs O_2/lb BOD
= 3636 lbs O_2/day
÷ 24 hrs/day
= 157 lbs O_2/hr
÷ 2.2 lbs O_2/HP-hr
= 69 HP

Say 70 horsepower

Oxygen Dispersion

Criteria: For oxygen dispersion (not for mixing):

0.10 HP/1000 ft^3

Use average volume of the 4 highest months
re: storage volume = 6.1 MG

$$6,100,000 \text{ gal} \div 7.48 \frac{\text{gal}}{\text{ft}^3} \times \frac{.1 \text{ HP}}{1000 \text{ ft}^3}$$

= 81.55 HP

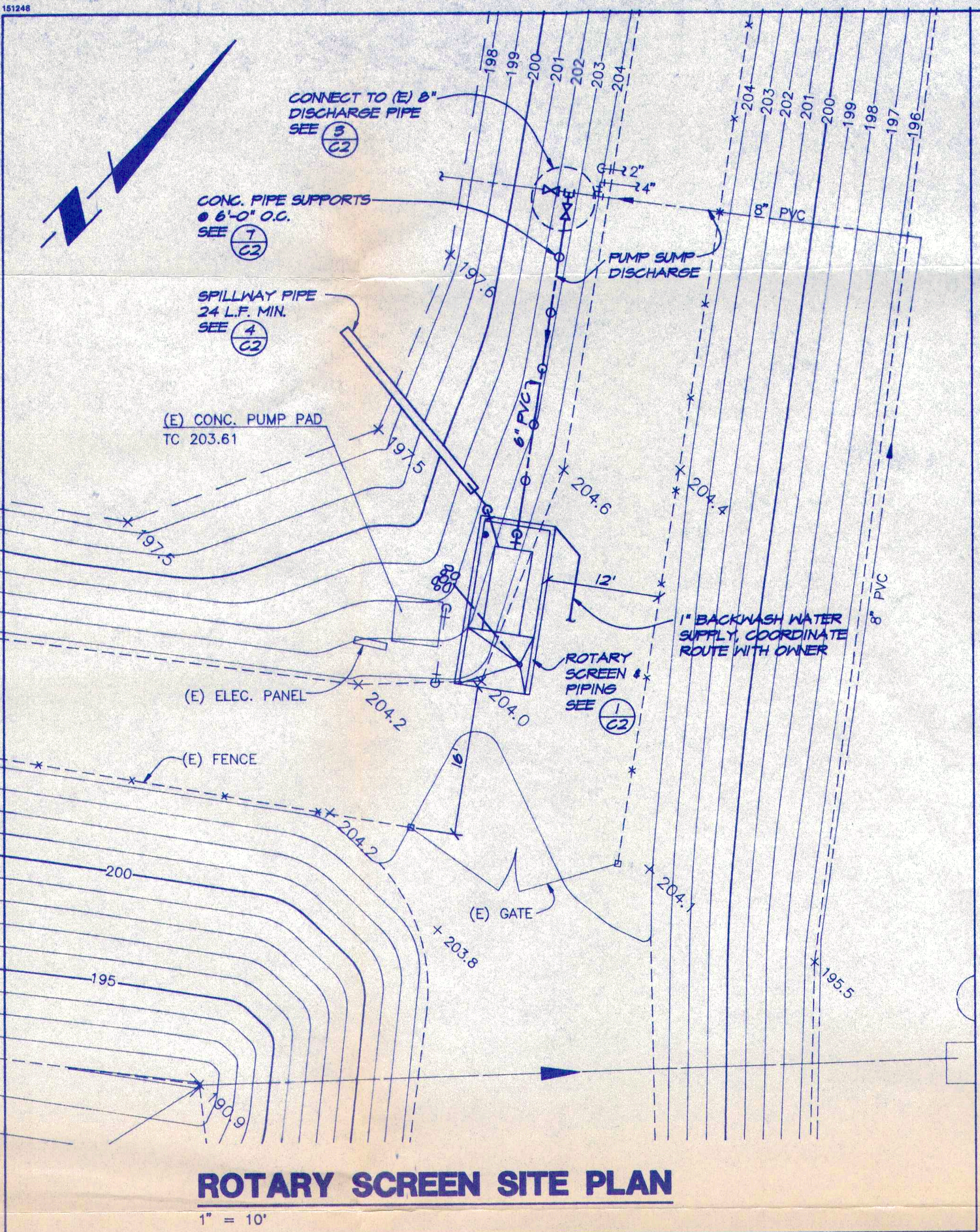
Say 80 horsepower

Improvements

Existing horsepower = 4 units x 7.5 HP/unit
= 30 HP

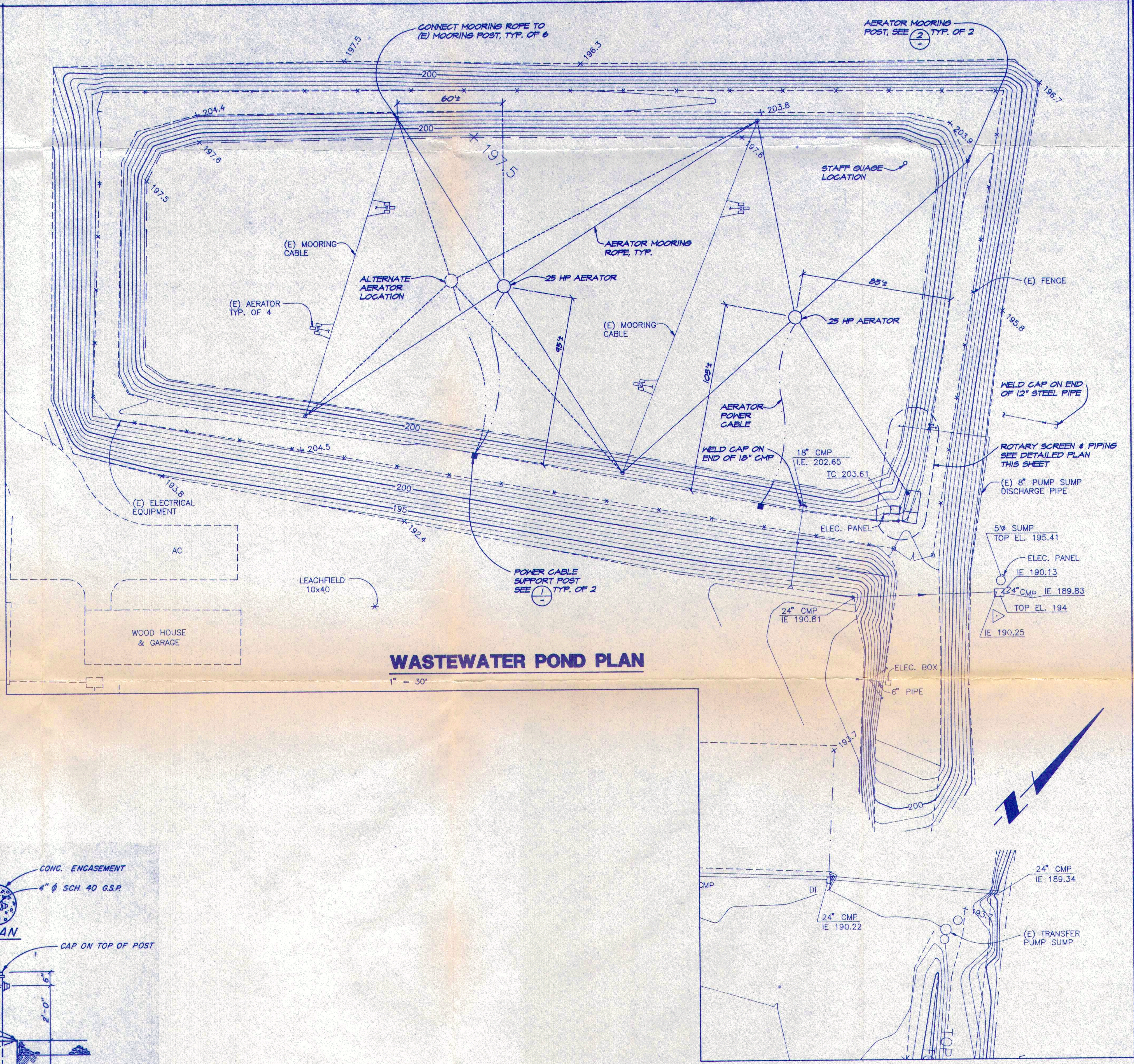
80 HP - 30 HP
= 50 horsepower

Add two 25 horsepower floating surface aerators



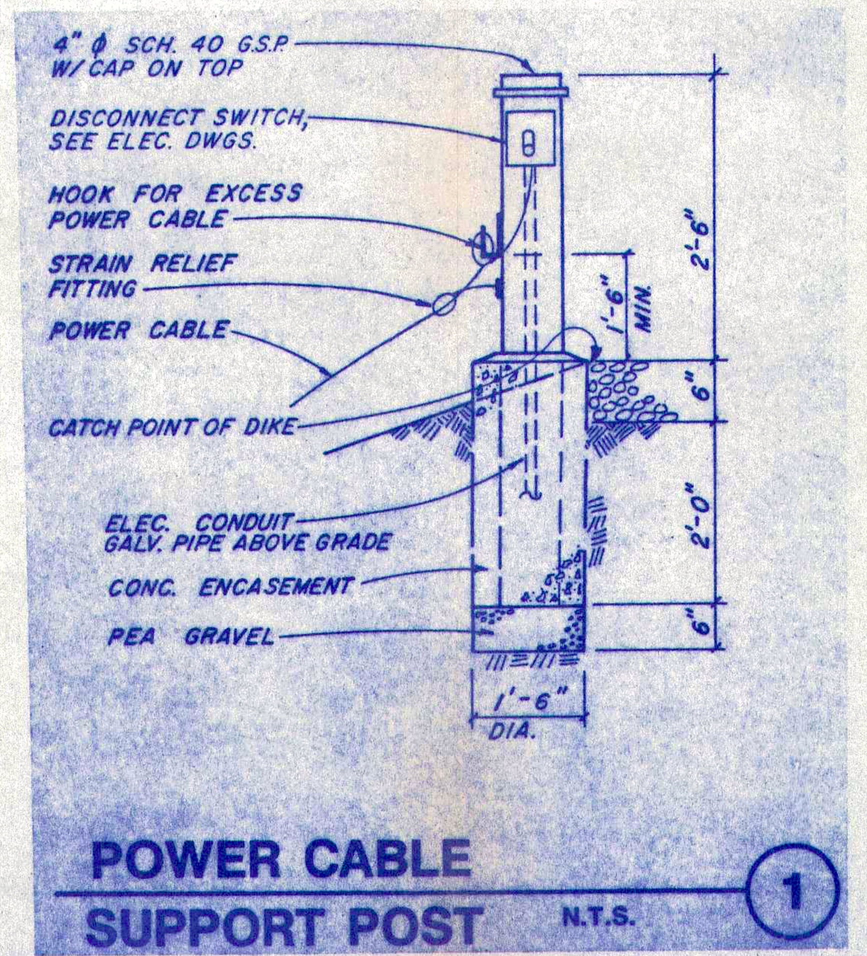
ROTARY SCREEN SITE PLAN

1" = 10'

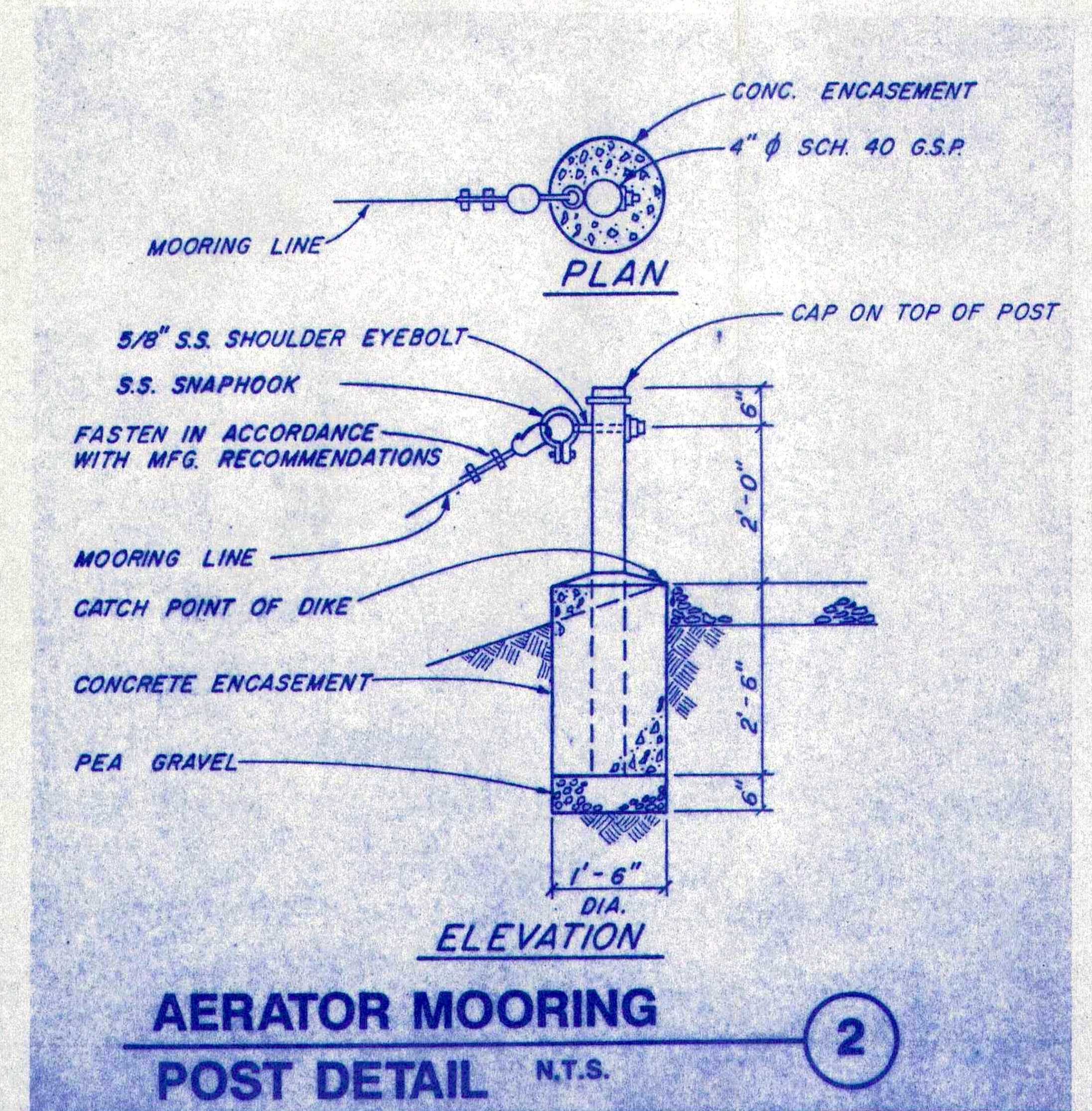


WASTEWATER POND PLAN

1" = 30'



POWER CABLE SUPPORT POST N.T.S. 1



AERATOR MOORING POST DETAIL N.T.S. 2

SUMMIT ENGINEERING, INC.
CONSULTING CIVIL ENGINEERS
1400 NORTH DUTTON AVENUE, STE. 22, SANTA ROSA, CALIFORNIA 95401-4644
PH (707) 527-0775 FAX (707) 527-0212

UPPER VALLEY RECYCLING & DISPOSAL SERVICE

ST. HELENA, CALIFORNIA

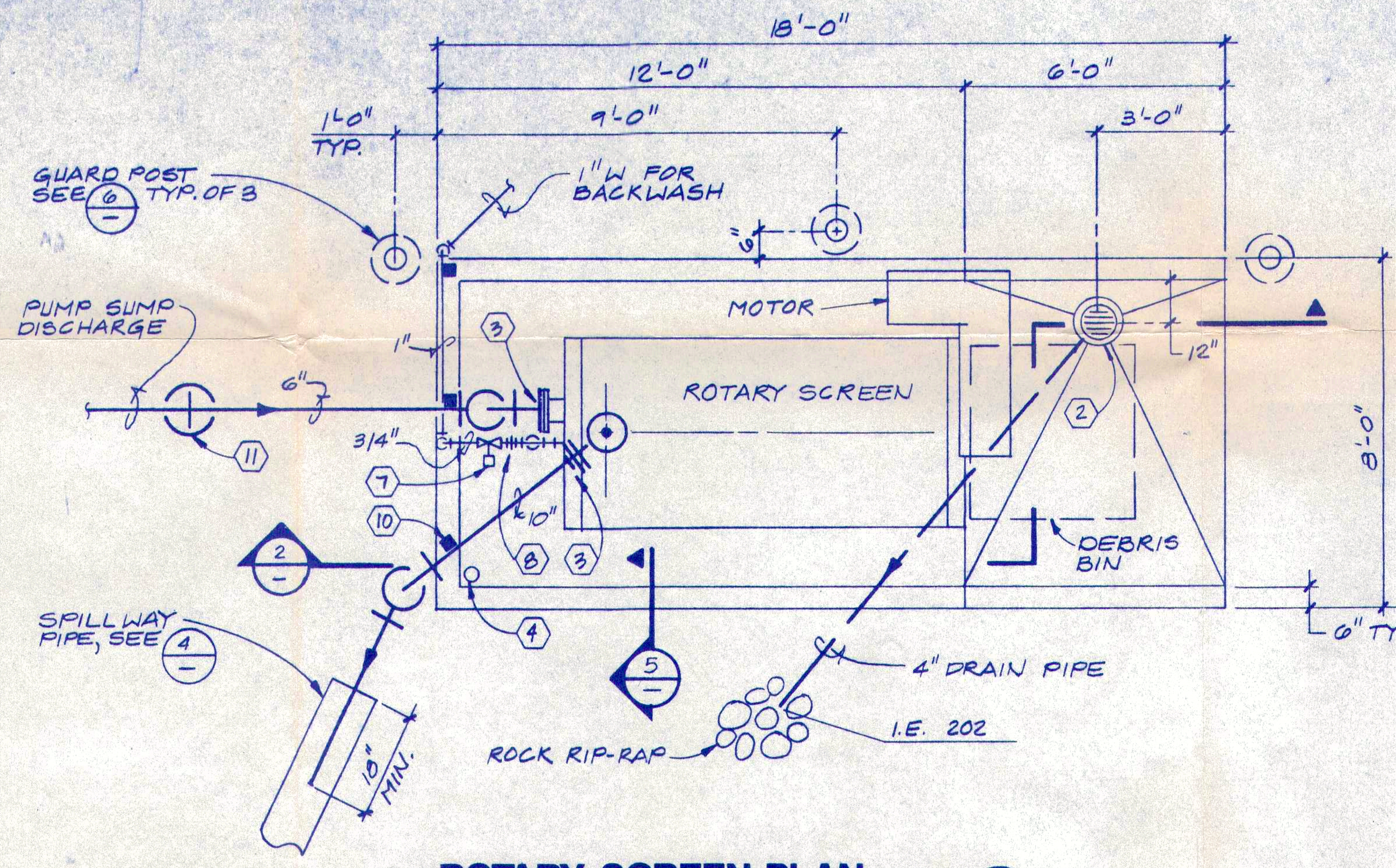
WASTEWATER SYSTEM IMPROVEMENTS

WASTEWATER POND PLAN ROTARY SCREEN SITE PLAN & DETAILS

10-22-92 ISSUED FOR APPROVAL

EXP. DATE 12/31/93

DATE: 10-22-92
JOB NO.: 9239.8
SCALE: AS NOTED
DRAWN: EF
CHECKED: CC
SHEET: C1

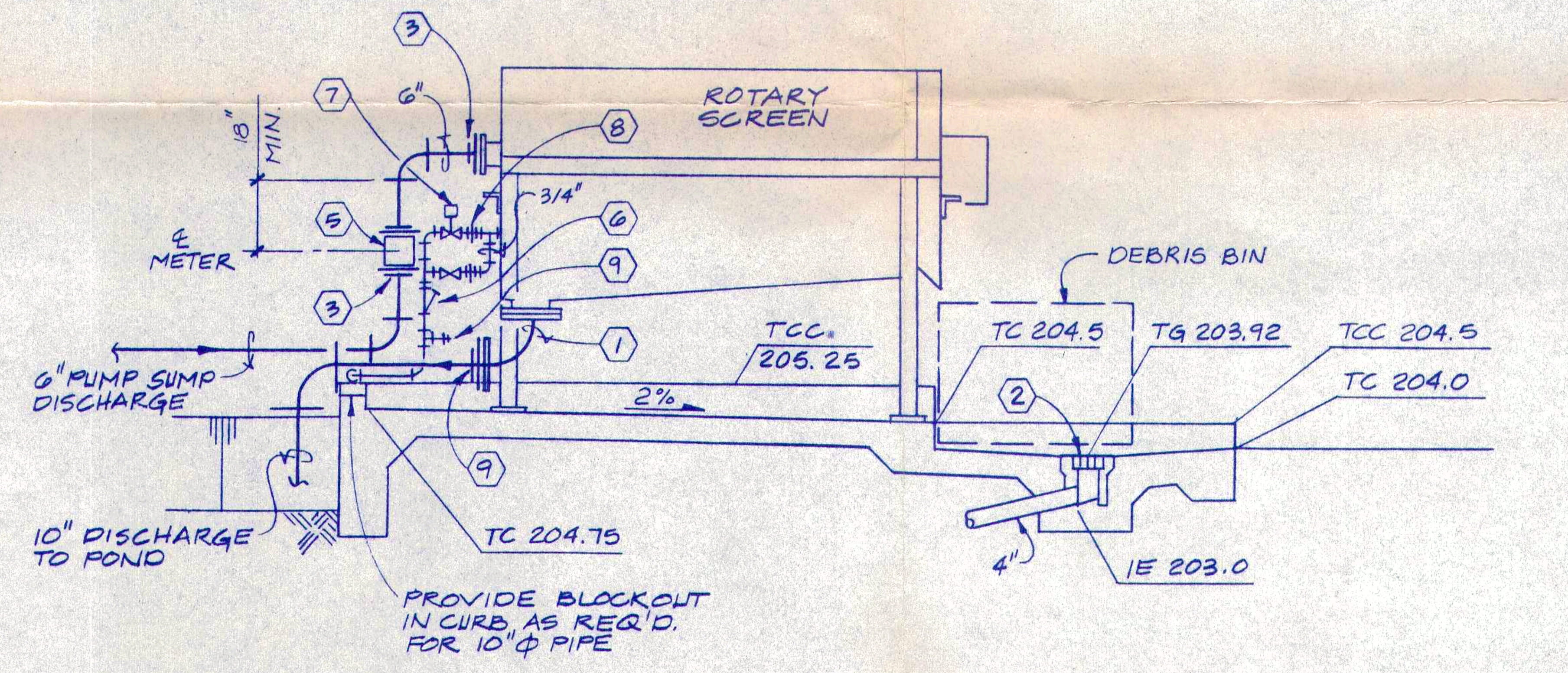


ROTARY SCREEN PLAN (1)

3/8" = 1'-0"

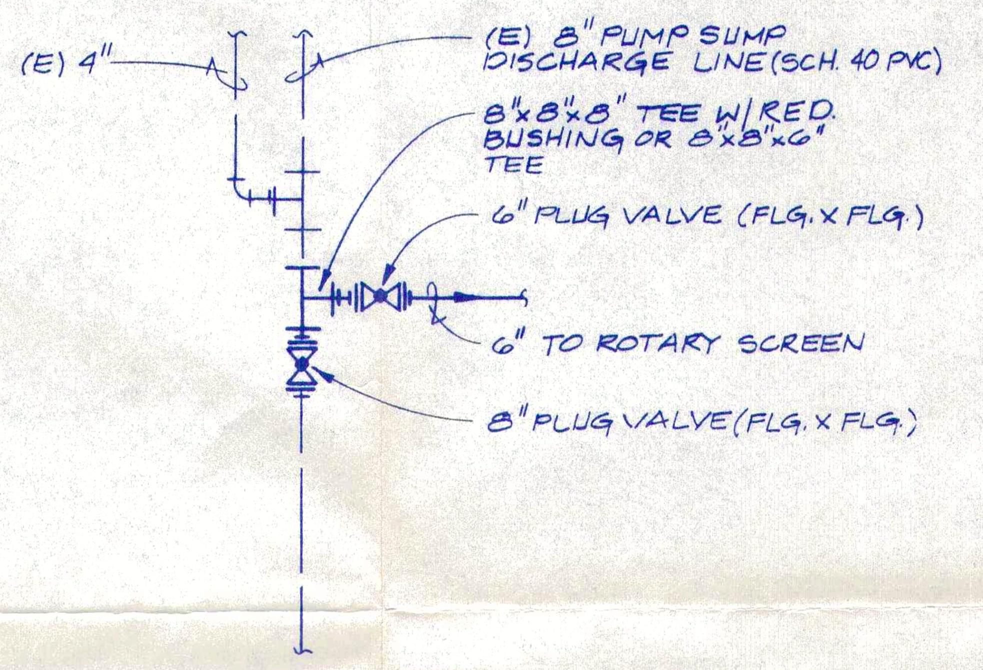
FITTING AND EQUIPMENT SCHEDULE

⬡	DESCRIPTION
1	10" DUCTILE IRON FLANGED 90° BEND
2	CHRISTY V1 DRAIN BOX W/CAST IRON GRATE
3	FLANGED CONNECTION (SIZE AS REQUIRED)
4	AERATOR MOORING POST, SEE DETAIL 2/C1
5	MAGNETIC FLOWMETER
6	3/4" WYE STRAINER
7	SOLENOID VALVE
8	UNION, TYP
9	3/4" HOSE BIBB
10	PIPE SUPPORT, SEE DETAIL 8/-
11	CONCRETE PIPE SUPPORT SEE DETAIL 7/-



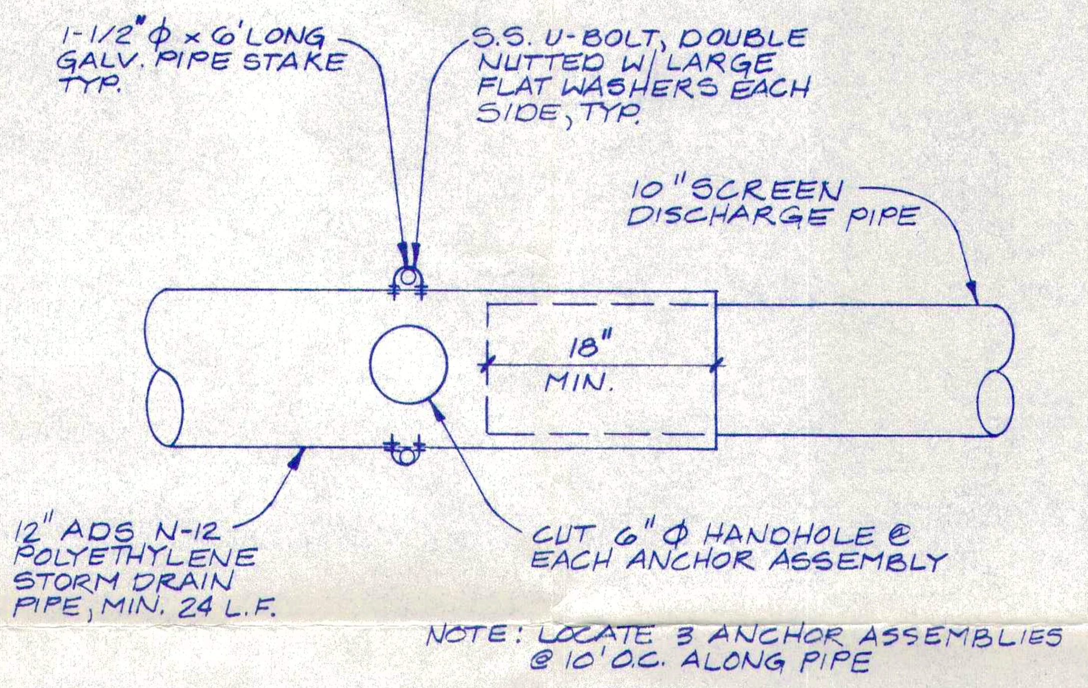
SECTION (2)

3/8" = 1'-0"



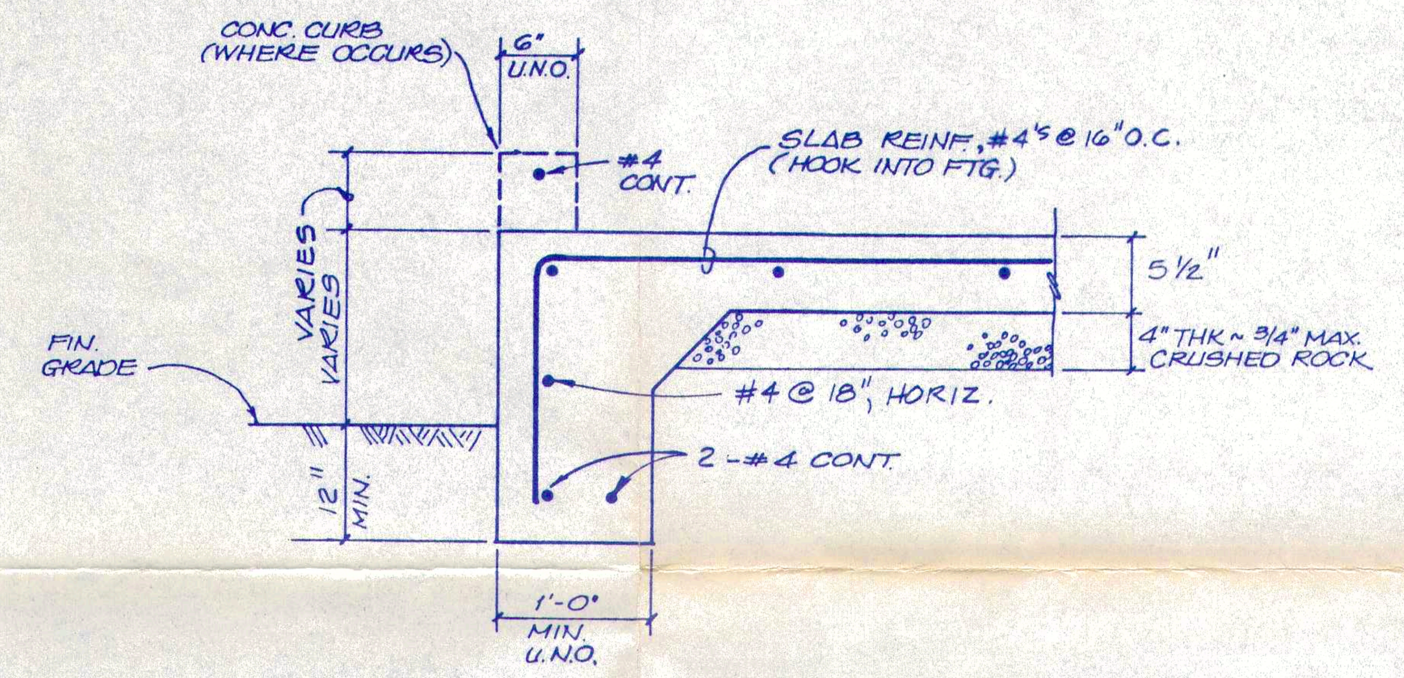
CONNECTION DETAIL (3)

N.T.S.



SPILLWAY PIPE DETAIL (4)

N.T.S.



SECTION (5)

N.T.S.

MATERIAL SPECIFICATIONS

1. 6" PUMP SUMP DISCHARGE LINE (SCREEN INLET LINE) & 10' DISCHARGE TO POND (SCREEN OUTLET LINE)

   A. Piping -- PVC Schedule 40 pipe conforming to ASTM D1785 with Schedule 40, Grade 1 fittings conforming to ASTM D2466.

   B. Plug Valves -- DeZurik Series 100 eccentric valve with cast iron body, flanged ends, Hycar coated plug (RS26) and wrench/hand lever operator.

2. BACKWASH WATERLINE:

   A. Underground -- PVC Schedule 40 pipe and fittings conforming to the above requirements

   B. Above ground -- galvanized steel, schedule 40, conforming to ASTM A120. Fittings to be malleable iron, class 150 conforming to ANSI B16.3, banded and galvanized.

   C. Gate Valve -- Red - White Valve Corporation Fig 291 or equal, 125 pound W.S.P., 200 pond W.O.G., with bronze body, solid wedge disc and non-rising stem.

   D. Solenoid valve: ASCO 8210 series, normally closed solenoid valve with brass body, Buna "N" seat, 120V and NEMA 4X solenoid enclosure for a maximum operating pressure differential of 100 psi.

   E. Wye Strainer: Watts Regulator Company 745 series with cast bronze body, brass retainer cap, viton "O" ring, 80 mesh stainless steel screen and WWP of 250 psi at 210° F.

   F. Hose Bibb: Watts Regulator 5C-6 hose bibb with Watts Regulator No. 8 vacuum breaker.

3. 4" DRAIN LINE: PVC Sewer pipe conforming to the requirements of ASTM D-3034, SDR35.

4. SPILLWAY PIPE: ADS N-12 High density polyethylene (HDPE) pipe with corrugated exterior and smooth interior conforming to the requirements of AASHTO M-252 and M-294.

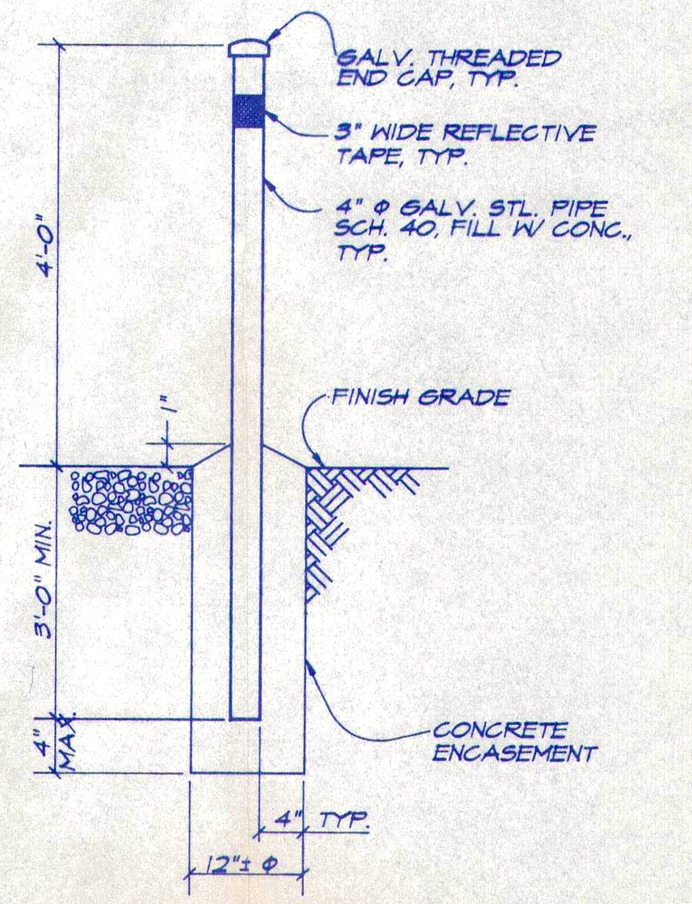
CONCRETE NOTES

1. CONCRETE SHALL BE 5 SACK MINIMUM COMMERCIAL QUALITY MIX:

LOCATION	MIN. fc' @ 28 DAYS
FOUNDATION AND SLABS ON GRADE	2500 PSI

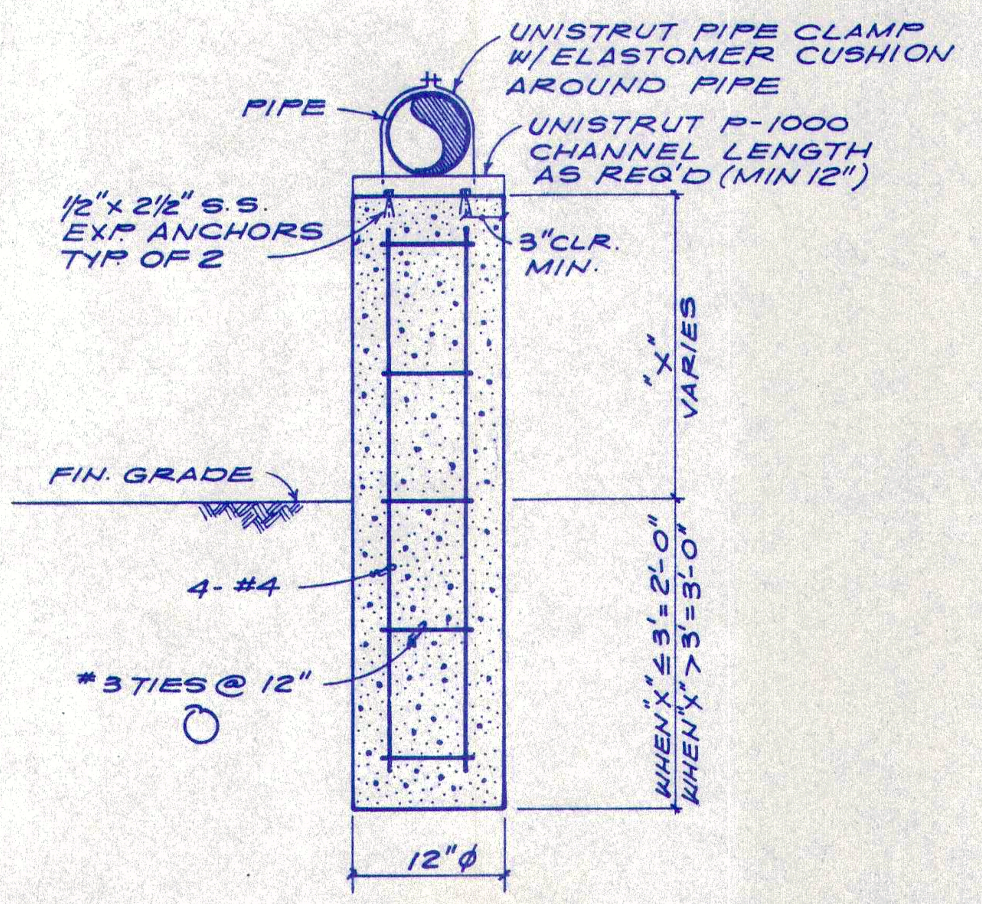
2. REINFORCING STEEL: ASTM A-615, GRADE 60 FOR #5 BARS AND LARGER, GRADE 40 FOR #4 BARS AND SMALLER.

3. CONCRETE WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF ACI-318.



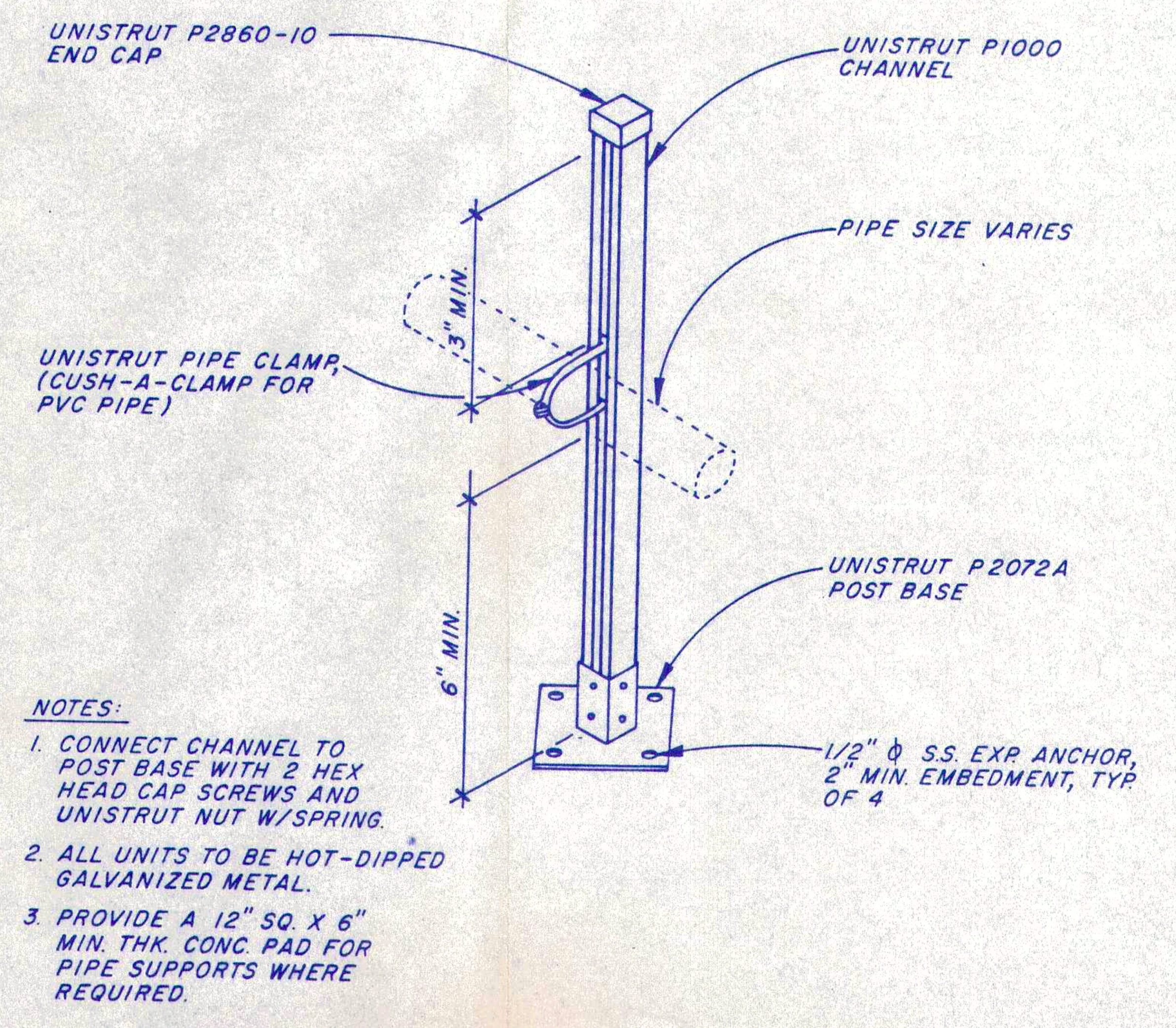
GUARD POST DETAIL (6)

N.T.S.



CONCRETE PIPE SUPPORT (7)

N.T.S.



NOTES:

1. CONNECT CHANNEL TO POST BASE WITH 2 HEX HEAD CAP SCREWS AND UNISTRUT NUT W/SPRING.
2. ALL UNITS TO BE HOT-DIPPED GALVANIZED METAL.
3. PROVIDE A 12" SQ. X 6" MIN. THK. CONC. PAD FOR PIPE SUPPORTS WHERE REQUIRED.

PIPE SUPPORT (8)

N.T.S.

SUMMIT ENGINEERING, INC.
CONSULTING CIVIL ENGINEERS
1400 NORTH DUTTON AVENUE, STE. 22, SANTA ROSA, CALIFORNIA 95401-4644
PH (707) 527-0775 FAX (707) 527-0212

UPPER VALLEY RECYCLING & DISPOSAL SERVICE
ST. HELENA, CALIFORNIA

WASTEWATER SYSTEM IMPROVEMENTS

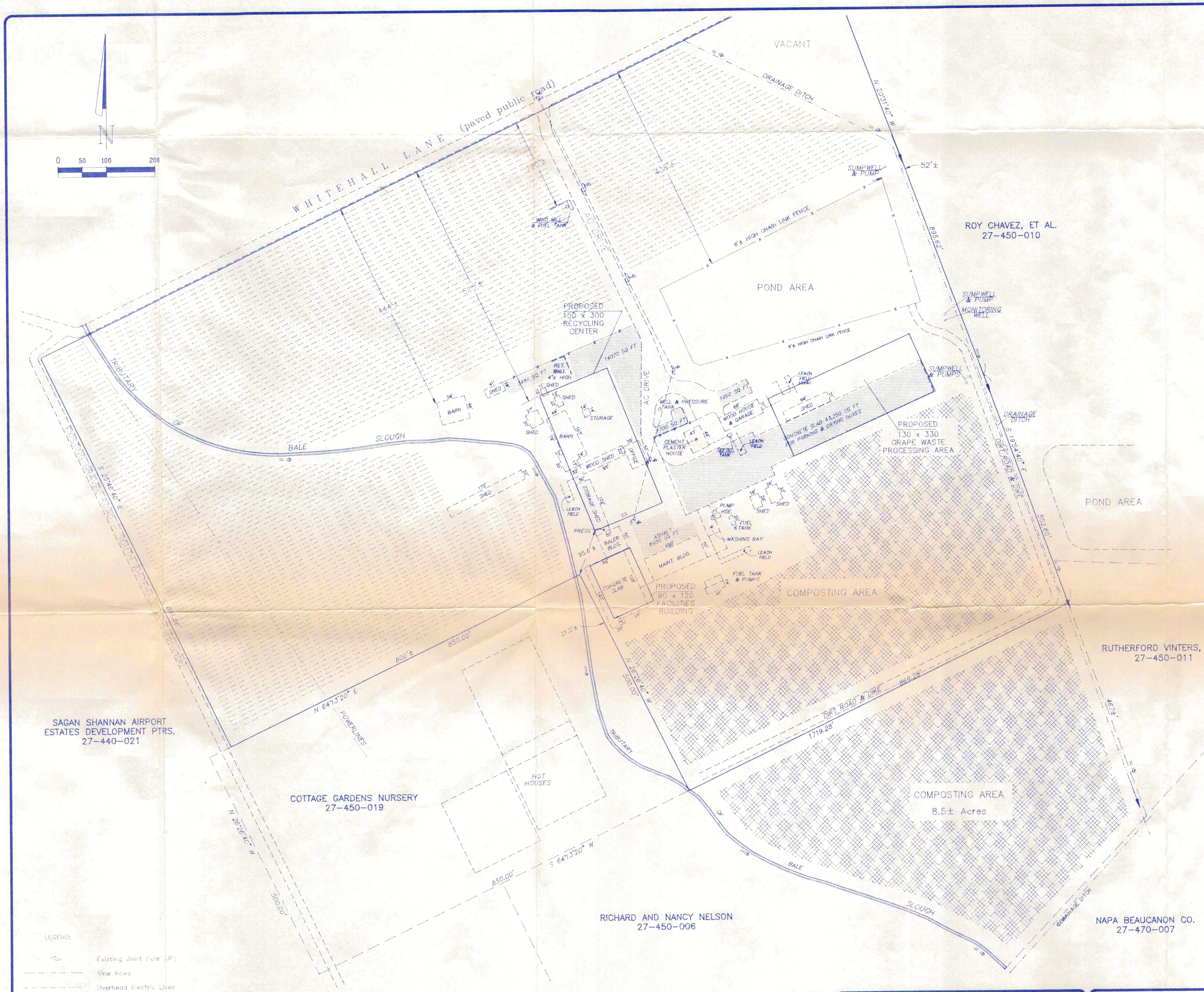
SECTIONS AND DETAILS

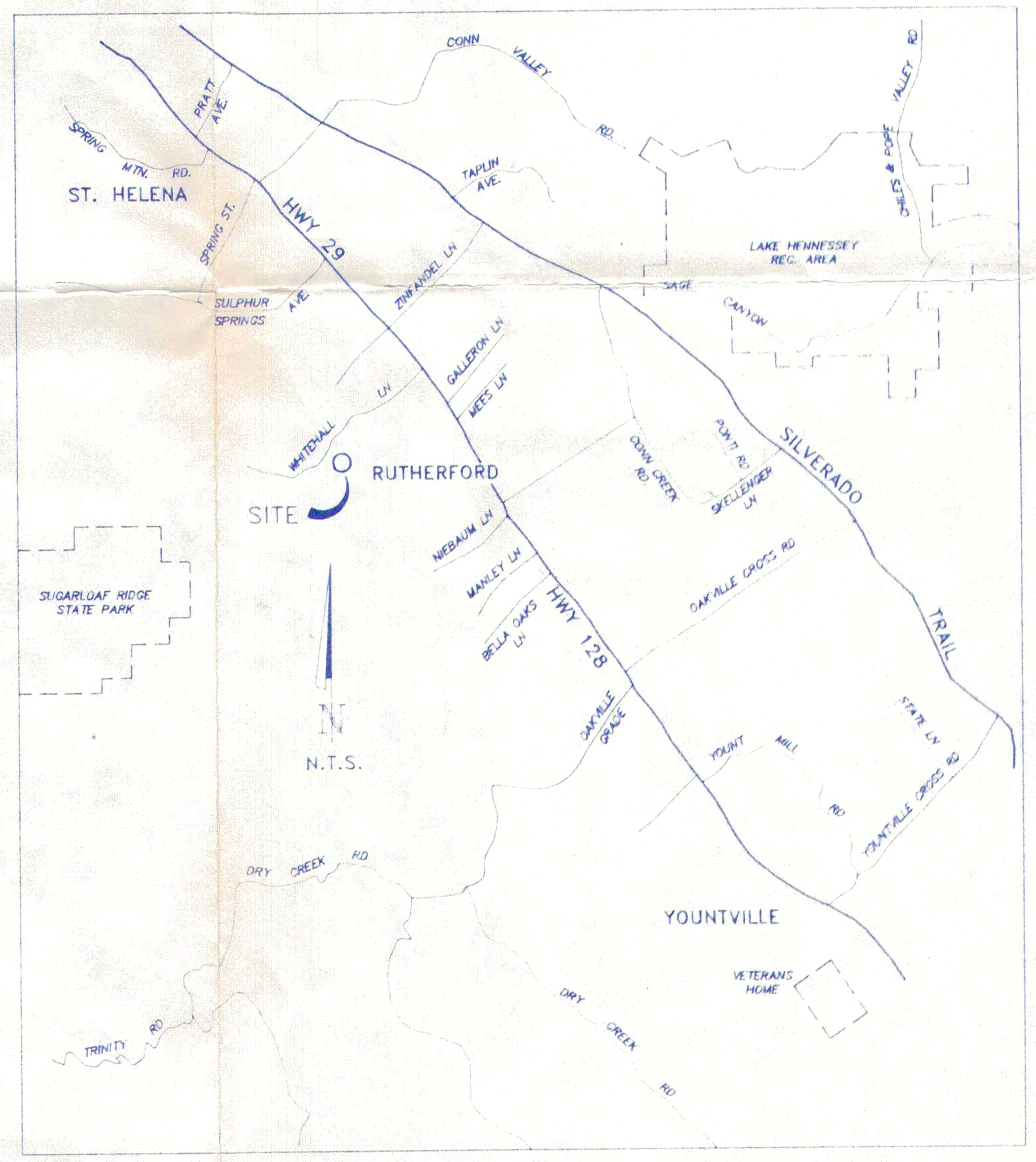
10-23-92 ISSUED FOR APPROVAL

REGISTERED PROFESSIONAL ENGINEER WILLIAM J. PHILLIPS II No. 24,978 CIVIL STATE OF CALIFORNIA
EXP. DATE 12/31/93

DATE: 10-22-92
JOB NO.: 9239.8
SCALE: AS NOTED
DRAWN: EF
CHECKED: CC
SHEET: C2

APPENDIX E - EMCON Retention Basin Design





VICINITY MAP

ACREAGE BY PROPOSED USE

VINEYARDS : 20.0 ACRES ±
COMPOST : 18.5 ACRES ± (10 AC. + 8.5 AC PROPOSED)
PONDS : 2.4 ACRES ±
CORP. AREA : 13.9 ACRES ±

TOTAL = 52.8 ACRES ±

GENERAL NOTES

C/O BOB PESTONI
2585 WHITEHALL LANE
ST. HELENA CA. 94574

A.P.N.: 27-450-020 AND 021
EXISTING AND PROPOSED WATER SOURCE: WELL
EXISTING AND PROPOSED SEWER SYSTEM: SEPTIC
PROPOSED AVAILABLE PARKING: 71,000 SQ.FT.

SITE MAP

OF THE LANDS OF

PESTONI, ET AL.

DBA "UPPER VALLEY DISPOSAL SERVICE"
1190 O.R. 739 & 1190 O.R. 743
NAPA COUNTY, CALIFORNIA

ALBION SURVEYS, INC.
ST. HELENA, CALIFORNIA
AUGUST, 1992

ALBION

ASSESSOR'S PARCEL NO: 27-450-020 & 021

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DATE OF ISSUE: DWN BY: CHK BY: DES BY: APP BY:

EMCON Associates

UPPER VALLEY DISPOSAL SERVICE
COMPOST FACILITY
NAPA COUNTY, CALIFORNIA

SITE MAP

DRAWING NO. 1
PROJECT NO. 331-01.11

CADD FILE: D:\ACAD\DWGS\NAPA\331\3310111S
DATE LAST REVISED: 11-02-1992

963-1217

Base topography prepared by Albion Surveys, Inc. August 1992. Elevation datum is assumed.

SCALE: 0 50 100 150 200 250 FEET

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
DATE OF ISSUE 9-25-92		DWN BY / DES BY			CHK BY / APP BY	

EMCON Associates

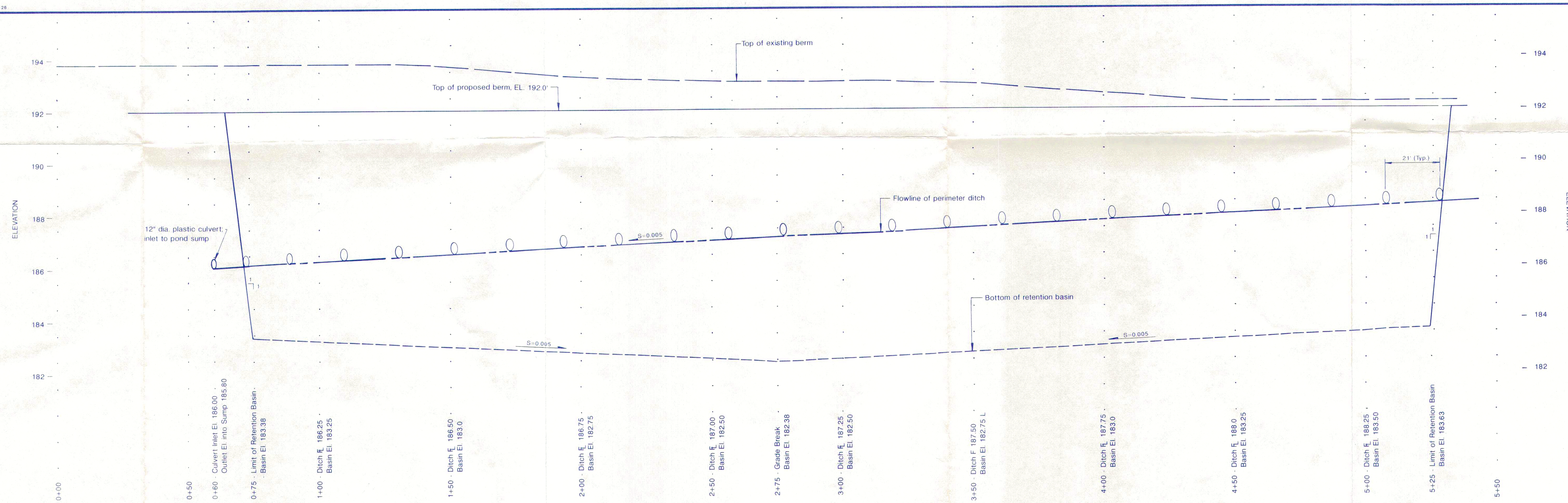
UPPER VALLEY RECYCLING AND DISPOSAL SERVICE
COMPOST FACILITY
NAPA COUNTY, CALIFORNIA

DRAINAGE AND GRADING PLAN

DRAWING NO. 2

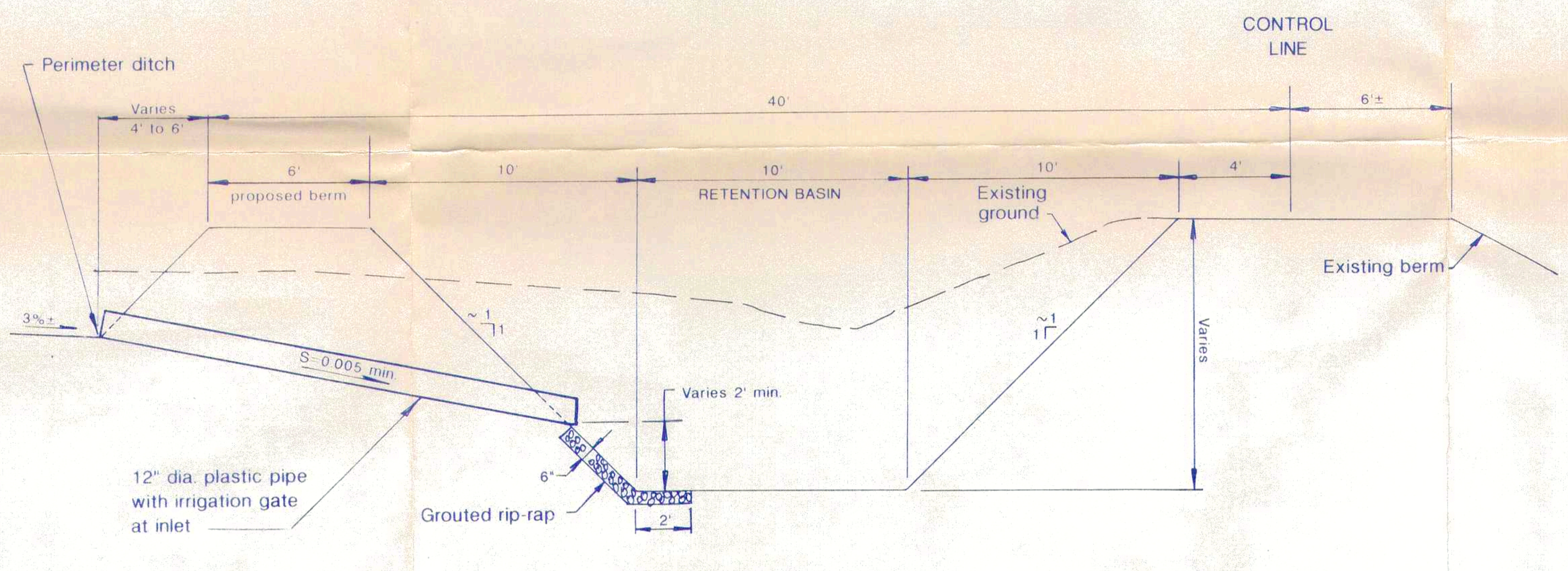
PROJECT NO. 331-01.11

CADD FILE: D:\ACAD\DWGS\NAPA\1062-X
DATE LAST REVISED: 09-25-92



PROFILE EASTERN BOUNDARY

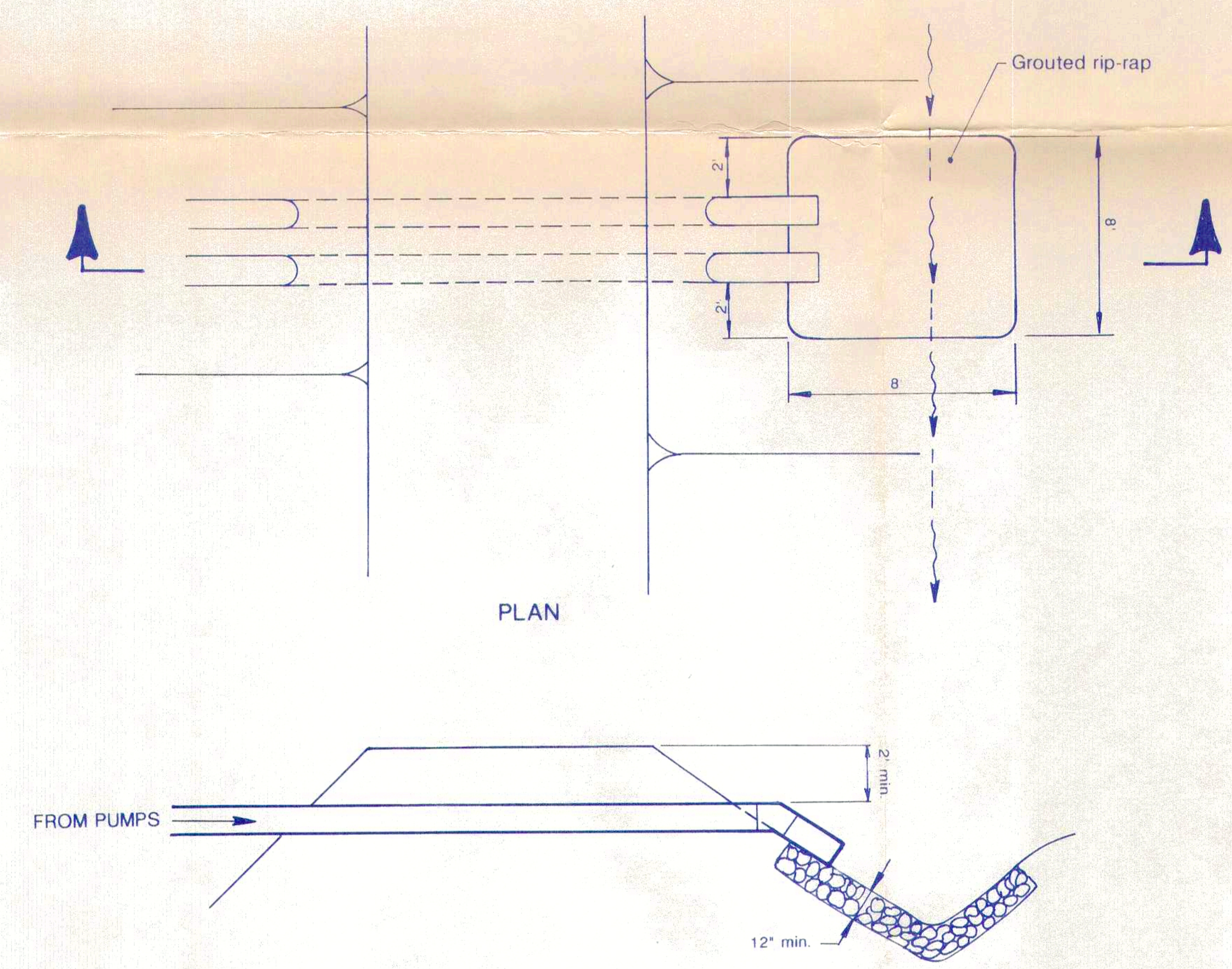
Horizontal Scale: 1"=20'
Vertical Scale: 1"=2'



TYPICAL RETENTION BASIN SECTION

DETAIL 1

1" = 5'

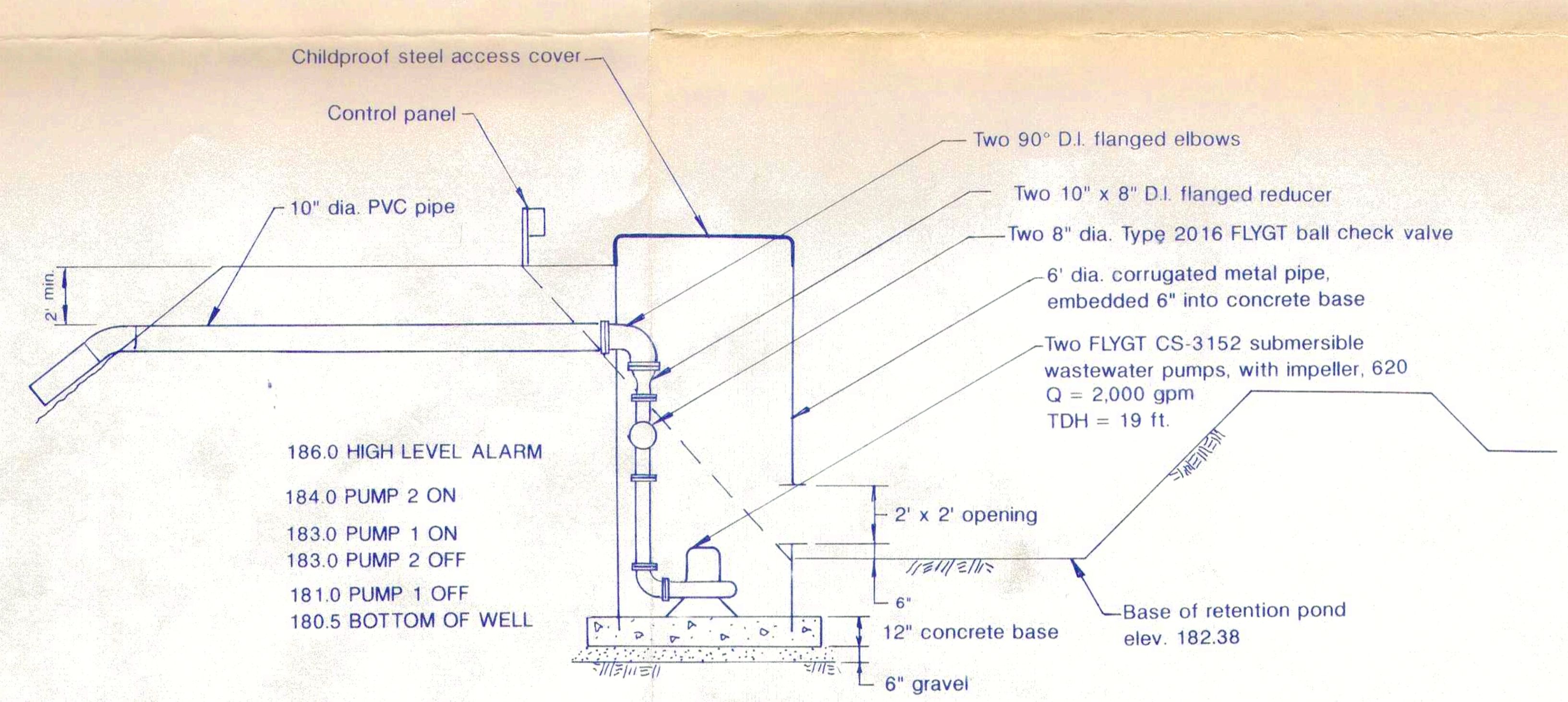


SECTION

DISCHARGE PIPE OUTLET PROTECTION

DETAIL 2

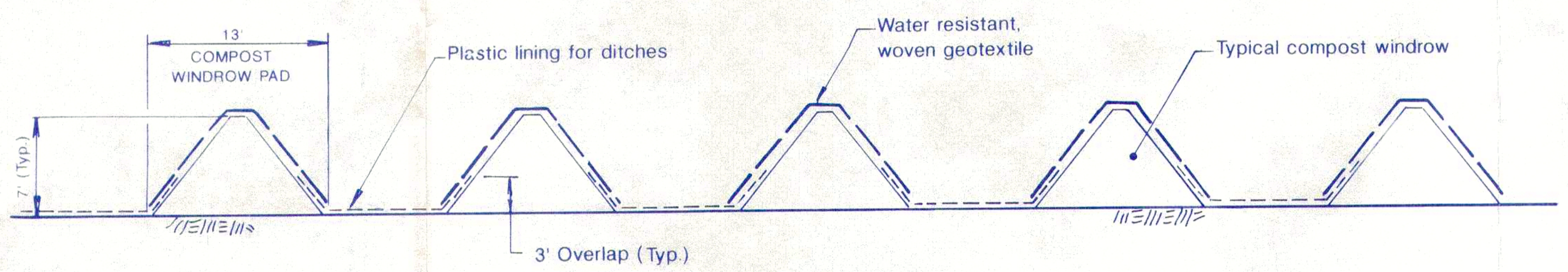
1" = 5'



RETENTION BASIN SUMP AND PUMP SYSTEM

DETAIL 3

1" = 5'



TYPICAL COMPOST WINDROW SECTION

DETAIL 4

1" = 10'

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DATE OF ISSUE Sept. 1992 | DWN BY | DES BY | CHK BY | APP BY KPB

EMCON Associates

UPPER VALLEY RECYCLING AND DISPOSAL SERVICE
COMPOST FACILITY
NAPA COUNTY, CALIFORNIA

SECTIONS AND DETAILS

DRAWING NO. 3

PROJECT NO 331-01.11

APPENDIX F - Water Balance and Basin Sizing Analysis

Site Variables

24 Hour, 25 Year Rainfall (inch): 6.73 (NOAA Atlas 14, Vol. 6, Version 2-Helena)
Pan Evaporation Coefficient: 0.7 (Kohler et al. 1955, 1958)
24 Hour, 100 Year Rainfall (inch): 8.29 (NOAA Atlas 14, Vol. 6, Version 2-Helena)

Table 1: Site-Wide Area Analysis with Extreme Storm Events

Drainage Area	Area (ft2)	Area (Acre)	Runoff Coefficient (Summer, Material Uncovered)	Runoff Coefficient (Winter, Material Covered)	24-Hour, 25-Year Storm Runoff, Summer (acre-ft)	24-Hour, 25-Year Storm Runoff, Winter (acre-ft)	24-Hour, 100-Year Storm Runoff, Summer (acre-ft)	24-Hour, 100-Year Storm Runoff, Winter (acre-ft)
Wastewater Pond Drainage								
Area 1 (Southwest Storage)	60812	1.40	0.70	N/A	0.55	N/A	0.68	N/A
Area 2 (Interior Access Road)	38828	0.89	0.70	0.70	0.35	0.35	0.43	0.43
Area 3A (Piles Uncovered In Summer)	138473	3.18	0.70	N/A	1.25	N/A	1.54	N/A
Area 3B (Remainder Compost Area)	97310	2.23	0.70	0.70	0.88	0.88	1.08	1.08
Area 4 (Pond and Surround)	84661	1.94	1.00	1.00	1.09	1.09	1.34	1.34
Area 5 (Southeast Storage)	138882	3.19	0.70	0.70	1.25	1.25	1.54	1.54
Area 7 (New Facilities)	35958	0.83	0.90	0.90	0.42	0.42	0.51	0.51
				Total Runoff	5.78	3.99	7.12	4.91
Retention Basin Drainage								
Area 1 (Southwest Storage)	60812	1.40	N/A	1	N/A	0.78	N/A	0.96
Area 3A (Piles Covered In Winter)	138473	3.18	N/A	1	N/A	1.78	N/A	2.20
Area 6 (Retention Basin and Surround)	23326	0.54	1.00	1.00	0.30	0.30	0.37	0.37
				Total Runoff	0.30	2.87	0.37	3.53

Table 2: Wastewater Pond Size and Water Use

Pond Volume (acre-ft) (2-ft Freeboard)	Annual Use (March-November) (acre-ft)[1]	Est. Monthly Use (March-November)
21.52	10.76	1.35

[1] Annual water usage is estimated from site operator statements: Half of full pond used each year from spring to rainy season. Pond is near empty or near-empty prior to rainy season.

Table 3: Wastewater Pond Water Design Storm Storage, from Empty

Season	Design Storm	Percent Full	Drainage Area (acre)	Max. Rain (inch)[2]	Associated Storm[3]
Summer	25-Year, 24-Hour	26.9%	13.66	27.01	500-Year, 10-Day
Summer	100-Year, 24-Hour	33.1%	13.66	27.01	500-Year, 10-Day
Winter	25-Year, 24-Hour	18.5%	9.08	40.62	500-Year, 30-Day
Winter	100-Year, 24-Hour	22.8%	9.08	40.62	500-Year, 30-Day

[1] Percent of volume used to retain 25-Year, 24-Hour storm, maintaining 2-ft. freeboard.
[2] Is the maximum depth of rainfall the Pond can retain, after the design storm, based on conservative runoff coefficient of 0.7.
[3] Point precipitation frequency estimate corresponding to Max. Rain, per NOAA Altas 14, Volume 6, Version 2, Saint Helena station.

Table 4: Wastewater Pond Water Storage, with Annual Rainfall

Season	Water Volume Prior to Event (acre-ft)[1]	Water Volume Remining (acre-ft)	Drainage Area (acre)	Max. Rain (inch)[2]	Associated Storm[3]
Summer	16.60	4.92	13.66	6.18	10-Year, 24-Hour
Winter	15.70	5.82	5.89	16.92	50-Year, 4-Day

[1] See rainfall year analyses.
[2] Is the maximum depth of rainfall the Pond can retain based on conservative runoff coefficient of 0.7.
[3] Point precipitation frequency estimate corresponding to Max. Rain, per NOAA Altas 14, Volume 6, Version 2, Saint Helena station.

GENERAL NOTES:

1. Area 7 (New Facilities) is a proposed 15,000 sq. ft. blending barn, CNG truck refueling station, and truck parking stalls. Area 7 has not been constructed at the time of this analysis.

2. Water use based on existing site configuration, without Area 7 or curing in Area 5. Annual water use is estimated and expected to vary.
3. Materials covered December 1 to April 1 (defined as "Winter") and prior to rain events, increasing runoff for these months.

4. Retention Basin used for temporary storage only while discharging to adjacent surface tributary.

Table 5: Site Water Balance: Average Annual Rainfall, Discharching Only Clean Stormwater (Typical Year with No Optional Retention)

Month	Average Rainfall (inch)	Runoff Area 1 (acre-ft)	Runoff Area 2 (acre-ft)	Runoff Area 3A (acre-ft)	Runoff Area 3B (acre-ft)	Runoff Area 4 (acre-ft)	Area 5 Runoff (acre-ft)	Area 6 Runoff (acre-ft)	Area 7 Runoff (acre-ft)	Total Monthly Runoff (acre-ft)	Clean Stormwater Discharged (acre-ft)[1]	Estimated Water Retained (acre-ft)[2]	Estimated Water Use (acre-ft)[3]	Average Pan Evap. (inch)[4]	Est. Basin Surface Area (acre)[5]	Est. Evap. (acre-ft)	Monthly Balance (acre-ft)	Cumulative Balance (acre-ft)
November	3.93	0.32	0.20	1.04	0.51	0.64	0.73	0.18	0.24	3.86	0.18	3.69		1.75	1.15	0.12	3.57	3.57
December	6.9	0.56	0.36	1.83	0.90	1.12	1.28	0.31	0.43	6.78	2.70	4.09		1.01	1.34	0.08	4.01	7.58
January	7.6	0.62	0.40	2.01	0.99	1.23	1.41	0.34	0.47	7.47	2.97	4.50		1.03	1.54	0.09	4.41	11.99
February	6.53	0.53	0.34	1.73	0.85	1.06	1.21	0.29	0.40	6.42	2.55	3.87		1.51	1.70	0.15	3.72	15.70
March	4.32	0.35	0.22	1.14	0.56	0.70	0.80	0.19	0.27	4.25	1.69	2.56	1.35	3.03	1.79	0.32	0.90	16.60
April	2.1	0.17	0.11	0.56	0.27	0.34	0.39	0.09	0.13	2.06	0.09	1.97	1.35	4.80	1.81	0.51	0.12	16.72
May	0.85	0.07	0.04	0.16	0.11	0.14	0.16	0.04	0.05	0.77	0.04	0.73	1.35	7.33	1.76	0.75	-1.37	15.35
June	0.25	0.02	0.01	0.05	0.03	0.04	0.05	0.01	0.02	0.23	0.01	0.21	1.35	9.60	1.68	0.94	-2.07	13.28
July	0.03	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.03	1.35	10.82	1.59	1.00	-2.32	10.95
August	0.07	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.06	0.00	0.06	1.35	9.45	1.49	0.82	-2.11	8.85
September	0.29	0.02	0.02	0.05	0.04	0.05	0.05	0.01	0.02	0.26	0.01	0.25	1.35	6.99	1.41	0.57	-1.67	7.18
October	1.72	0.14	0.09	0.32	0.22	0.28	0.32	0.08	0.11	1.55	0.08	1.48	1.35	4.35	1.39	0.35	-0.22	6.96

[1] *Clean stormwater discharged is Area 1 and compost Area 3a (in winter, with covered compost piles) and retention basin Area 6.*

[2] *Clean stormwater is routinely captured by site stormwater control structures and placed into the Pond for reuse. This additional optional capture is not reflected in the model.*

[3] *Water use is approximate and will vary depending on site requirements.*

[4] *Evaporation taken from Western Regional Climate Center Evaporation Stations, Class A Pans, for Markley Cove (1970-2005).*

[5] *Basin surface area calculated from sizing worksheet:* $Surface\ Area = -0.0003(volume)^2 + 0.0504(volume) + 0.9731$

Total estimated runoff: 33.75 acre-ft Total estimated annual discharge: 10.32 acre-ft Estimated discharge of total runoff: 31%

Estimated maximum Pond volume is end of April: 16.72 acre-ft. Estimated maximum pond volume use, maintaining 2-ft. freeboard: 78%

Remainder volume in pond at end of October expected to be utilized during next compost season or properly disposed of in accordance with site permits.

Table 6: Site Water Balance: Average Annual Rainfall with 25-Year, 24-Hour Event in Winter with Compost Tarps Installed (With No Optional Retention)

Month	Average Rainfall (inch)	Runoff Area 1 (acre-ft)	Runoff Area 2 (acre-ft)	Runoff Area 3A (acre-ft)	Runoff Area 3B (acre-ft)	Runoff Area 4 (acre-ft)	Area 5 Runoff (acre-ft)	Area 6 Runoff (acre-ft)	Area 7 Runoff (acre-ft)	Total Monthly Runoff (acre-ft)	Clean Stormwater Discharged (acre-ft)[1]	Estimated Water Retained (acre-ft)[2]	Estimated Water Use (acre-ft)[3]	Average Pan Evap. (inch)[4]	Est. Basin Surface Area (acre)[5]	Est. Evap. (acre-ft)	Monthly Balance (acre-ft)	Cumulative Balance (acre-ft)
November	3.93	0.32	0.20	1.04	0.51	0.64	0.73	0.18	0.24	3.86	0.18	3.69		1.75	1.15	0.12	3.57	3.57
December	6.9	0.56	0.36	1.83	0.90	1.12	1.28	0.31	0.43	6.78	2.70	4.09		1.01	1.34	0.08	4.01	7.58
January	7.6	0.62	0.40	2.01	0.99	1.23	1.41	0.34	0.47	7.47	2.97	4.50		1.03	1.54	0.09	4.41	11.99
February	6.53	0.53	0.34	1.73	0.85	1.06	1.21	0.29	0.40	6.42	2.55	3.87		1.51	1.70	0.15	3.72	15.70
										6.85	2.87	3.99						
March	4.32	0.35	0.22	1.14	0.56	0.70	0.80	0.19	0.27	4.25	1.69	2.56	1.35	3.03	1.95	0.34	4.85	20.56
April	2.1	0.17	0.11	0.56	0.27	0.34	0.39	0.09	0.13	2.06	0.09	1.97	1.35	4.80	1.96	0.55	0.08	20.64
May	0.85	0.07	0.04	0.16	0.11	0.14	0.16	0.04	0.05	0.77	0.04	0.73	1.35	7.33	1.91	0.82	-1.43	19.20
June	0.25	0.02	0.01	0.05	0.03	0.04	0.05	0.01	0.02	0.23	0.01	0.21	1.35	9.60	1.84	1.03	-2.16	17.04
July	0.03	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.03	1.35	10.82	1.75	1.10	-2.42	14.62
August	0.07	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.06	0.00	0.06	1.35	9.45	1.65	0.91	-2.19	12.43
September	0.29	0.02	0.02	0.05	0.04	0.05	0.05	0.01	0.02	0.26	0.01	0.25	1.35	6.99	1.56	0.64	-1.73	10.69
October	1.72	0.14	0.09	0.32	0.22	0.28	0.32	0.08	0.11	1.55	0.08	1.48	1.35	4.35	1.54	0.39	-0.26	10.44

[1] *Clean stormwater discharged is Area 1 and compost Area 3a (in winter, with covered compost piles) and retention basin Area 6.*

[2] *Clean stormwater is routinely captured by site stormwater control structures and placed into the Pond for reuse. This additional optional capture is not reflected in the model.*

[3] *Water use is approximate and will vary depending on site requirements.*

[4] *Evaporation taken from Western Regional Climate Center Evaporation Stations, Class A Pans, for Markley Cove (1970-2005).*

[5] *Basin surface area calculated from sizing worksheet:* $Surface\ Area = -0.0003(volume)^2 + 0.0504(volume) + 0.9731$

[6] *25-Year event occurs by end of March.*

Total estimated runoff: 40.60 acre-ft Total estimated annual discharge: 13.19 acre-ft Estimated discharge of total runoff: 32%

Estimated maximum Pond volume is end of April: 20.64 acre-ft. Estimated maximum pond volume use, maintaining 2-ft. freeboard: 96%

Remainder volume in pond at end of October expected to be utilized in site operations over subsequent compost seasons or properly disposed of in accordance with site permits.

Table 7: Site Water Balance: Average Annual Rainfall with 25-Year, 24-Hour Event When Tarps Not Installed (Maximum Likely Wastewater Pond Volume with No Optional Retention)

Month	Average Rainfall (inch)	Runoff Area 1 (acre-ft)	Runoff Area 2 (acre-ft)	Runoff Area 3A (acre-ft)	Runoff Area 3B (acre-ft)	Runoff Area 4 (acre-ft)	Area 5 Runoff (acre-ft)	Area 6 Runoff (acre-ft)	Area 7 Runoff (acre-ft)	Total Monthly Runoff (acre-ft)	Clean Stormwater Discharged (acre-ft)[1]	Estimated Water Retained (acre-ft)[2]	Estimated Water Use (acre-ft)[3]	Average Pan Evap. (inch)[4]	Est. Basin Surface Area (acre)[5]	Est. Evap. (acre-ft)	Monthly Balance (acre-ft)	Cumulative Balance (acre-ft)
November	3.93	0.32	0.20	1.04	0.51	0.64	0.73	0.18	0.24	3.86	0.18	3.69		1.75	1.15	0.12	3.57	3.57
December	6.9	0.56	0.36	1.83	0.90	1.12	1.28	0.31	0.43	6.78	2.70	4.09		1.01	1.34	0.08	4.01	7.58
January	7.6	0.62	0.40	2.01	0.99	1.23	1.41	0.34	0.47	7.47	2.97	4.50		1.03	1.54	0.09	4.41	11.99
February	6.53	0.53	0.34	1.73	0.85	1.06	1.21	0.29	0.40	6.42	2.55	3.87		1.51	1.70	0.15	3.72	15.70
March	4.32	0.35	0.22	1.14	0.56	0.70	0.80	0.19	0.27	4.25	1.69	2.56	1.35	3.03	1.79	0.32	0.90	16.60
25-Year[6]										6.08	0.30	5.78						
April	2.1	0.17	0.11	0.56	0.27	0.34	0.39	0.09	0.13	2.06	0.09	1.97	1.35	4.80	2.02	0.57	5.84	22.44
May	0.85	0.07	0.04	0.16	0.11	0.14	0.16	0.04	0.05	0.77	0.04	0.73	1.35	7.33	1.98	0.85	-1.46	20.98
June	0.25	0.02	0.01	0.05	0.03	0.04	0.05	0.01	0.02	0.23	0.01	0.21	1.35	9.60	1.91	1.07	-2.20	18.78
July	0.03	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.03	1.35	10.82	1.81	1.15	-2.46	16.32
August	0.07	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.06	0.00	0.06	1.35	9.45	1.72	0.95	-2.23	14.08
September	0.29	0.02	0.02	0.05	0.04	0.05	0.05	0.01	0.02	0.26	0.01	0.25	1.35	6.99	1.63	0.67	-1.76	12.32
October	1.72	0.14	0.09	0.32	0.22	0.28	0.32	0.08	0.11	1.55	0.08	1.48	1.35	4.35	1.61	0.41	-0.28	12.04

[1] *Clean stormwater discharged is Area 1 and compost Area 3a (in winter, with covered compost piles) and retention basin Area 6.*

[2] *Clean stormwater is routinely captured by site stormwater control structures and placed into the Pond for reuse. This additional optional capture is not reflected in the model.*

[3] *Water use is approximate and will vary depending on site requirements.*

[4] *Evaporation taken from Western Regional Climate Center Evaporation Stations, Class A Pans, for Markley Cove (1970-2005).*

[5] *Basin surface area calculated from sizing worksheet:* $Surface\ Area = -0.0003(volume)^2 + 0.0504(volume) + 0.9731$

[6] *25-Year event occurs by end of April at point when the Pond is fullest and compost piles are completely uncovered.*

Total estimated runoff: 39.83 acre-ft Total estimated annual discharge: 10.62 acre-ft Estimated discharge of total runoff: 27%

Estimated maximum water volume in pond is end of April 22.44 acre-ft. Estimated maximum pond volume use, maintaining 2-ft. freeboard: 104%

Remainder volume in pond at end of October expected to be utilized in site operations over subsequent compost seasons or properly disposed of in accordance with site permits.

Field-Measured Characteristics

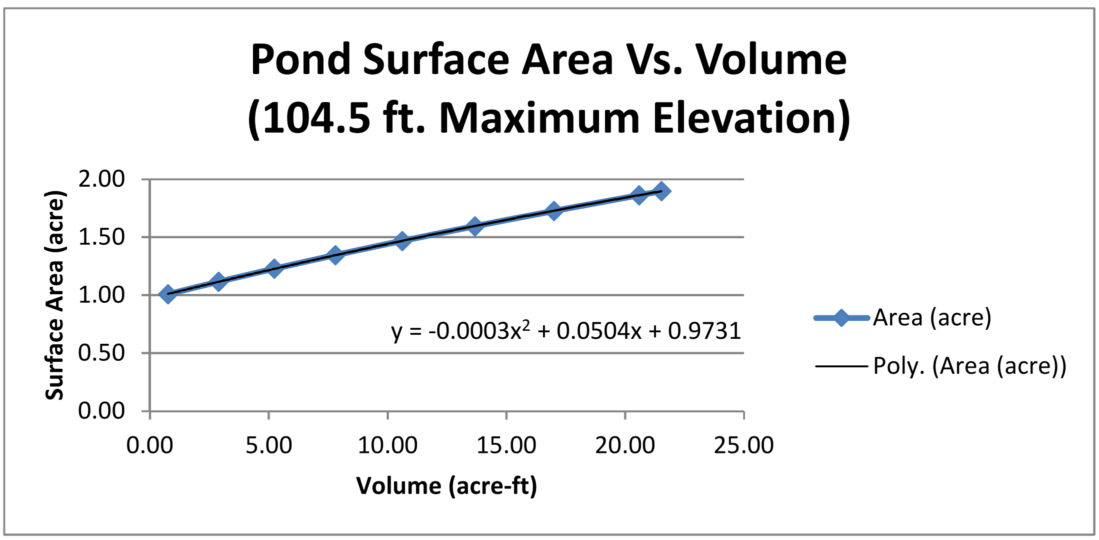
Design Bottom Elevation:	88.5 ft
Design Emergency Spillway Elevation:	104.5 ft
Top Containment Elevation:	106.5 ft

Outlet pipe at 104.5 ft elevation can be sealed if necessary.

Surface Area and Water Volume at Different Depths

Elevation (ft)	Volume (cy)	Volume (acre-ft)	Surface Area (sq. ft)	Area (acre)	
106.5	41145	25.50	96724	2.22	(Full-No Freeboard)
106	39441	24.45	87313	2.00	
104.5	34721	21.52	82655	1.90	(2 ft. Freeboard)
104	33204	20.58	81119	1.86	
102	27416	16.99	75205	1.73	
100	22057	13.67	69507	1.60	
98	17115	10.61	63955	1.47	
96	12580	7.80	58584	1.34	
94	8428	5.22	53544	1.23	
92	4644	2.88	48649	1.12	
90	1216	0.75	43917	1.01	(Near-Empty)

Volumes and areas generated in Civil 3D from field measurements, CB&I 2015, and "Reservoir Plan Map", 1989.



Sizing Calculation Inputs (For Water Balance Sheet)

1st Coefficient	2nd Coefficient	3rd Coefficient
-0.0003	0.0504	0.9731

$$Surface\ Area = -0.0003(volume)^2 + 0.0504(volume) + 0.9731$$

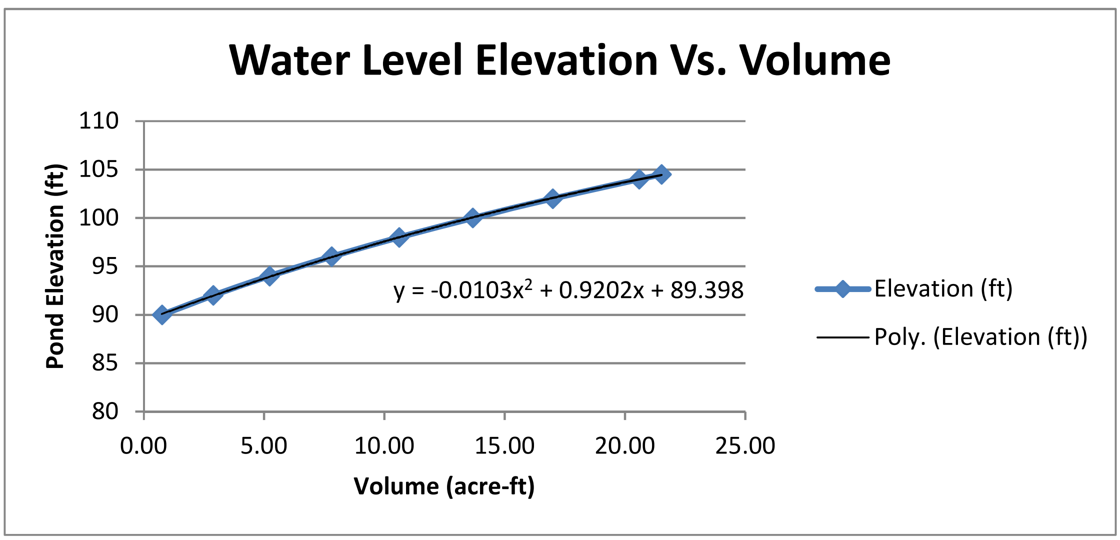
Pond Maximum Operational Depth Determination

Wastewater Pond to be operated to provide 100% containment for the 100-year, 24-hour storm event.

Required Volume, Winter:	4.91 acre-ft	(With tarps on compost)
Required Volume, Summer:	7.12 acre-ft	(No tarps on compost)
Pond Volume (with freeboard):	21.52 acre-ft	

Pond Elevation at Different Volumes

Elevation (ft)	Volume (cy)	Volume (acre-ft)
106.5	41145	25.50
106	39441	24.45
104.5	34721	21.52
104	33204	20.58
102	27416	16.99
100	22057	13.67
98	17115	10.61
96	12580	7.80
94	8428	5.22
92	4644	2.88
90	1216	0.75



Water Level Elevation Vs. Volume Calculation

1st Coefficient	2nd Coefficient	3rd Coefficient
-0.0103	0.9202	89.398

$$Elevation = -0.0103(volume)^2 + 0.9202(volume) + 89.398$$

Maximum Operational Depth,Winter:	11.8 ft
Maximum Operational Depth, Summer:	10.5 ft

Based on bottom elevation of 90 ft.

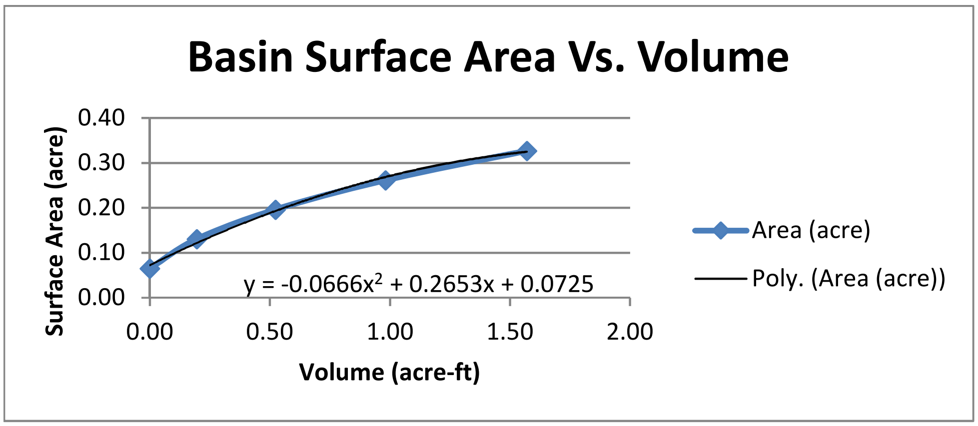
Characteristics (approximate):

Trapezoid Depth:	8	ft
Trapezoid Top Width:	30	ft
Side Slope:	1.5:1	horiz:vert
Trapezoid Bottom Width:	6	ft
Length:	475	ft

Surface Area and Water Volume at Different Depths

Depth Below Top (ft)	Volume (cy)	Volume (acre-ft)	Surface Area (sq. ft)	Area (acre)	
0	2533	1.57	14250	0.33	(Full-No Freeboard)
2	1583	0.98	11400	0.26	(2 ft. Freeboard)
4	844	0.52	8550	0.20	
6	317	0.20	5700	0.13	
8	0	0.00	2850	0.07	(Empty)

Volumes and areas generated in Civil 3D from field measurements, CB&I 2015, and "Surface Drainage System, Details II", 1989.



Note: Retention basin is intented to act as temporary storage of clean surface runoff or groundwater only.

NOAA Atlas 14, Volume 6, Version 2 SAINT HELENA
Station ID: 04-7643
Location name: Saint Helena, California, US*
Latitude: 38.5067°, Longitude: -122.4714°
Elevation:
Elevation (station metadata): 225 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.133 (0.119-0.151)	0.163 (0.145-0.186)	0.203 (0.180-0.232)	0.236 (0.207-0.271)	0.280 (0.237-0.335)	0.315 (0.259-0.386)	0.350 (0.281-0.441)	0.387 (0.300-0.503)	0.437 (0.323-0.596)	0.476 (0.339-0.675)
10-min	0.191 (0.170-0.217)	0.234 (0.208-0.266)	0.291 (0.258-0.332)	0.338 (0.296-0.389)	0.402 (0.339-0.481)	0.451 (0.372-0.553)	0.502 (0.402-0.633)	0.554 (0.430-0.721)	0.626 (0.464-0.854)	0.682 (0.486-0.968)
15-min	0.231 (0.206-0.262)	0.283 (0.252-0.322)	0.352 (0.312-0.401)	0.408 (0.358-0.470)	0.486 (0.410-0.581)	0.546 (0.450-0.669)	0.607 (0.486-0.765)	0.670 (0.520-0.872)	0.757 (0.561-1.03)	0.825 (0.588-1.17)
30-min	0.350 (0.311-0.397)	0.428 (0.381-0.487)	0.532 (0.471-0.607)	0.618 (0.542-0.711)	0.735 (0.620-0.879)	0.825 (0.680-1.01)	0.918 (0.736-1.16)	1.01 (0.787-1.32)	1.15 (0.848-1.56)	1.25 (0.889-1.77)
60-min	0.518 (0.461-0.588)	0.635 (0.564-0.722)	0.789 (0.699-0.900)	0.915 (0.803-1.05)	1.09 (0.919-1.30)	1.22 (1.01-1.50)	1.36 (1.09-1.72)	1.50 (1.17-1.96)	1.70 (1.26-2.31)	1.85 (1.32-2.62)
2-hr	0.795 (0.707-0.902)	0.965 (0.857-1.10)	1.18 (1.05-1.35)	1.36 (1.19-1.56)	1.59 (1.34-1.90)	1.76 (1.45-2.16)	1.94 (1.55-2.44)	2.11 (1.64-2.75)	2.34 (1.74-3.20)	2.52 (1.79-3.57)
3-hr	1.02 (0.910-1.16)	1.24 (1.10-1.41)	1.51 (1.34-1.72)	1.73 (1.51-1.99)	2.01 (1.70-2.40)	2.22 (1.83-2.72)	2.43 (1.94-3.06)	2.63 (2.04-3.43)	2.91 (2.15-3.96)	3.11 (2.21-4.41)
6-hr	1.55 (1.38-1.76)	1.88 (1.67-2.13)	2.29 (2.02-2.61)	2.60 (2.29-3.00)	3.02 (2.55-3.62)	3.33 (2.74-4.08)	3.63 (2.91-4.57)	3.92 (3.04-5.11)	4.31 (3.19-5.88)	4.59 (3.27-6.51)
12-hr	2.22 (1.98-2.52)	2.72 (2.42-3.10)	3.35 (2.97-3.83)	3.85 (3.38-4.43)	4.50 (3.80-5.39)	4.99 (4.11-6.11)	5.46 (4.38-6.88)	5.93 (4.61-7.72)	6.55 (4.85-8.94)	7.01 (4.99-9.95)
24-hr	3.12 (2.80-3.54)	3.90 (3.50-4.43)	4.89 (4.38-5.57)	5.68 (5.06-6.52)	6.73 (5.83-7.93)	7.51 (6.40-9.01)	8.29 (6.92-10.1)	9.08 (7.40-11.4)	10.1 (7.96-13.1)	10.9 (8.33-14.5)
2-day	4.09 (3.68-4.64)	5.25 (4.71-5.96)	6.71 (6.01-7.64)	7.87 (7.00-9.02)	9.38 (8.13-11.1)	10.5 (8.95-12.6)	11.6 (9.70-14.2)	12.7 (10.4-16.0)	14.2 (11.2-18.4)	15.3 (11.7-20.4)
3-day	4.70 (4.23-5.34)	6.11 (5.49-6.94)	7.89 (7.07-8.98)	9.29 (8.27-10.6)	11.1 (9.63-13.1)	12.5 (10.6-14.9)	13.8 (11.5-16.9)	15.1 (12.3-18.9)	16.9 (13.3-21.9)	18.2 (13.9-24.2)
4-day	5.21 (4.68-5.91)	6.79 (6.09-7.71)	8.78 (7.87-10.0)	10.3 (9.21-11.9)	12.4 (10.7-14.6)	13.9 (11.9-16.7)	15.4 (12.9-18.9)	16.9 (13.8-21.2)	18.9 (14.9-24.5)	20.3 (15.6-27.1)
7-day	6.52 (5.86-7.40)	8.38 (7.52-9.52)	10.7 (9.63-12.2)	12.6 (11.2-14.5)	15.1 (13.1-17.8)	17.0 (14.5-20.4)	18.9 (15.7-23.1)	20.7 (16.9-26.0)	23.2 (18.3-30.1)	25.1 (19.2-33.5)
10-day	7.45 (6.70-8.46)	9.50 (8.53-10.8)	12.1 (10.9-13.8)	14.2 (12.7-16.3)	17.0 (14.7-20.0)	19.1 (16.2-22.9)	21.2 (17.7-25.9)	23.3 (19.0-29.1)	26.1 (20.5-33.8)	28.2 (21.6-37.6)
20-day	9.88 (8.88-11.2)	12.6 (11.3-14.3)	16.0 (14.3-18.2)	18.7 (16.6-21.4)	22.2 (19.2-26.1)	24.8 (21.1-29.7)	27.4 (22.9-33.5)	30.0 (24.5-37.6)	33.4 (26.3-43.3)	36.0 (27.5-48.0)
30-day	11.7 (10.5-13.3)	14.9 (13.4-16.9)	18.9 (16.9-21.5)	22.0 (19.6-25.2)	26.0 (22.5-30.7)	29.0 (24.7-34.7)	31.9 (26.6-39.0)	34.7 (28.3-43.5)	38.5 (30.3-49.8)	41.2 (31.5-55.0)
45-day	14.2 (12.8-16.1)	18.1 (16.2-20.5)	22.8 (20.4-26.0)	26.4 (23.5-30.3)	31.1 (26.9-36.6)	34.4 (29.3-41.2)	37.6 (31.4-46.0)	40.8 (33.2-51.0)	44.8 (35.2-58.0)	47.7 (36.5-63.6)
60-day	16.8 (15.1-19.1)	21.3 (19.1-24.2)	26.8 (24.0-30.5)	30.9 (27.5-35.4)	36.1 (31.2-42.5)	39.8 (33.8-47.7)	43.3 (36.1-52.9)	46.6 (38.0-58.4)	50.9 (40.0-65.9)	53.9 (41.2-71.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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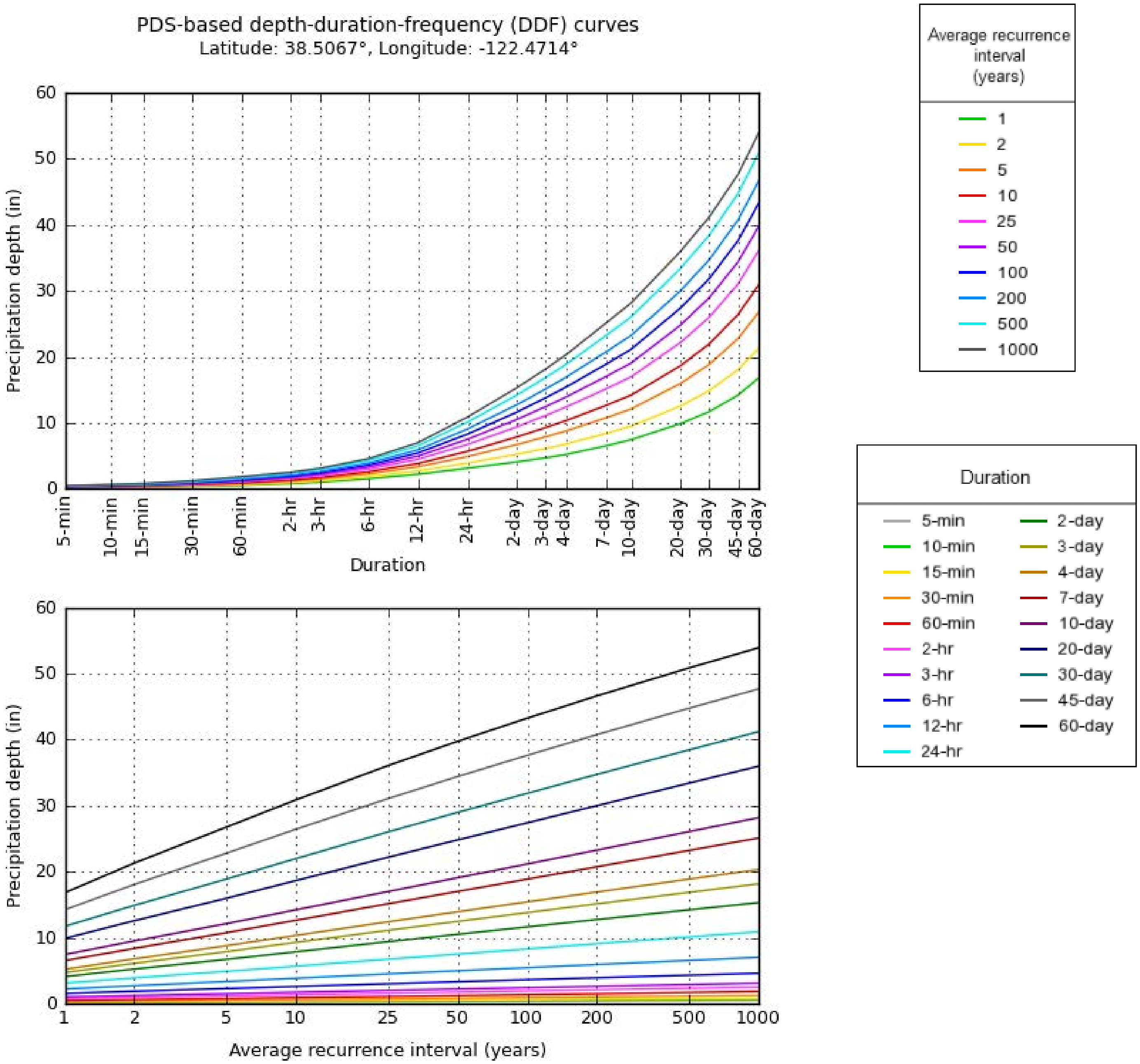
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed May 11 17:24:37 2016

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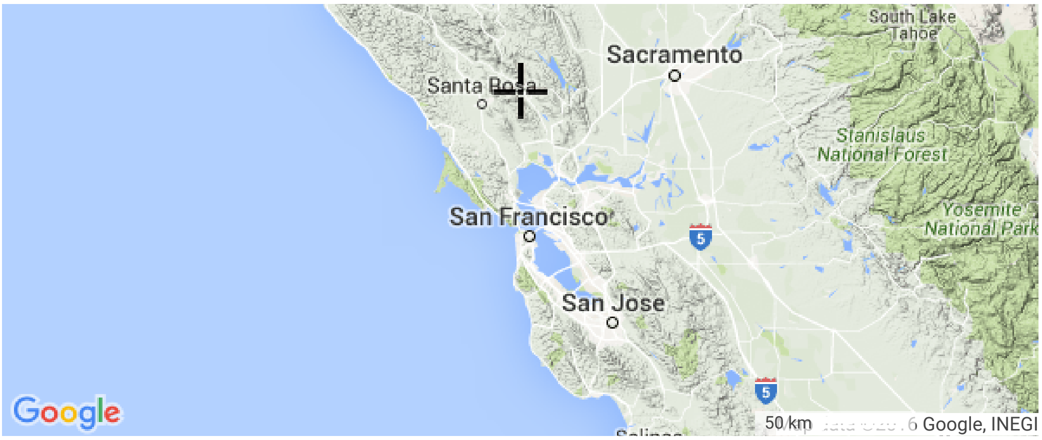
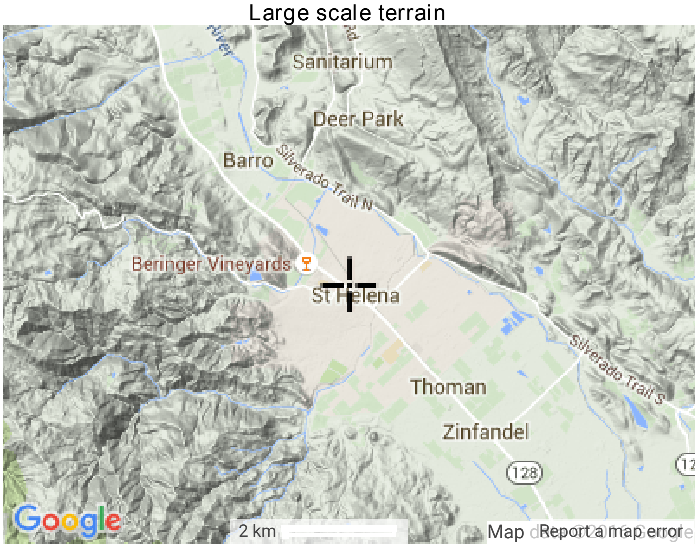
Maps & aerials

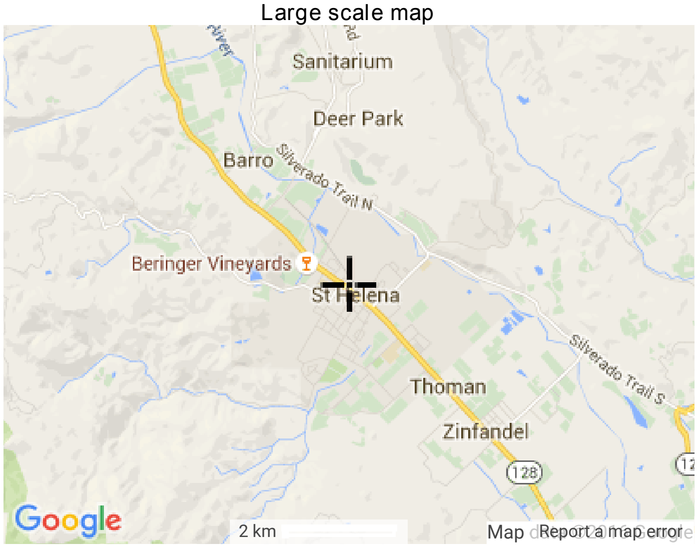
Small scale terrain



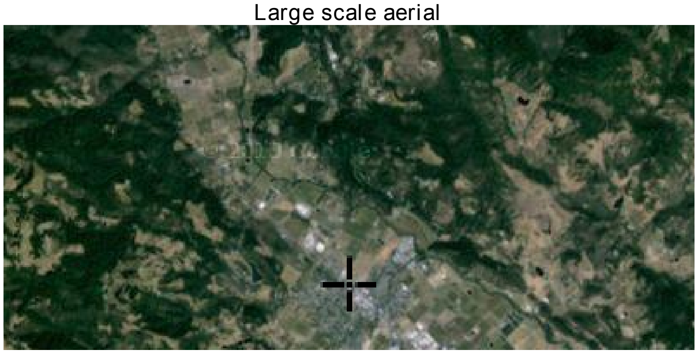
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

SAINT HELENA, CALIFORNIA (047643)

Period of Record Monthly Climate Summary

Period of Record : 10/24/1907 to 12/31/2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	56.6	61.1	65.4	71.5	78.1	85.0	89.7	88.9	85.9	77.3	66.2	57.6	73.6
Average Min. Temperature (F)	36.4	38.9	40.3	42.7	46.7	50.4	52.1	51.4	49.1	45.4	40.3	36.7	44.2
Average Total Precipitation (in.)	7.60	6.53	4.32	2.10	0.85	0.25	0.03	0.07	0.29	1.72	3.93	6.90	34.61
Average Total SnowFall (in.)	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 93.9% Min. Temp.: 93.9% Precipitation: 93.7% Snowfall: 68.9%
Snow Depth: 68.9%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

Evaporation Stations

Standard daily pan evaporation is measured using the four-foot diameter Class A evaporation pan. The pan water level reading is adjusted when precipitation is measure to obtain the actual evaporation. Most Class A pans are installed above ground, allowing effects such as radiation on the side walls and heat exchnges with the pan material. These effects tend to increase the evaporation totals. The amounts can then be adjusted by multiplying the totals b 0.70 or 0.80 to more closely estimate the evaporation from naturally existing urfaces such as a shallow lake, wet soil or other moist natural surfaces.

Many stations do not measure pan evaportation during winter months. A "0.00" total indicates no measuement is taken.

Stations marked with an asterisk (*) have estimated totals computed from meteorological measurements using a form of the Penman equation.

Click on a State: Arizona, California, Colorado, Hawaii & Pacific Islands, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

ALASKA

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
BROOKS RIVER	1967-1990	0.00	0.00	0.00	0.00	0.00	2.48	2.88	1.63	0.73	0.00	0.00	0.00	7.72
CENTRAL 2	1962-2005	0.00	0.00	0.00	0.00	0.00	3.97	4.00	2.43	2.19	0.00	0.00	0.00	12.59
COPPER CENTER	1961-1982	0.00	0.00	0.00	0.00	0.00	6.03	4.06	3.14	1.71	0.00	0.00	0.00	14.94
JUNEAU AP	1949-2005	0.00	0.00	0.00	0.00	3.33	3.29	3.82	3.14	1.02	0.00	0.00	0.00	14.60
MATANUSKA AES	1917-2005	0.00	0.00	0.00	0.00	4.22	4.44	3.92	3.05	1.83	0.00	0.00	0.00	17.46
MC GRATH WB AIRPORT	1939-2005	0.00	0.00	0.00	0.00	4.20	4.42	3.65	2.29	1.40	0.00	0.00	0.00	15.96
MCKINLEY PARK	1949-2005	0.00	0.00	0.00	0.00	0.00	2.96	2.55	1.75	0.53	0.00	0.00	0.00	7.79
OIL WELL ROAD E P	1967-1974	0.00	0.00	0.00	0.00	0.00	5.17	3.83	2.81	1.40	0.00	0.00	0.00	13.21
OLD EDGERTON	1970-1996	0.00	0.00	0.00	0.00	3.31	4.56	4.16	3.04	1.65	0.00	0.00	0.00	16.72
PALMER AAES	1949-2005	0.00	0.00	0.00	0.00	4.44	4.71	4.12	2.96	1.75	0.00	0.00	0.00	17.98
RAMPART 2	1963-1978	0.00	0.00	0.00	0.00	4.23	4.56	3.79	2.56	1.54	0.00	0.00	0.00	16.68
COLLEGE UNIV EXP STN	1931-2005	0.00	0.00	0.00	0.00	4.25	5.04	4.56	2.82	1.38	0.00	0.00	0.00	18.05

ARIZONA

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
BARTLETT DAM	1939-2005	3.92	4.92	7.10	10.02	13.77	16.21	15.56	13.95	12.10	9.66	5.86	4.47	117.54
BLACK RIVER PUMPS	1948-2005	0.00	0.00	0.00	6.93	8.83	10.12	7.99	7.02	5.70	3.94	0.00	0.00	50.53
DAVIS DAM # 2	1958-1977	7.49	7.46	9.75	12.78	16.71	19.48	19.87	17.91	14.64	12.03	8.40	7.80	154.32
DAVIS DAM	1948-1961	3.54	5.13	7.60	9.30	11.33	13.33	13.14	12.15	9.51	7.24	5.38	3.88	101.53
DOUGLAS	1948-2005	0.00	0.00	0.00	11.34	13.19	13.55	10.66	10.27	8.18	6.44	0.00	0.00	73.63
FORT VALLEY	1909-2005	0.00	0.00	0.00	0.00	5.86	7.37	6.03	4.91	3.35	0.00	0.00	0.00	27.52
GRAND CANYON NATL PARK	1957-1977	0.00	0.00	0.00	0.00	6.94	10.45	8.79	8.12	6.83	4.91	0.00	0.00	46.04
GRAND CANYON N P 2	1976-2005	0.00	0.00	0.00	0.00	7.46	9.80	8.94	7.29	6.10	4.45	0.00	0.00	44.04
HAWLEY LAKE	1967-1988	0.00	0.00	0.00	0.00	7.57	8.55	6.89	5.48	4.68	0.00	0.00	0.00	33.17
MANY FARMS SCHOOL	1951-1975	0.00	3.66	5.45	9.18	12.23	15.14	12.87	10.88	9.40	6.54	3.26	2.16	90.77
MC NARY 2 N	1933-2005	0.00	0.00	0.00	0.00	7.86	8.25	6.60	5.98	4.90	3.97	0.00	0.00	37.56
MESA	1896-2005	3.03	4.02	6.11	8.64	11.33	12.67	13.10	11.87	9.69	6.81	4.15	2.96	94.38
NOGALES 6 N	1952-2005	3.59	4.46	7.01	9.35	11.91	13.31	10.00	8.28	8.06	7.17	4.49	3.57	91.20
PAGE	1957-2005	0.00	2.60	5.84	8.27	10.72	12.86	13.06	11.38	8.42	5.13	2.29	0.00	80.57
ROOSEVELT 1 WNW	1905-2005	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32	96.49
SACATON	1908-2005	3.83	5.15	7.51	10.06	13.56	14.89	13.69	12.05	10.20	7.91	4.94	3.63	107.42
SAFFORD AGRICULTRL CTR	1948-2005	2.63	3.83	7.14	10.54	13.81	15.38	13.13	10.68	8.73	5.90	3.28	2.52	97.57
SAN CARLOS RESERVOIR	1948-2005	2.25	3.27	5.66	8.40	11.70	13.94	13.43	11.40	9.23	6.31	3.53	2.18	91.30
SIERRA ANCHA	1913-1979	2.19	2.93	4.58	6.42	8.97	10.94	10.39	8.88	8.00	6.22	3.50	2.37	75.39
SNOWFLAKE 15 W	1965-1998	0.00	0.00	0.00	0.00	11.03	14.38	11.29	9.12	7.96	6.45	3.40	0.00	63.63
STEWART MOUNTAIN	1948-2005	3.52	4.56	6.94	10.04	13.11	14.27	14.44	13.10	10.69	7.95	4.53	3.08	106.23
TEMPE A S U	1953-2005	1.56	2.93	4.79	7.04	9.44	10.85	10.99	9.92	7.63	5.14	2.56	1.44	74.29
TUCSON UNIV OF ARIZONA	1894-2005	3.25	4.57	6.95	9.88	12.87	14.91	13.17	11.65	10.35	7.81	4.73	3.37	103.51
TUCSON U OF ARIZ # 1	1982-2005	3.94	4.68	7.53	10.57	14.14	16.51	14.61	12.17	10.71	8.05	4.93	3.23	111.07
WAHWEAP	1961-2005	1.95	2.77	6.30	9.42	12.82	14.94	15.26	13.31	10.06	7.06	3.69	2.60	100.18
WHITERIVER 1 SW	1900-2005	1.69	2.94	5.84	8.01	9.92	11.70	9.48	8.47	7.68	5.87	3.51	2.54	77.65
WINKELMAN 6 S	1942-1980	3.12	4.03	7.00	9.98	12.40	13.90	11.19	9.84	9.56	7.51	4.31	2.94	95.78
YUMA CITRUS STATION	1920-2005	3.58	4.36	6.81	9.17	11.75	13.19	13.85	12.28	9.51	6.91	4.43	3.37	99.21

CALIFORNIA

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ANTIOCH PUMP PLANT 3	1955-2005	1.17	1.99	4.25	6.27	8.96	10.84	11.60	10.06	7.77	4.91	2.07	1.22	71.11
AUBURN DAM PROJECT	1972-1984	1.42	1.89	3.13	4.89	7.73	10.08	11.66	10.70	8.08	5.00	1.97	1.36	67.91
AVENAL 9 SSE	1955-1961	1.80	2.90	6.20	9.39	12.96	16.73	18.67	16.37	12.61	8.05	3.89	2.44	112.01
BACKUS RANCH	1948-1963	2.85	3.86	6.77	9.80	12.69	15.93	16.92	15.95	12.19	8.01	4.25	2.98	112.20
BEAUMONT PUMPING PLANT	1948-1975	2.90	3.29	4.08	5.03	6.40	8.15	10.64	9.97	7.90	5.87	3.22	2.90	70.35
BEAUMONT 1 E	1948-2001	3.10	3.73	4.99	5.23	7.60	9.31	10.97	10.66	8.85	6.53	5.16	3.95	80.08
BERRYESSA LAKE	1957-1970	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	5.72	2.48	1.66	77.00
BOCA	1948-2005	0.00	0.00	0.00	0.00	6.83	8.52	10.01	9.09	6.48	4.32	0.00	0.00	45.25
BRANNAN ISLAND	1968-1977	1.15	1.74	4.36	7.03	10.49	12.39	13.51	12.02	9.03	4.80	1.83	1.08	79.43
CACHUMA LAKE	1952-2005	2.44	3.53	4.41	6.01	7.55	8.56	9.50	8.98	7.00	5.42	3.49	2.79	69.68
CAMP PARDEE	1948-2005	0.72	1.12	2.32	4.18	7.04	9.43	11.17	9.50	6.51	3.77	1.40	0.72	57.88
CHICO EXPERIMENT STN	1906-2005	1.26	2.13	3.82	5.63	8.28	10.11	11.48	9.71	7.36	4.46	2.09	1.30	67.63
CHULA VISTA	1948-2005	2.81	3.45	5.03	6.06	6.76	6.96	7.63	7.48	6.21	5.02	3.58	2.78	63.77
COW CREEK	1948-1961	3.21	5.62	9.78	13.98	17.25	21.37	21.89	20.17	15.36	10.71	4.91	3.85	148.10
DAVIS 1 WSW	1917-2005	1.49	2.34	4.54	7.13	10.19	12.17	12.77	11.28	9.08	6.35	2.89	1.45	81.68
DEATH VALLEY	1961-2005	3.93	5.38	9.10	13.00	16.76	19.11	20.98	18.86	13.95	9.78	5.54	3.75	140.14
DUTTONS LANDING	1955-1977	1.42	2.09	3.87	5.70	7.74	9.34	9.34	8.27	6.75	4.65	2.25	1.46	62.88
FALL RIVER MILLS INTAKE	1948-2005	0.00	0.00	2.47	5.80	7.54	9.48	12.14	10.57	7.59	3.78	1.14	0.00	60.51
FERNDALE 2 NW	1963-1973	0.70	1.17	2.26	3.21	3.95	4.38	4.49	4.07	3.59	2.06	1.04	0.72	31.64
FOLSOM DAM	1955-1993	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	4.89	2.06	1.25	66.18
FRIANT GOVERNMENT CAMP	1948-2005	1.46	2.12	3.82	5.89	9.42	12.07	13.96	12.47	9.00	5.76	2.61	1.37	79.95
GRIZZLY ISLAND REFUGE	1971-1977	1.45	2.25	4.00	5.72	8.07	9.82	10.69	8.93	6.88	4.33	2.10	1.55	65.79
HETCH HETCHY	1931-2005	0.00	0.00	0.00	3.84	5.31	7.34	8.78	7.86	5.85	3.23	1.74	0.00	43.95
INDIO FIRE STATION	1927-2005	2.85	4.38	7.15	9.98	12.73	14.85	14.95	13.59	10.80	7.60	3.98	2.49	105.35
KETTLEMAN CITY 1 SSW	1955-2005	1.73	2.99	5.80	8.32	11.75	14.27	16.11	14.74	10.82	7.30	3.46	1.74	99.03
KNIGHTS FERRY 2 ESE	1959-1977	1.00	1.69	3.14	5.65	8.54	10.14	11.60	10.31	7.74	4.62	2.69	1.00	68.12
LAKE PILLSBURY 2	1964-1970	0.58	1.42	3.01	4.62	7.41	8.38	10.31	9.35	6.93	3.61	1.19	0.87	57.68
LAKESHORE 2	1948-1972	1.09	1.68	2.97	4.78	6.15	7.43	9.71	8.79	6.44	3.40	1.41	0.95	54.80
LAKE SOLANO	1975-2005	1.48	2.37	4.28	6.66	9.24	11.24	11.53	9.86	7.58	5.26	2.59	1.67	73.76
LAKE SPAULDING	1914-2003	0.00	0.00	0.00	0.00	4.57	6.52	8.16	6.78	4.54	1.98	0.00	0.00	32.55
LAKE SPAULDING DAM	1955-1971	0.00	0.00	0.00	0.00	7.20	9.98	12.38	11.85	8.94	6.64	0.00	0.00	56.99
LITTLE PANOCHE DET DAM	1968-1975	1.77	2.89	5.87	9.39	14.56	16.31	18.45	16.63	12.46	7.60	3.04	1.78	110.75
LODI	1948-2005	1.19	1.95	3.82	6.01	8.60	9.92	10.63	9.11	6.68	4.08	1.86	1.07	64.92
LOS BANOS DET RESV	1968-2005	1.57	2.71	5.44	9.34	14.18	16.58	17.85	15.63	11.87	7.49	3.34	1.82	107.82
MANDEVILLE ISLAND	1955-1965	1.10	2.38	4.77	6.95	8.55	10.44	11.22	9.71	7.41	5.12	2.47	1.13	71.25
MANTECA	1965-1977	1.20	1.71	4.04	6.33	9.24	10.53	11.64	10.22	7.19	4.13	1.78	1.16	69.17
MARKLEY COVE	1970-2005	1.03	1.51	3.03	4.80	7.33	9.60	10.82	9.45	6.99	4.35	1.75	1.01	61.67
MOJAVE	1948-2005	0.00	4.65	6.45	9.97	13.59	15.33	17.21	16.00	11.83	8.28	4.76	3.52	111.59
MONTICELLO DAM	1957-1970	1.02	1.83	3.24	4.96	7.35	9.36	11.20	10.07	7.56	4.82	1.98	1.08	64.47
NACIMIENTO DAM	1957-1978	1.58	2.20	3.92	5.53	7.92	9.85	11.28	10.43	7.76	5.16	2.57	1.66	69.86
NEWARK	1948-2005	1.71	2.15	4.16	5.76	7.77	8.64	9.04	8.00	6.64	4.52	2.36	1.55	62.30
NEW MELONES DAM	1979-1992	1.34	2.25	3.56	5.93	9.16	11.85	13.73	12.29	8.86	5.75	2.37	1.28	78.37
NEW MELONES DAM HQ	1992-2005	1.30	1.83	3.46	5.25	7.94	10.23	12.23	11.72	8.71	5.52	2.23	1.19	71.61
OAKDALE WOODWARD DAM	1948-1967	1.03	1.72	3.42	5.47	8.95	11.88	14.23	12.22	8.53	5.52	2.10	1.02	76.09
PLACERVILLE IFG	1955-1991	1.53	1.67	2.72	3.98	5.84	7.79	9.41	8.45	6.62	3.93	1.87	1.51	55.32
RIVERSIDE CITRUS EXP ST	1948-2005	3.32	3.59	4.86	6.28	7.33	8.59	10.88	10.28	7.84	5.85	3.81	3.03	75.66
SALT SPRINGS PWR HOUSE	1948-1998	1.84	2.47	3.27	4.86	6.49	7.92	10.30	9.95	7.89	5.18	2.68	2.26	65.11
SAN LUIS DAM	1963-2005	1.41	2.49	5.31	8.67	13.14	15.75	18.38	16.68	12.01	7.42	3.02	1.56	105.84
SHASTA DAM	1948-2005	1.50	2.08	3.17	5.05	7.28	9.18	11.36	10.36	7.55	4.85	2.29	1.63	66.30
STOCKTON MOWRY BRIDGE	1955-1965	0.72	1.58	3.87	5.97	8.47	10.95	10.82	9.56	6.60	3.93	1.70	0.74	64.91
TAHOE	1914-2005	0.00	0.00	0.00	0.00	4.27	5.23	5.98	5.35	3.16	1.57	0.00	0.00	25.56
TRACY PUMPING PLANT	1955-2005	1.53	2.47	5.30	8.20	12.01	14.88	16.92	14.55	10.64	6.57	2.93	1.48	97.48
TRINITY DAM VISTA POINT	1959-1973	0.00	0.00	2.83	3.98	6.56	8.32	10.67	9.15	5.97	2.74	0.57	0.85	51.64
TRINITY RIVER HATCHERY	1974-2005	0.58	1.00	2.77	4.43	6.78	8.32	9.71	8.91	6.15	3.20	0.99	0.51	53.35
TULELAKE	1932-2005	0.00	0.00	0.00	4.56	7.55	8.39	9.52	8.53	6.80	3.49	0.00	0.00	48.84
TURNTABLE CREEK	1948-1969	1.98	2.60	3.76	5.25	6.32	8.29	10.23	9.90	8.35	5.71	3.08	2.37	67.84
TWITCHELL DAM	1962-2005	3.08	3.33	4.47	5.89	7.36	8.15	9.22	8.69	7.42	5.92	4.07	3.14	70.74
WALNUT GROVE	1953-1961	1.53	2.90	4.74	5.73	7.76	10.04	10.22	8.81	6.40	3.60	2.10	1.32	65.15
WARM SPRINGS DAM	1973-1998	1.17	1.83	3.23	5.37	7.83	9.33	10.04	8.49	6.58	4.59	2.10	1.17	61.73
WHISKEYTOWN RESERVOIR	1960-2005	0.87	1.23	2.51	4.05	6.41	8.05	10.04	8.80	6.25	3.40	1.14	0.78	53.53
WILLOW CREEK 1 NW	1968-2005	0.58	1.35	1.81	2.74	4.73	6.50	7.53	6.05	3.79	1.94	0.75	0.92	38.69

COLORADO

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AKRON 4 E	1918-2005	0.00	0.00	0.00	7.30	9.29	11.43	13.26	11.16	9.09	6.16	0.00	0.00	67.69
ALAMOSA WSO AP	1948-2005	0.00	0.00	0.00	7.06	9.01	10.08	9.16	7.81	6.40	4.39	0.00	0.00	53.91
ARBOLES	1957-1963	0.00	0.00	0.00	5.41	7.95	9.56	9.78	8.61	6.52	0.00	0.00	0.00	47.83
BONNY LAKE	1949-2005	0.00	0.00	0.00	7.26	8.69	10.86	11.78	10.61	8.12	6.12	4.57	0.00	68.01
CLIMAX	1949-2005	0.00	0.00	0.00	0.00	0.00	5.36	5.32	4.44	3.41	0.00	0.00	0.00	18.53
CONEJOS 3 NNW	1948-1960	0.00	0.00	0.00	6.30	7.14	7.67	7.41	6.87	7.19	5.74	0.00	0.00	48.32
ESTES PARK	1948-1994	0.00	0.00	0.00	5.78	5.26	7.09	7.13	6.15	5.04	4.04	0.00	0.00	40.49
FORT COLLINS	1900-2005	0.00	0.00	2.50	4.52	5.42	6.32	6.92	6.07	4.74	3.07	1.48	0.00	41.04
GRAND JUNCTION WALKER	1900-2005	0.00	0.00	4.67	8.53	12.18	15.96	16.53	14.02	10.98	7.05	2.42	0.00	92.34
GRAND JUNCTION 6 ESE	1962-2005	0.00	0.00	0.00	6.60	9.29	11.77	12.01	10.24	7.48	4.65	2.09	0.00	64.13
GRAND LAKE 6 SSW	1948-2005	0.00	0.00	0.00	0.00	4.82	7.75	7.81	6.79	5.24	3.10	0.00	0.00	35.51
GREEN MOUNTAIN DAM	1948-2005	0.00	0.00	0.00	0.00	4.96	6.56	6.93	5.90	4.65	2.90	0.00	0.00	31.90
JOHN MARTIN DAM	1941-2005	0.00	0.00	6.40	8.04	9.67	11.30	12.31	10.28	7.82	5.61	2.78	0.00	74.21
LAKE GEORGE 8 SW	1948-2005	0.00	0.00	0.00	0.00	5.15	8.26	7.39	6.02	5.72	0.00	0.00	0.00	32.54
MEREDITH	1963-2005	0.00	0.00	0.00	0.00	7.69	8.26	8.34	6.96	5.25	3.21	0.00	0.00	39.71
MONTROSE 1	1948-1982	1.68	1.49	3.34	5.69	7.49	9.47	9.04	7.39	5.54	3.45	1.61	1.26	57.45
PLATORO	1949-1991	0.00	0.00	0.00	0.00	5.86	8.10	6.57	5.24	5.52	3.33	0.00	0.00	34.62
PUEBLO WSO AP	1954-2005	0.00	0.00	0.00	8.71	9.50	11.51	12.14	10.41	8.17	6.14	0.00	0.00	66.58
PUEBLO CITY RESERVOIR	1948-1971	0.00	5.13	5.86	6.85	8.81	10.09	10.60	8.85	7.43	5.30	2.99	2.71	74.62
PUEBLO RESERVOIR	1975-2005	0.00	0.00	0.00	7.18	9.34	10.87	11.58	9.92	7.90	5.88	0.00	0.00	62.67
PUEBLO 6 SSW	1971-1985	0.00	0.00	4.82	7.47	8.57	10.65	11.30	9.40	7.13	5.53	0.00	0.00	64.87
SAN LUIS LAKES 3W	1948-1955	0.00	0.00	4.50	6.07	8.51	9.88	8.49	7.77	6.57	4.53	0.00	0.00	56.32
SPRINGFIELD 7 WSW	1956-2002	0.00	0.00	0.00	7.85	9.73	11.44	12.69	11.28	8.53	6.29	4.57	0.00	72.38
SUGARLOAF RESERVOIR	1948-2005	0.00	0.00	0.00	0.00	0.00	7.03	6.15	4.97	4.15	2.93	0.00	0.00	25.23
TRINIDAD LAKE	1989-2005	0.00	0.00	0.00	6.75	9.04	10.55	9.88	8.27	7.65	6.17	3.92	2.21	64.44
TWIN LAKES RESERVOIR	1949-2005	0.00	0.00	0.00	0.00	6.93	8.65	7.92	6.79	5.33	3.96	0.00	0.00	39.58
VALLECITO DAM	1948-2005	0.00	0.00	1.91	3.82	5.29	6.22	6.09	5.31	4.39	3.04	1.60	0.00	37.67
WAGON WHEEL GAP 3 N	1948-1972	0.00	0.00	0.00	0.00	6.69	7.90	7.15	5.81	5.30	2.61	0.00	0.00	35.46
WALSH 1 W	1951-2005	0.00	0.00	0.00	0.00	10.78	12.35	12.76	11.63	9.42	6.88	0.00	0.00	63.82
WIGGINS 7 SW	1960-1971	0.00	0.00	0.00	6.82	8.50	8.42	9.97	8.09	5.87	4.22	2.23	0.00	54.12

HAWAII

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
HILO WSO AP 87	1949-2005	5.06	4.87	5.15	5.40	5.66	6.49	6.44	6.13	5.40	5.37	4.06	4.46	64.49
HONOLULU OBSRVY 702.2	1962-2005	4.72	5.23	7.01	7.84	8.93	9.41	10.10	10.09	8.82	7.68	5.94	5.08	90.85
LIHUE WSO AP 1020.1	1950-2005	5.62	6.22	7.62	8.22	9.21	9.85	10.40	10.21	9.18	8.04	6.27	5.67	96.51
U S MAGNETIC OBSERVATOR	1949-1960	4.16	4.58	5.90	7.09	7.87	8.16	8.15	8.21	7.24	6.17	4.41	4.83	76.77

PACIFIC ISLANDS

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
GUAM NAS	1945-2005	6.98	0.00	0.00	7.96	7.20	6.58	6.22	5.53	4.68	4.70	0.00	0.00	49.85
GUAM WSMO	1957-1998	5.84	6.07	7.38	7.82	7.73	6.92	6.02	5.28	5.15	5.36	5.42	5.74	74.73
JOHNSTON ISLAND WSO AIR	1953-2004	8.69	8.76	10.29	10.25	10.79	11.42	11.50	10.82	9.81	9.53	8.19	8.75	118.80
MARCUS ISLAND WB	1953-1968	6.91	8.06	8.66	8.70	8.71	9.49	8.89	9.40	8.22	7.46	6.91	6.81	98.22
PAGO PAGO WSO AIRPORT	1966-2005	7.96	6.17	6.84	5.95	5.94	6.66	6.69	6.62	7.36	8.08	7.13	9.12	84.52
WAKE ISLAND WSO AP	1953-2004	0.00	0.00	0.00	7.57	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00	13.46
YAP ISLAND WSO AIRPORT	1953-2005	6.31	6.20	7.37	7.40	6.97	5.51	5.61	5.68	5.61	5.85	5.50	5.93	73.94

IDAHO

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ABERDEEN EXPERIMNT STN	1914-2005	0.00	0.00	0.00	0.00	7.46	8.95	10.28	9.40	6.41	3.85	0.00	0.00	46.35
ARROWROCK DAM	1916-2005	0.00	0.00	0.00	0.00	5.94	7.53	10.18	8.93	5.75	2.35	0.00	0.00	40.68
BLACKFOOT DAM	1948-1971	0.00	0.00	0.00	0.00	0.00	7.56	9.19	7.42	3.97	0.00	0.00	0.00	28.14
EMMETT 2 E	1948-2005	0.00	0.00	0.00	5.62	7.09	8.82	10.58	9.44	6.56	4.57	0.00	0.00	52.68
ISLAND PARK	1937-2005	0.00	0.00	0.00	0.00	0.00	4.90	6.58	5.69	0.00	0.00	0.00	0.00	17.17

LIFTON PUMPING STN	1935-2005	0.00	0.00	0.00	4.08	5.97	7.41	8.70	7.80	5.35	3.02	0.00	0.00	42.33
MACKAY 4 NW	1965-1988	0.00	0.00	0.00	0.00	6.81	8.39	10.23	8.73	6.39	0.00	0.00	0.00	40.55
MINIDOKA DAM	1947-2005	0.00	0.00	0.00	6.79	8.17	10.76	13.01	11.48	8.26	4.63	2.94	0.00	66.04
MOSCOW UNIV OF IDAHO	1893-2005	0.00	0.00	3.03	3.85	5.66	6.53	8.62	8.23	5.29	3.03	2.85	0.00	47.09
PALISADES	1947-1993	0.00	0.00	0.00	4.01	5.56	7.04	9.38	8.32	5.48	3.58	0.00	0.00	43.37
PARMA EXPERIMENT STN	1922-2005	0.00	0.00	0.00	6.00	8.26	9.05	10.41	9.47	6.30	0.00	0.00	0.00	49.49
REXBURG RICKS COLLEGE	1977-2005	0.00	0.00	0.00	0.00	6.59	7.29	8.06	7.36	5.23	0.00	0.00	0.00	34.53
SANDPOINT EXPERMNT STN	1910-2005	0.00	0.00	0.00	0.00	4.96	5.51	7.47	6.78	4.47	0.00	0.00	0.00	29.19
TWIN FALLS WSO	1963-2005	0.00	0.00	0.00	5.80	8.09	9.15	10.24	9.09	6.65	4.25	0.77	0.00	54.04

MONTANA

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
BABB 6 NE	1948-2005	0.00	0.00	0.00	0.00	5.23	5.91	6.87	5.90	4.06	0.00	0.00	0.00	27.97
BOZEMAN MONTANA ST UNIV	1892-2005	0.00	0.00	0.00	3.34	5.58	6.03	8.34	7.17	4.57	2.62	0.00	0.00	37.65
BOZEMAN 6 W EXP FARM	1966-2005	0.00	0.00	0.00	4.24	5.68	6.62	8.19	7.73	4.88	2.99	0.00	0.00	40.33
CANYON FERRY DAM	1948-1957	0.00	0.00	0.00	0.00	7.98	7.13	8.17	7.41	5.50	3.11	0.00	0.00	39.30
CANYON FERRY DAM	1907-1996	0.00	0.00	0.00	3.15	5.04	6.21	7.91	7.04	4.18	1.93	0.00	0.00	35.46
DILLON WMCE	1895-2005	0.00	0.00	0.00	3.05	4.72	5.32	6.41	5.45	3.48	2.84	0.00	0.00	31.27
FORT ASSINNIBOINE	1917-2005	0.00	0.00	0.00	4.54	6.43	7.30	8.86	8.12	5.00	0.00	0.00	0.00	40.25
FORT PECK	1948-1956	0.00	0.00	0.00	0.00	5.99	8.17	9.51	8.04	5.36	4.25	0.00	0.00	41.32
FORT PECK POWER PLANT	1956-2005	0.00	0.00	0.00	0.00	7.34	8.45	10.42	9.81	5.83	3.53	0.00	0.00	45.38
HUNGRY HORSE DAM	1948-2005	0.00	0.00	0.00	0.00	4.83	5.62	7.81	6.63	3.46	1.37	0.00	0.00	29.72
HUNTLEY EXPERIMENT STN	1911-2005	0.00	0.00	0.00	5.03	6.71	7.40	8.88	8.15	5.10	0.00	0.00	0.00	41.27
LONESOME LAKE	1948-1981	0.00	0.00	0.00	0.00	7.42	7.60	9.25	8.31	5.70	0.00	0.00	0.00	38.28
MALTA 7 E	1972-2005	0.00	0.00	0.00	4.67	6.50	6.51	7.61	6.84	4.17	1.34	0.00	0.00	37.64
MEDICINE LAKE 3 SE	1911-2005	0.00	0.00	0.00	0.00	7.44	7.69	9.62	9.19	5.36	0.00	0.00	0.00	39.30
MOCCASIN EXPERIMENT STN	1909-2005	0.00	0.00	0.00	4.35	6.59	7.72	9.66	9.21	6.39	0.00	0.00	0.00	43.92
SIDNEY	1910-2005	0.00	0.00	0.00	3.99	5.63	6.44	6.93	5.45	2.89	1.81	0.00	0.00	33.14
TIBER DAM	1952-2005	0.00	0.00	0.00	0.00	4.51	6.46	7.65	5.56	4.34	0.00	0.00	0.00	28.52
VALIER	1911-2005	0.00	0.00	0.00	0.00	5.37	6.49	7.33	5.62	4.72	0.00	0.00	0.00	29.53
WESTERN AG RESEARCH CNT	1965-2005	0.00	0.00	0.00	0.00	5.08	6.03	7.26	6.07	4.14	2.25	0.00	0.00	30.83
YELLOWTAIL DAM	1948-2005	0.00	0.00	0.00	0.00	6.94	8.84	10.60	9.74	6.58	4.86	0.00	0.00	47.56

NEVADA

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
BEOWAWE U OF N RANCH	1972-2005	0.00	0.00	0.00	3.98	7.17	8.68	10.42	9.52	6.97	4.43	0.00	0.00	51.17
BOULDER CITY	1931-2004	3.71	4.68	7.56	10.67	13.79	16.57	16.45	14.41	11.51	8.11	4.87	3.69	116.02
CALIENTE	1928-2005	0.00	0.00	3.97	6.82	8.57	10.58	11.13	9.41	6.89	4.35	1.91	0.00	63.63
CENTRAL NEVADA FIELD LA	1965-1986	0.00	0.00	2.98	5.95	8.69	10.49	12.24	11.31	8.08	4.88	1.73	0.00	66.35
FALLON EXPERIMENT STN	1950-1992	1.34	2.23	4.39	6.15	7.70	8.91	9.87	8.63	6.10	3.90	1.91	1.37	62.50
LAHONTAN	1948-2005	0.00	0.00	0.00	7.18	9.64	11.58	13.75	12.23	7.83	4.51	2.09	0.00	68.81
LOGANDALE	1968-1992	2.55	3.61	5.26	8.96	12.44	14.20	14.38	12.07	8.67	7.66	3.86	2.89	96.55
RUBY LAKE	1948-2005	0.00	0.00	0.00	5.10	7.09	8.90	10.54	9.37	6.51	3.95	0.00	0.00	51.46
RYE PATCH DAM	1948-2005	0.00	0.00	3.71	5.83	7.38	9.23	11.15	10.06	6.95	4.30	0.77	0.00	59.38
SILVERPEAK	1967-2005	0.00	3.84	7.26	10.13	13.60	16.31	17.98	15.92	11.32	6.88	2.94	0.00	106.18
TOPAZ LAKE	1957-2005	0.00	0.00	0.00	7.15	9.11	10.94	12.68	11.56	8.80	5.95	2.79	0.00	68.98

NEW MEXICO

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ABIQUIU DAM	1957-2005	0.00	0.00	6.06	7.43	9.95	11.39	10.52	8.90	7.23	5.30	3.13	2.22	72.13
AGRICULTURAL COLLEGE	1892-1959	3.01	4.00	7.89	10.20	8.65	13.99	12.33	11.16	8.31	6.28	4.35	2.89	93.06
ALAMOGORDO DAM	1939-1975	3.73	4.35	8.21	11.30	12.88	14.43	13.66	11.59	9.17	7.19	4.89	3.46	104.86
ANIMAS	1923-2005	3.87	4.91	8.29	10.78	12.36	14.25	11.60	11.07	8.54	6.71	4.69	3.61	100.68
ARTESIA 6 S	1914-2005	4.38	3.03	7.25	7.66	12.11	13.13	10.86	10.44	9.36	6.34	3.12	0.00	87.68
BITTER LAKES WL REFUGE	1950-2005	2.67	3.93	6.82	9.60	11.31	12.62	11.88	10.16	8.02	5.85	3.53	2.50	88.89
BOSQUE DEL APACHE	1914-2005	3.21	4.20	7.76	10.20	11.61	13.13	11.56	10.36	8.03	6.25	3.66	2.54	92.51
BRANTLEY DAM	1987-2005	4.65	0.00	8.62	11.77	14.61	15.46	14.19	12.22	9.88	7.97	5.77	4.34	109.48
CABALLO DAM	1938-2005	4.42	5.10	8.56	11.37	13.59	14.80	13.08	11.35	9.26	7.27	4.78	3.48	107.06
CAPULIN NATL MONUMENT	1966-1979	0.00	0.00	0.00	0.00	9.08	10.57	9.71	9.18	7.65	0.00	0.00	0.00	46.19

CLOVIS 13 N	1929-2005	3.83	4.12	6.63	8.72	10.15	11.45	11.65	9.55	7.64	5.78	3.95	3.21	86.68
COCHITI DAM	1975-2005	0.00	4.14	6.44	8.48	11.07	12.95	12.38	10.62	8.91	6.29	3.94	2.79	88.01
CONCHAS DAM	1938-2005	0.00	0.00	7.35	8.88	10.29	11.69	11.37	10.06	8.24	6.18	4.04	2.79	80.89
EAGLE NEST	1937-2005	0.00	0.00	0.00	4.91	7.67	7.83	7.07	5.87	5.30	4.31	0.00	0.00	42.96
EL VADO DAM	1923-2005	0.00	0.00	3.61	5.43	7.46	8.84	8.52	6.91	5.66	3.84	1.72	0.00	51.99
ELEPHANT BUTTE DAM	1917-2005	3.47	4.87	8.61	12.22	14.94	16.37	14.15	12.05	9.78	7.70	4.91	3.34	112.41
ESTANCIA	1914-2005	0.00	0.00	3.26	6.79	8.56	9.27	8.61	7.10	5.60	3.82	2.62	0.00	55.63
FARMINGTON AG SCIENCE C	1978-2005	0.00	0.00	0.00	7.97	10.06	12.00	12.52	10.70	8.15	5.41	0.00	0.00	66.81
FLORIDA	1939-1992	3.54	4.81	8.10	10.94	13.03	14.80	11.84	10.10	8.51	6.58	4.57	3.11	99.93
GALLUP RANGER STN	1966-1975	0.00	0.00	0.00	6.61	9.31	12.12	10.50	8.70	7.95	5.07	2.20	0.00	62.46
JEMEZ DAM	1953-2005	0.00	0.00	0.00	9.91	12.27	13.95	14.29	11.45	9.80	6.72	3.65	0.00	82.04
JORNADA EXP RANGE	1925-2005	2.50	4.18	7.24	10.06	11.94	12.85	10.88	9.53	7.82	5.71	3.61	2.50	88.82
LAGUNA	1914-2005	0.00	0.00	0.00	8.47	9.33	11.98	10.76	8.88	6.83	5.00	1.98	0.00	63.23
LAKE AVALON	1914-1979	4.49	5.33	9.42	12.36	14.31	15.16	14.14	12.33	9.25	7.26	4.68	4.20	112.93
LAKE MC MILLAN	1941-1949	0.00	0.00	0.00	13.78	8.14	14.26	13.38	13.45	10.35	6.15	0.00	0.00	79.51
LOS LUNAS 3 SSW	1923-2005	1.87	2.81	5.27	7.77	9.74	10.49	10.06	8.67	6.58	4.64	2.75	2.45	73.10
NARROWS	1948-1964	3.09	5.67	7.62	11.07	13.37	15.44	13.07	11.42	9.97	7.20	4.32	2.64	104.88
NAVAJO DAM	1963-2005	0.00	0.00	0.00	6.58	9.10	11.07	11.24	9.66	7.22	4.74	0.00	0.00	59.61
PORTALES 7 WNW	1934-1960	3.26	4.57	8.24	8.85	10.72	12.16	10.44	9.28	7.95	5.98	4.15	3.53	89.13
HOOD RANGER STN	1954-2005	0.00	0.00	0.00	7.84	9.02	10.81	8.25	6.87	6.12	5.14	2.65	0.00	56.70
ROSWELL WSO AIRPORT	1893-1972	0.00	0.00	0.00	11.29	0.00	15.87	12.11	12.63	7.92	6.97	4.66	4.51	75.96
SANTA FE	1867-1972	0.00	0.00	3.00	7.28	8.73	10.93	9.95	8.26	7.15	5.10	2.50	0.00	62.90
SANTA FE 2	1972-2005	0.00	0.00	0.00	7.10	9.76	11.31	10.36	9.20	7.41	5.08	0.00	0.00	60.22
SHIPROCK	1926-2005	0.00	0.00	0.00	7.84	10.57	14.44	13.17	10.80	9.80	6.54	0.00	0.00	73.16
SOCORRO	1914-2005	0.00	0.00	4.83	7.09	9.17	9.35	8.56	7.57	5.73	4.14	0.00	0.00	56.44
STATE UNIVERSITY	1959-2005	3.00	4.33	7.40	9.90	12.03	12.91	12.05	10.34	8.14	6.17	3.85	2.79	92.91
SUMNER LAKE	1921-2005	0.00	0.00	7.33	10.22	12.35	13.54	13.36	11.16	9.02	6.97	4.92	3.17	92.04
TUCUMCARI 4 NE	1904-2005	0.00	0.00	0.00	9.83	11.53	13.11	13.00	11.13	8.96	6.74	0.00	0.00	74.30
UTE DAM	1965-2005	4.38	4.91	7.53	8.78	10.75	10.49	10.92	9.42	7.56	6.68	4.98	3.04	89.44

OREGON

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ASTOR EXPERIMENT STN	1948-1973	0.56	0.96	1.47	2.21	3.75	3.95	4.65	4.10	2.95	1.65	0.87	0.70	27.82
BEND 7 NE	1991-2005	0.00	0.00	0.00	4.25	6.14	6.69	8.66	7.91	5.42	0.00	0.00	0.00	39.07
CORVALLIS STATE UNIV	1889-2005	0.00	0.00	1.79	2.96	4.59	5.86	7.70	7.07	5.06	2.33	0.96	0.00	38.32
COTTAGE GROVE DAM	1943-2005	0.00	1.27	2.16	3.07	4.56	5.60	7.75	6.70	4.47	2.06	0.82	0.00	38.46
DETROIT DAM	1954-2005	0.19	1.16	1.69	2.51	4.38	5.90	7.68	6.64	4.24	2.05	0.88	0.46	37.78
DORENA DAM	1948-2005	0.00	1.01	1.94	2.95	4.98	6.11	8.19	7.15	4.66	2.01	0.00	0.00	39.00
FERN RIDGE DAM	1943-2005	0.39	0.79	1.92	3.17	5.03	6.21	8.12	7.09	4.76	2.21	0.67	0.34	40.70
HERMISTON 2 S	1928-1997	0.00	0.00	3.44	5.43	7.91	9.67	11.32	9.66	6.32	3.97	0.00	0.00	57.72
HOOD RIVER EXP STN	1928-2005	0.00	0.00	0.00	0.00	6.45	6.80	8.81	7.04	3.32	3.09	0.00	0.00	35.51
KLAMATH FALLS AGR STN	1949-2004	0.70	1.31	2.81	4.73	7.21	8.79	10.24	9.41	6.30	4.37	0.00	0.67	56.54
LOOKOUT POINT DAM	1955-2005	0.00	1.76	2.29	3.10	4.67	5.77	7.69	6.89	4.45	1.96	1.01	0.00	39.59
MADRAS 1 NNW	1952-2005	0.00	0.00	0.00	4.72	7.12	8.66	10.23	9.17	6.21	3.16	1.70	0.00	50.97
MALHEUR BRANCH EXP STN	1943-2005	0.00	0.00	0.00	5.68	7.71	8.94	11.06	9.57	6.17	3.14	0.72	0.00	52.99
VOLTAGE 2 NW	1959-2005	0.00	0.00	0.00	4.37	6.22	7.67	9.58	8.52	5.86	3.19	0.00	0.00	45.41
MEDFORD EXP STN	1937-2003	0.53	1.02	2.26	3.56	5.29	6.54	8.24	6.78	4.05	1.81	0.76	0.44	41.28
MORO	1928-2005	0.00	0.00	2.96	5.11	7.74	9.60	12.34	11.18	7.15	3.56	0.00	0.00	59.64
N WILLAMETTE EXP STN	1963-2005	0.63	1.18	2.29	3.31	5.15	6.01	7.40	6.78	4.68	2.39	1.05	0.57	41.44
ODELL LAKE LAND PAN	1948-1980	0.00	0.00	0.00	0.00	3.17	4.13	5.54	3.81	1.90	0.67	0.00	0.00	19.22
ODELL LAKE WATER PAN	1945-1959	0.00	0.00	0.00	0.00	1.87	2.71	3.97	4.01	3.44	2.02	0.00	0.00	18.02
PELTON DAM	1958-2005	0.00	0.00	0.00	4.48	6.77	8.26	9.98	8.12	5.22	2.49	0.00	0.00	45.32
PENDLETON BR EXP STN	1956-2005	0.00	0.00	3.41	5.09	6.93	8.81	11.78	10.85	7.02	3.80	0.00	0.00	57.69
SUMMER LAKE 1 S	1957-2005	0.00	0.00	0.00	5.19	7.28	8.71	10.88	9.79	6.48	3.48	1.90	0.00	53.71
UNION EXP STN	1928-2005	0.00	0.00	0.00	3.16	4.80	6.03	7.49	6.80	4.32	2.74	0.00	0.00	35.34
WARM SPRINGS RESERVOIR	1931-1974	0.00	0.00	0.00	4.85	7.21	8.66	11.73	10.19	6.77	3.49	0.00	0.00	52.90
WICKIUP DAM	1941-2005	0.00	0.00	0.00	2.99	5.14	6.46	7.99	6.84	4.68	2.46	0.00	0.00	36.56
WINCHESTER	1950-2005	0.00	0.00	0.00	2.25	3.79	5.51	6.93	6.38	4.51	1.33	0.00	0.00	30.70
WINCHESTER 3 W F STN	1981-1989	0.91	0.96	2.06	3.62	5.04	6.62	8.48	8.19	4.94	2.46	1.17	0.87	45.32

UTAH

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ARCHES NATL PARK HQ	1980-2005	0.00	0.00	0.00	7.44	9.81	12.33	12.94	11.15	8.16	4.73	0.00	0.00	66.56
BEAR RIVER BAY	1969-1996	0.00	0.00	0.00	6.27	10.17	12.59	13.86	12.29	7.83	4.89	0.00	0.00	67.90
BEAR RIVER REFUGE	1948-1984	0.00	0.00	0.00	4.80	7.21	8.66	10.46	9.30	6.13	3.27	1.27	0.00	51.10

BRYCE CANYON NAT'L PRK	1971-1978	0.00	0.00	0.00	0.00	6.86	7.86	8.07	7.21	5.30	0.00	0.00	0.00	35.30
FARMINGTON USU FLD STN	1948-2005	0.00	0.00	0.00	0.00	7.33	6.35	9.25	8.62	4.63	2.97	0.00	0.00	39.15
FERRON	1948-2005	0.00	0.00	0.00	5.20	5.66	8.06	6.58	6.39	5.49	3.53	0.00	0.00	40.91
FISH SPRINGS REFUGE	1960-2005	0.00	0.00	0.00	7.02	10.70	12.90	15.92	13.58	9.92	5.84	0.00	0.00	75.88
FLAMING GORGE	1957-2005	0.00	0.00	0.00	0.00	6.23	8.74	9.71	8.62	5.76	3.94	0.00	0.00	43.00
FORT DUCHESNE	1894-2005	0.00	0.00	0.00	5.16	7.41	8.61	9.06	7.98	5.57	3.25	0.00	0.00	47.04
GREEN RIVER AVIATION	1893-2005	0.00	0.00	0.00	6.07	8.07	9.29	9.49	7.97	5.74	3.52	1.60	0.00	51.75
GUNNISON	1956-1990	0.00	0.00	0.00	5.10	7.23	8.70	9.65	8.26	6.03	3.81	0.00	0.00	48.78
HITE	1949-1962	0.00	0.00	0.00	7.84	11.74	14.14	14.01	12.44	8.34	4.86	1.94	0.00	75.31
LOGAN USU EXP STN	1950-1978	0.00	0.00	0.00	4.01	5.98	7.05	8.37	7.50	5.02	2.92	0.00	0.00	40.85
LOGAN 5 SW EXP FARM	1969-2005	0.00	0.00	3.30	4.57	6.57	8.48	10.05	8.93	5.88	3.51	0.00	0.00	51.29
MANILA	1952-2005	0.00	0.00	0.00	0.00	7.31	8.66	9.83	8.37	6.50	4.63	0.00	0.00	45.30
MEXICAN HAT	1948-2005	0.00	0.00	6.31	8.45	11.99	14.42	14.87	12.48	9.37	5.52	2.25	0.00	85.66
MILFORD	1906-2005	0.00	0.00	0.00	7.47	10.22	13.54	15.47	13.24	9.88	6.16	2.32	0.00	78.30
MOAB	1889-2005	0.00	0.00	4.19	7.29	10.41	12.03	12.72	10.75	7.66	4.25	2.26	0.00	71.56
MORGAN	1948-2005	0.00	0.00	0.00	4.94	6.96	7.30	9.07	8.01	6.15	3.74	0.00	0.00	46.17
PIUTE DAM	1948-1971	0.00	0.00	0.00	0.00	7.91	9.98	10.13	8.40	6.98	4.60	0.00	0.00	48.00
PROVO AIRPORT	1948-1953	0.00	0.00	2.91	6.03	6.83	8.62	8.88	8.36	6.09	3.41	0.00	0.00	51.13
PROVO BYU	1980-2005	0.00	0.00	2.59	4.71	6.81	8.77	9.85	8.70	5.59	2.92	0.00	0.00	49.94
PROVO RADIO KAYK	1952-1977	0.00	0.00	0.00	4.38	5.94	7.53	8.32	7.58	5.40	3.21	1.53	0.00	43.89
ST GEORGE	1862-2005	0.00	0.00	4.57	7.36	10.08	12.22	13.17	11.55	8.22	4.83	2.68	0.00	74.68
SALTAIR SALT PLANT	1956-1991	0.00	0.00	3.66	6.20	9.19	11.88	14.40	12.67	8.58	4.86	2.32	0.00	73.76
SCOFIELD DAM	1948-1991	0.00	0.00	0.00	0.00	5.52	7.84	8.29	6.94	5.13	3.90	0.00	0.00	37.62
SEVIER DRY LAKE	1987-1993	0.00	0.00	2.93	6.33	13.52	16.06	18.32	0.00	0.00	0.00	0.00	0.00	57.16
STRAWBERRY RESERVOIR EA	1956-1977	0.00	0.00	0.00	0.00	5.82	7.28	7.87	7.31	5.08	3.02	0.00	0.00	36.38
UTAH LAKE LEHI	1928-2003	0.00	0.00	2.77	5.19	7.11	8.80	9.61	8.58	6.10	3.81	1.42	0.00	53.39
VERNAL ARPT	1928-2005	0.00	0.00	0.00	5.07	6.41	7.48	6.64	6.34	4.89	2.92	0.00	0.00	39.75
WANSHIP DAM	1955-2005	0.00	0.00	0.00	0.00	6.09	6.79	7.41	6.59	4.79	3.19	0.00	0.00	34.86

WASHINGTON

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
BELLINGHAM 2 N	1948-1985	0.00	0.00	0.00	2.75	4.59	5.35	6.28	5.56	3.34	1.22	0.00	0.00	29.09
BELLINGHAM 3 SSW	1985-2005	0.00	0.00	0.00	0.00	3.77	4.69	5.31	4.50	2.65	1.39	0.00	0.00	22.31
BUMPING LAKE	1931-1967	0.00	0.00	0.00	0.00	4.01	4.13	5.58	4.63	3.19	2.34	0.00	0.00	23.88
CONNELL 1 W	1960-2003	0.00	0.00	0.00	5.43	8.35	9.89	11.90	10.77	6.88	3.00	0.00	0.00	56.22
ELTOPIA 6 W	1954-1973	0.00	0.00	3.23	5.46	6.61	7.73	9.36	7.56	4.93	2.45	0.83	0.00	48.16
ELTOPIA 8 WSW	1974-2005	0.00	0.00	0.00	4.44	6.10	7.05	8.07	7.04	4.44	2.06	0.62	0.00	39.82
LAKE KACHESS	1931-1977	0.00	0.00	0.00	2.37	3.78	4.82	6.12	5.12	3.20	0.00	0.00	0.00	25.41
LIND 3 NE EXP STN	1931-2005	0.00	0.00	0.00	5.35	8.02	9.40	12.02	10.44	6.87	2.59	0.00	0.00	54.69
MOSES LAKE 3 E	1943-1979	0.00	0.00	0.00	5.51	7.50	8.78	10.29	8.10	5.53	2.79	0.00	0.00	48.50
OROVILLE 1 S	1960-1970	0.00	0.00	0.00	4.49	5.82	6.36	7.42	6.22	4.28	1.99	0.00	0.00	36.58
OTHELLO 6 ESE	1941-2002	0.00	0.00	0.00	5.40	7.60	9.00	10.77	9.14	6.12	2.92	0.00	0.00	50.95
PROSSER 4 NE	1931-2005	0.00	0.00	2.49	4.86	6.57	7.50	8.61	7.09	4.73	2.48	0.80	0.69	45.82
PUYALLUP 2 W EXP STN	1931-1995	0.00	0.71	1.58	2.46	3.97	4.63	5.61	4.97	2.92	1.28	0.61	0.00	28.74
QUINCY 1 S	1941-2005	0.00	0.00	0.00	5.76	8.05	9.00	10.20	8.52	5.52	2.60	0.00	0.00	49.65
RIMROCK TIETON DAM	1947-1977	0.00	0.00	0.00	0.00	5.35	7.08	15.41	6.71	3.70	1.63	0.00	0.00	39.88
SEATTLE MAPLE LEAF R	1941-1960	0.61	0.82	1.80	3.26	4.64	5.12	6.70	5.19	3.49	1.62	0.74	0.53	34.52
SPOKANE WSO AIRPORT	1889-2005	0.00	0.00	0.00	4.66	7.27	8.57	11.28	10.22	6.41	0.00	0.00	0.00	48.41
WALLA WALLA 3 W ENT LA	1931-1962	0.00	0.00	0.00	4.79	6.26	7.61	9.72	7.95	4.78	2.58	0.00	0.00	43.69
WENATCHEE EXP STN	1950-1997	0.00	0.00	0.00	4.74	6.87	7.87	9.38	7.83	4.19	0.00	0.00	0.00	40.88
WHITMAN MISSION	1962-2005	0.00	0.00	0.00	4.58	6.58	8.17	10.34	9.08	5.52	2.84	0.00	0.00	47.11
WIND RIVER	1901-1977	0.00	0.00	0.00	2.91	4.19	4.64	6.15	4.97	3.31	1.62	0.00	0.00	27.79
YAKIMA WSO AP	1946-2005	0.00	0.00	0.00	5.27	7.62	8.71	10.42	9.29	5.90	0.00	0.00	0.00	47.21

WYOMING

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ANCHOR DAM	1961-1979	0.00	0.00	0.00	0.00	6.46	7.57	9.66	8.31	5.95	5.33	0.00	0.00	43.28
ARCHER	1948-2005	0.00	0.00	0.00	3.66	5.71	7.08	8.30	7.94	5.94	4.45	0.00	0.00	43.08
BOYSEN DAM	1948-2005	0.00	0.00	0.00	5.44	6.72	8.24	9.86	9.08	5.92	3.20	0.00	0.00	48.46
FARSON	1915-2005	0.00	0.00	0.00	0.00	7.45	9.37	10.67	8.94	6.53	3.80	0.00	0.00	46.76
GILLETTE 9 ESE	1925-2005	0.00	0.00	0.00	4.52	6.40	7.50	9.88	9.44	6.18	4.36	2.39	0.00	50.67
GREEN RIVER	1915-2005	0.00	0.00	0.00	0.00	8.22	9.71	11.08	9.80	6.82	4.62	0.00	0.00	50.25
HEART MOUNTAIN	1949-2005	0.00	0.00	0.00	3.50	5.82	6.37	7.35	6.67	4.37	3.43	0.00	0.00	37.51
KEYHOLE DAM	1949-1958	0.00	0.00	0.00	4.99	6.06	7.25	9.56	9.01	6.04	3.68	0.00	0.00	46.59
LARAMIE 2 NW	1966-2005	0.00	0.00	0.00	0.00	8.21	10.26	10.71	9.58	7.48	4.76	0.00	0.00	51.00

LOOKOUT 14 NE	1948-1965	0.00	0.00	0.00	0.00	7.50	11.32	10.89	10.40	7.76	7.30	0.00	0.00	55.17
MORTON 1 NW	1949-1968	0.00	0.00	0.00	3.91	5.59	6.73	8.27	7.31	4.96	3.35	0.00	0.00	40.12
PATHFINDER DAM	1948-1991	0.00	0.00	3.20	5.07	6.78	8.78	10.53	9.75	7.17	4.95	2.81	0.00	59.04
SEMINOE DAM	1948-2005	0.00	0.00	0.00	0.00	5.24	8.27	8.99	8.12	5.59	0.00	0.00	0.00	36.21
SHERIDAN FIELD STN	1920-2005	0.00	0.00	0.00	3.55	6.29	7.88	10.21	9.73	6.48	0.00	0.00	0.00	44.14
WHALEN DAM	1949-1991	0.00	0.00	3.32	5.17	7.44	9.00	10.39	9.09	6.24	4.18	0.00	0.00	54.83

APPENDIX G - EMCON Surface Drainage Assessment

COMPUTATION COVER SHEET

PROJECT TITLE: Upper Valley Disposal Service - Compost Facility PROJECT NO. 331-01.11

DESCRIPTION: Drainage calculations for 1-in-25 year storm event

TITLE OF COMPUTATIONS

COMPUTATIONS BY: Signature [signature] 9-24-92 DATE
Printed Name and Title: Timothy J. Daleiden, Staff Engineer

ASSUMPTIONS AND PROCEDURES CHECKED BY: (Peer Reviewer) Signature [signature] 9-25-92 DATE
Printed Name and Title: GEORGE E. CURLEY, PROJECT MANAGER

COMPUTATIONS CHECKED BY: Signature [signature] 9/25/92 DATE
Printed Name and Title: RANDALL WALL, STAFF ENG.

COMPUTATIONS BACKCHECKED BY: (Originator) Signature [signature] 9/25/92 DATE
Printed Name and Title: Timothy J. Daleiden, STAFF ENGINEER

APPROVED BY: (PM or Designate) Signature [signature] 9/28/92 DATE
Printed Name and Title: ENGINEER

APPROVAL NOTES:

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL

EMCON Associates

1/12/87

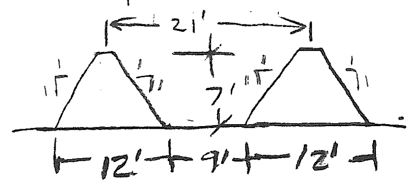
COMPUTATION SHEET

Project Title: Upper Valley Disposal Service - Compost **Project No.** 331-01.11
Description: Drainage Calculations **Sheet** ____ **of** ____
Originated By: T. Daleiden **Date:** 9-21-92 **Checked By:** ____ **Date:** ____

Problem: Estimate normal depth of flow of runoff between windrows when the compost windrows are covered.

Given:

1) "n" for plastic lined area equals 0.016
2) area between windrows approximates a trapezoidal ditch w/ 1:1 side slopes and a 9' base.
3) Rational Equation is valid
4) size for 1-in-25 year storm intensity
5) windrows are as shown and area ~ 800' long



6) "C" for covered windrows is 1.0
7) uniform slope of 1%

Solution:

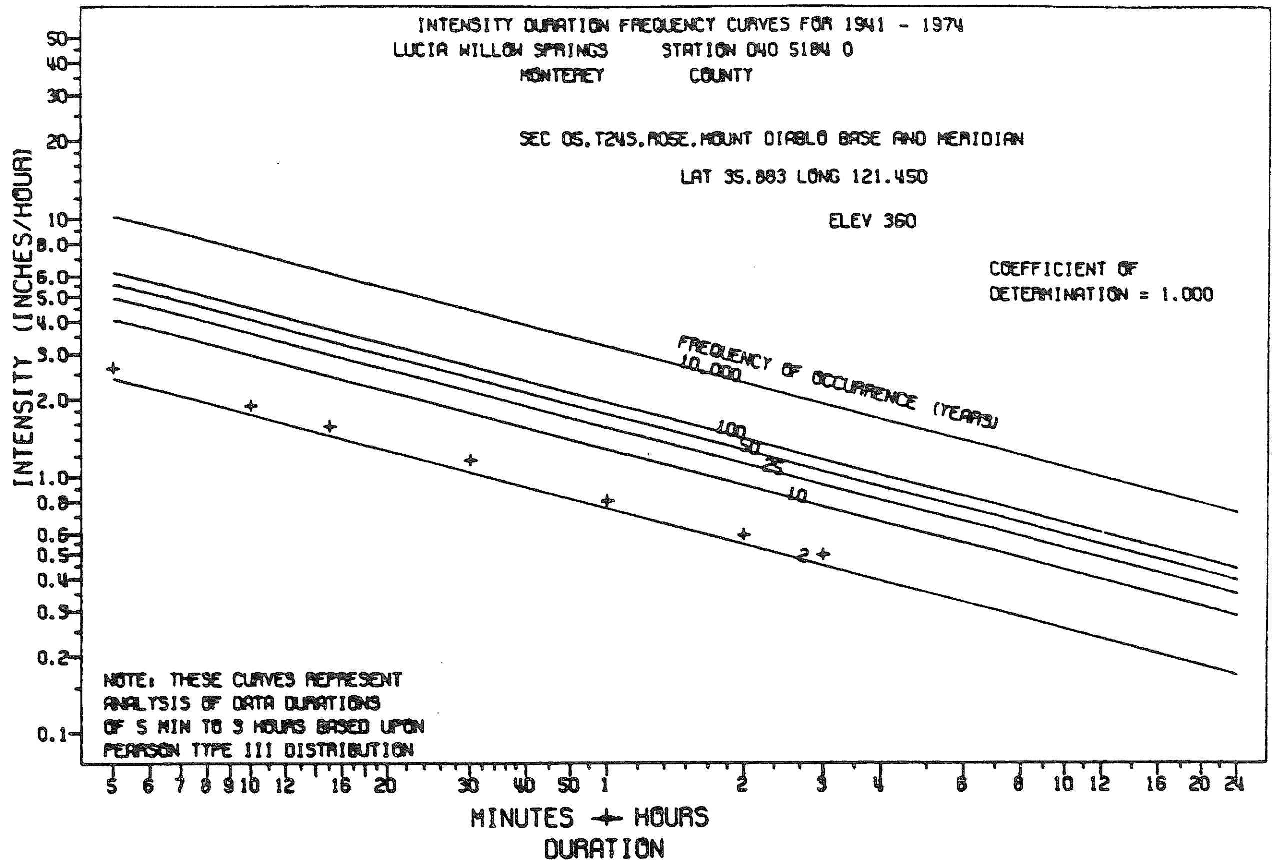
t_c is primarily comprised of ditch flow time
assume a velocity of 2 fps.

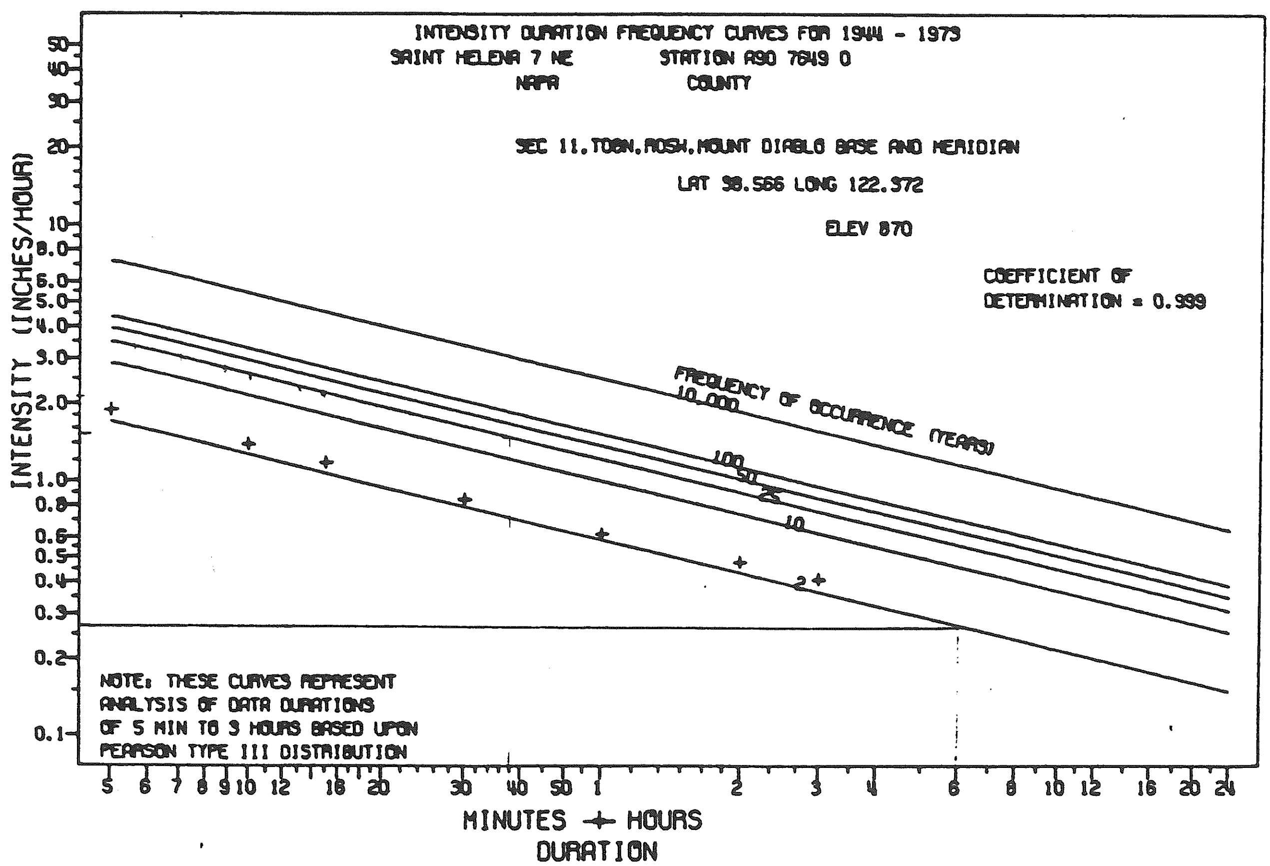
$$t_c = \frac{800'}{(2)(60)} = 6.7 \text{ min.}$$

$$i = 3.0$$

$$A = \frac{800' \times 21'}{43{,}560} = 0.386 \text{ Ac}$$

$$Q = (3.0)(1.0)(0.386) = 1.2 \text{ cfs}$$


INTENSITY DURATION FREQUENCY CURVES FOR 1941 - 1974
LUCIA WILLOW SPRINGS STATION 040 5184 0
MONTEREY COUNTY
SEC 05,T24S,R05E,MOUNT DIABLO BASE AND MERIDIAN
LAT 35.883 LONG 121.450
ELEV 360
COEFFICIENT OF DETERMINATION = 1.000
FREQUENCY OF OCCURRENCE (YEARS)
10,000
100
50
25
10
2
INTENSITY (INCHES/HOUR)
NOTE: THESE CURVES REPRESENT ANALYSIS OF DATA DURATIONS OF 5 MIN TO 3 HOURS BASED UPON PEARSON TYPE III DISTRIBUTION
MINUTES + HOURS
DURATION


INTENSITY DURATION FREQUENCY CURVES FOR 1944 - 1973
SAINT HELENA 7 NE STATION A90 7649 0
NAPA COUNTY
SEC 11,T08N,R05W,MOUNT DIABLO BASE AND MERIDIAN
LAT 38.566 LONG 122.372
ELEV 870
COEFFICIENT OF DETERMINATION = 0.999
FREQUENCY OF OCCURRENCE (YEARS)
10,000
100
50
25
10
2
INTENSITY (INCHES/HOUR)
NOTE: THESE CURVES REPRESENT ANALYSIS OF DATA DURATIONS OF 5 MIN TO 3 HOURS BASED UPON PEARSON TYPE III DISTRIBUTION
MINUTES + HOURS
DURATION

COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ___ of ___
Originated By: ______ Date: ______ Checked By: ______ Date: ______

Use Table 7-11 King's "Handbook of Hydraulics"

$$K' = \frac{Q \cdot n}{b^{8/3} s^{1/2}} = \frac{(1.2)(.016)}{(9)^{8/3} (0.01)^{1/2}} = 0.00055$$

$D/b = 0.01$

$D_N = 0.09'$

$A = (0.09)\left(\frac{9 + 9.18}{2}\right) = 0.818$ sf

$V = 1.2/0.818 = 1.5$ fps

$V_{AVE} \approx 1$ fps

$t_c = 800/60 = 13.4$ min

$i = 2.3$

$Q = (2.3)(1.0)(0.386) = 0.89$ close enough

Table 7-11. Values of K' in Formula $Q = \frac{K'}{n} b^{8/3} s^{1/2}$ for Trapezoidal Channels

D = depth of water b = bottom width of channel

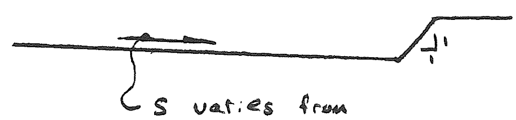
$\frac{D}{b}$	Side slopes of channel, ratio of horizontal to vertical									
	Vertical	¼–1	½–1	¾–1	1–1	1½–1	2–1	2½–1	3–1	4–1
.01	.00068	.00068	.00069	.00069	.00069	.00069	.00069	.00069	.00070	.00070
.02	.00213	.00215	.00216	.00217	.00218	.00220	.00221	.00222	.00223	.00225
.03	.00414	.00419	.00423	.00426	.00428	.00433	.00436	.00439	.00443	.00449
.04	.00660	.00670	.00679	.00685	.00691	.00700	.00708	.00716	.00723	.00736
.05	.00946	.00964	.00979	.00991	.01002	.01019	.01033	.01047	.01060	.01086
.06	.0127	.0130	.0132	.0134	.0136	.0138	.0141	.0143	.0145	.0150
.07	.0162	.0166	.0170	.0173	.0175	.0180	.0183	.0187	.0190	.0197
.08	.0200	.0206	.0211	.0215	.0219	.0225	.0231	.0236	.0240	.0250
.09	.0241	.0249	.0256	.0262	.0267	.0275	.0282	.0289	.0296	.0310
.10	.0284	.0294	.0304	.0311	.0318	.0329	.0339	.0348	.0358	.0376
.11	.0329	.0343	.0354	.0364	.0373	.0387	.0400	.0413	.0424	.0448
.12	.0376	.0393	.0408	.0420	.0431	.0450	.0466	.0482	.0497	.0527
.13	.0425	.0446	.0464	.0480	.0493	.0516	.0537	.0556	.0575	.0613
.14	.0476	.0502	.0524	.0542	.0559	.0587	.0612	.0636	.0659	.0706
.15	.0528	.0559	.0585	.0608	.0627	.0662	.0692	.0721	.0749	.0805
.16	.0582	.0619	.0650	.0676	.0700	.0740	.0777	.0811	.0845	.0912
.17	.0638	.0680	.0716	.0748	.0775	.0823	.0866	.0907	.0947	.1026
.18	.0695	.0744	.0786	.0822	.0854	.0910	.0960	.1008	.1055	.1148
.19	.0753	.0809	.0857	.0899	.0936	.1001	.1059	.1115	.1169	.1277
.20	.0812	.0876	.0931	.0979	.1021	.1096	.1163	.1227	.1290	.1414
.21	.0873	.0945	.101	.106	.111	.120	.127	.135	.142	.156
.22	.0934	.1015	.109	.115	.120	.130	.139	.147	.155	.171
.23	.0997	.1087	.117	.124	.130	.141	.150	.160	.169	.187
.24	.1061	.1161	.125	.133	.140	.152	.163	.173	.184	.204
.25	.1125	.1236	.133	.142	.150	.163	.176	.188	.199	.222
.26	.119	.131	.142	.152	.160	.175	.189	.202	.215	.241
.27	.126	.139	.151	.162	.171	.188	.203	.218	.232	.260
.28	.132	.147	.160	.172	.182	.201	.217	.234	.249	.281
.29	.139	.155	.170	.182	.194	.214	.232	.250	.268	.302
.30	.146	.163	.179	.193	.205	.228	.248	.267	.287	.324
.31	.153	.172	.189	.204	.218	.242	.264	.285	.306	.347
.32	.160	.180	.199	.215	.230	.256	.281	.304	.327	.371
.33	.167	.189	.209	.227	.243	.271	.298	.323	.348	.396
.34	.174	.198	.219	.238	.256	.287	.316	.343	.370	.423
.35	.181	.207	.230	.251	.269	.303	.334	.363	.392	.450
.36	.189	.216	.241	.263	.283	.319	.353	.385	.416	.478
.37	.196	.225	.252	.275	.297	.336	.372	.406	.440	.507
.38	.203	.234	.263	.288	.312	.353	.392	.429	.465	.537
.39	.211	.244	.274	.301	.326	.371	.413	.452	.491	.568
.40	.218	.253	.286	.315	.341	.389	.434	.476	.518	.600
.41	.226	263	.297	.328	.357	.408	.456	.501	.546	.633
.42	.233	.273	.309	.342	.373	.427	.478	.526	.574	.668
.43	.241	.283	.321	.357	.389	.447	.501	.553	.603	.703
.44	.248	.293	.334	.371	.405	.467	.525	.580	.633	.740
.45	.256	.303	.346	.386	.422	.488	.549	.607	.664	.777

COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ____ of ____
Originated By: ______ Date: ______ Checked By: ______ Date: ______

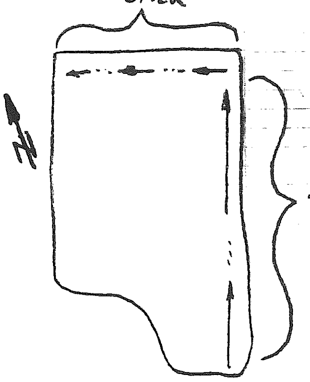
Problem: Determine normal depth of flow for 1-in-25 year storm runoff in eastern perimeter ditch when the compost windrows are not covered.

Given:
1) Use rational equation
2) "n" = 0.03 for straight ditch w/ some ponding
3) "C" = 0.8
4) s = 0.005
5) shape is as shown:



s varies from 2% to 5% (high end to low end)

for peak ditch flow use 5% (low end)



$t_c = t_{ditch} + t_{overland}$

$t_{overland} = \frac{1.8\,(1.1 - C)\,L^{1/2}}{S^{1/3}}$

$= \frac{1.8(1.1-0.8)(800)^{1/2}}{(1\%)^{1/3}}$

$= 15$ min.

for t_{ditch} assume ave. velocity is 1 fps

$t_d = \frac{500}{(1)(60)} = 8.3$ min

$t_c = 15 + 8 = 23$ min

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COMPUTATION SHEET

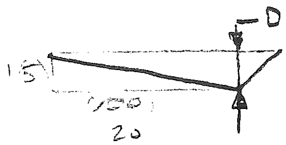
Project Title: ______ Project No. ______
Description: ______ Sheet ____ of ____
Originated By: ______ Date: ______ Checked By: ______ Date: ______

$i = 1.8$

$Q = (1.8)(0.8)(9.5) = 13.7$ cfs

for ditch w/ 5% & 1:1 side slopes

$A = \frac{1}{2} D (20D) + \frac{1}{2} D \cdot D = 10.5 D^2$



$P_W = \sqrt{D^2 + (20D)^2} + \sqrt{D^2 + D^2} = 21.02 D$

20.02 1.41 = 21.44

$R = 10.5 D^2 / 21.02 D = 0.500 D$ 0.49D

$R^{2/3} = 0.630 D^{2/3}$ 0.622D$^{2/3}$

$\frac{Q n}{1.486 (S)^{1/2}} = A \cdot R^{2/3} = 6.615 D^{8/3}$ 6.531D$^{8/3}$

$\therefore D = \left[\frac{(0.1017) Q \cdot n}{S^{1/2}} \right]^{3/8}$ $\left[\frac{.103 Qn}{S^{1/2}}\right]^{3/8}$

$D_N = \left[\frac{(0.1017)(13.7)(.03)}{(0.005)^{1/2}} \right]^{3/8} = 0.82$ = 0.82 ✓

$V = Q/A = 13.7 / 10.5 (.82)^2 = 1.9$ fps

$V_{ave} \approx 1$ fps

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COMPUTATION SHEET

Project Title: ______ **Project No.** ______
Description: ______ **Sheet** ______ **of** ______
Originated By: ______ **Date:** ______ **Checked By:** ______ **Date:** ______

Problem: The compost field slopes at 1% towards the east. The elevation at the east side is lower than the flowline of the existing perimeter creek. Storm water from the covered field needs to be pumped to the creek. The peak runoff from the site (when covered) is

$$Q = C\,i\,A$$

$$C = 1.0,\quad i = 2.3\ (t_c = 13\,min),\quad A = 9.5\,Ac$$

$$Q = (1)(2.3)(9.5) = 22\ cfs$$

This flow would require very large flow rate pumps which would be very expensive. A smaller pumping rate is to be used and storage of the peak flow will be incorporated into the design.

Approach:

1) Develop a hydrograph for 1-in-25 year, 24 hr. storm
2) Determine volume of storage required to contain peak runoff.

Solution:

1) Develop a hydrograph for the 24 hour, 25 year storm

Procedure and assumptions:

- use the Soil Conservation Service, Technical Release 55, "Urban Hydrology for Small Watersheds," June 1986, manual

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COMPUTATION SHEET

Project Title: ______ **Project No.** ______
Description: ______ **Sheet** ___ **of** ___
Originated By: ______ **Date:** ______ **Checked By:** ______ **Date:** ______

Given:

T_c = 13 min (see page 2) or 0.2 hours

A = 9.5 Ac = 0.0148 mi²

T_t = ~~0~~ hours

CN = 98 (for soil group D and paved parking lots)

Rainfall distribution type IA

24 hour, 25 year rainfall is 6.8 in from the NOAA Atlas 2, Precipitation-frequency atlas of the Western United States, Vol. XI, California, 1973

I_a = 0.041 in ✓

Solution:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad \text{where} \quad S = \frac{1000}{CN} - 10$$

$$= 0.204 ✓$$

45.6868

$$Q = \frac{[6.8 - 0.2(.204)]^2}{[6.8 + 0.8(.204)]} = 6.56 \text{ in} ✓$$

I_a/P = 0.041/6.8 = 0.0060 ✓

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Worksheet 5a: Basic watershed data

Project Upper Valley Disposal Service — Compost Fields (covered) Location Napa County By T. Daleiden Date 9-22-92

Circle one: Present (Developed) ______ Frequency (yr) 25 Checked ______ Date ______

Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
/	0.0148	0.2	∅	/	∅	6.8	98	6.56	0.097	0.041	0.006

↑ From worksheet 3 (Time of concentration, Travel time through subarea) ↑ From worksheet 2 (Runoff curve number, Runoff) ↑ From table 5-1 (Initial abstraction)

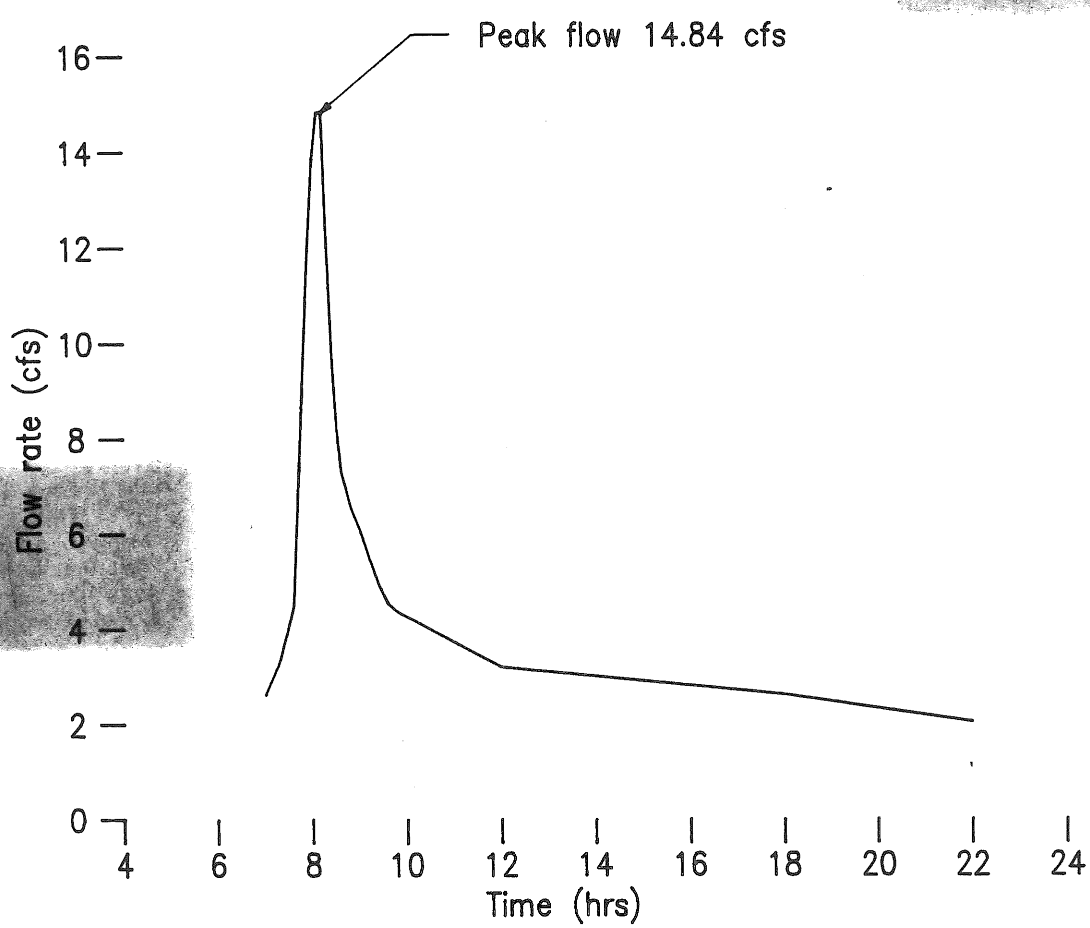
Worksheet 5b: Tabular hydrograph discharge summary

Project Upper Valley Disposal (Service) Compost Field (Covered) Location Napa County By T. Dalelden Date 9-22-92

Circle one: Present (Developed) ______ Frequency (yr) 25 Checked ______ Date ______

Subarea name	Basic watershed data used 1/ Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)	Select and enter hydrograph times in hours from exhibit 5-IA 2/											
					7.0	7.3	7.6	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.8
					Discharges at selected hydrograph times 3/ (cfs)											
	0.2	∅	0.10	0.097	2.72	3.49	4.85	13.87	14.94	15.81	13.58	9.99	8.44	7.37	6.60	6.31
					2.619	3.218	4.462	12.028	13.671	[illegible]	14.841	12.319	9.991	8.439	7.372	6.596
					9.0	9.2	9.4	9.6	9.8	10.0	~~12.0~~ 10.3	~~14.0~~ 10.6	~~16.0~~ 11	~~18.0~~ 11.5	~~22.0~~ 12	12.5
					5.92	5.24	4.75	4.37	4.27	4.27	3.20	2.91	2.81	2.52	2.04	
					6.111	5.529	4.947	4.559	4.365	4.268	4.074	3.88	[illegible]	[illegible]	3.201	[illegible]
					13	13.5	14	15	16	18	22					
					3.104	[illegible]	3.007	2.91	2.813	2.49	2.032					
Composite hydrograph at outlet																

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is A_mQ multiplied by tabular discharge from appropriate exhibit 5.



COVERED COMPOST FIELD HYDROGRAPH

COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ____ of ____
Originated By: ______ Date: ______ Checked By: ______ Date: ______

Problem: Develop hydrograph for runoff from uncovered compost field.

Approach: Use SCS TR-55 (June 1986)

Given: T_c = overland flow + ditch flow

$= 15 \text{ min} + 8 \text{ min} = 23 \text{ min} = 0.38 \text{ hr.}$ ✓

$A = 0.0148 \text{ mi}^2$ ✓

CN = 94 (Newly graded areas, no vegetation, soil group D) ✓ Pg 2-5

Type IA rainfall distribution ✓

24 hour, 25 year rainfall is 6.8 in ✓

$I_a = 0.128$ ✓ Pg 4-1

Solution: $Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$ $S = \frac{1000}{CN} - 10$

$= \frac{1000}{94} - 10 = 0.638$ ✓

$Q = \frac{[6.8 - 0.2(.638)]^2}{[6.8 + 0.8(.638)]} = 6.09 \text{ in}$ ✓

$I_a/P = 0.128/6.8 = 0.019$ ✓

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Worksheet 5a: Basic watershed data

Project Compost Field (uncovered) Upper Valley Disposal Service Location Napa County By T. Dalelda Date 9-23-92

Circle one: Present Developed ______ Frequency (yr) 25 Checked ______ Date ______

Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
/	0.0148	0.4	0.0	—	0	6.8	94	6.09	0.09 /	0.128	0.019

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ From worksheet 3 (columns T_c, T_t)

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ From worksheet 2 (columns CN, Q)

↑ ↑ ↑ ↑ From table 5-1 (column I_a)

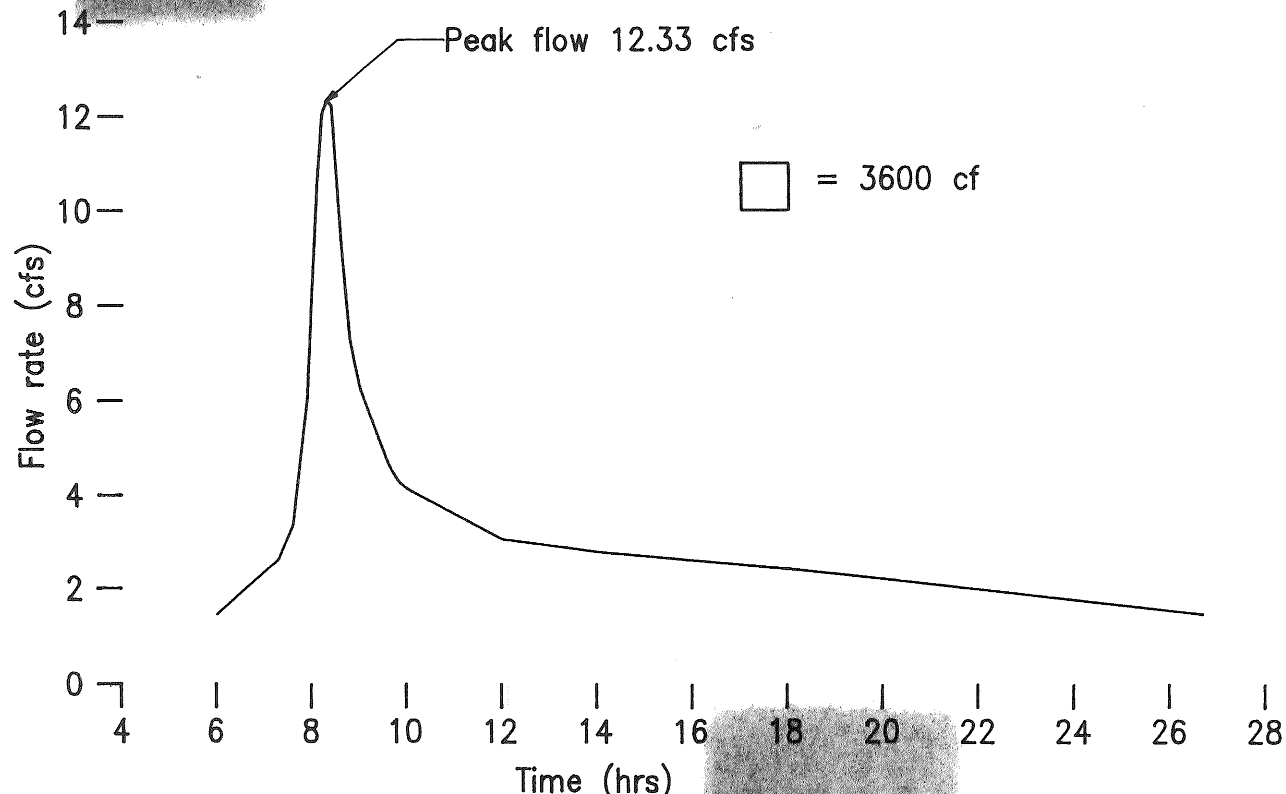
Worksheet 5b: Tabular hydrograph discharge summary

Project Upper Valley Disposal Service — Compost Field (uncovered) Location Napa County By T. Daleiden Date 9-23-92

Circle one: Present **(Developed)** ______ Frequency (yr) 25 Checked ______ Date ______

Subarea name	Basic watershed data used 1/ Subarea T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)	Select and enter hydrograph times in hours from exhibit 5- 2/ 7.0	7.3	7.6	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.8
					Discharges at selected hydrograph times 3/ (cfs)											
	0.4	0.0	0.019	0.09	2.34	2.61	3.33	6.03	8.37	10.53	12.06	12.33	12.24	10.89	9.45	7.29
					9.0	9.2	9.4	9.6	9.8	10.0	12.0	14.0	16.0	18.0	22.0	
					6.3	5.76	5.22	4.68	4.32	4.14	3.06	2.79	2.61	2.43	1.98	
Composite hydrograph at outlet																

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is A_mQ multiplied by tabular discharge from appropriate exhibit 5.



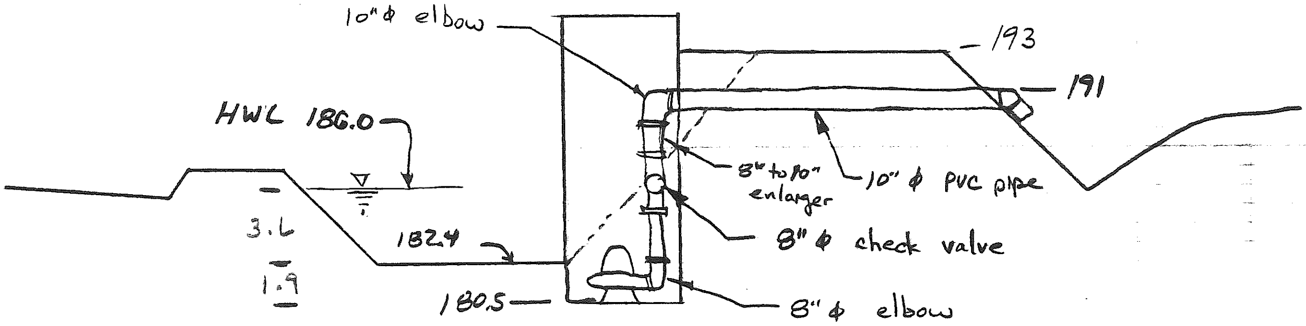
UNCOVERED COMPOST HYDROGRAPH

COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ______ of ______
Originated By: ______ Date: ______ Checked By: ______ Date: ______

Problem: Develop system curve for stormwater pumps

Given: Geometry



Static head varies from 10.5' to 5.0' ✓

total length of 8" dia. pipe

Item	equivalent length
8" ϕ elbow	52 feet
8" ϕ check valve	21 feet

Σ = 73 feet + 10 feet = 83 feet ✓
say 100'

total length of 10" dia. pipe

1 - 90° elbow ➔ 27 ft + 20 feet = 47 feet ✓
say 50 feet

COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ____ of ____
Originated By: ______ Date: ______ Checked By: ______ Date: ______

8" Φ pipe ; L = 100'

$1\ gal/min \left(\frac{1\ ft^3}{7.48\ gal}\right)\left(\frac{1\ min}{60\ sec}\right) = .002228\ ft^3/s$

A = 50.27 in² = 0.349 ft²

Q gpm	$V_{8"\Phi}$	$H_v = \frac{v^2}{2g}$	S* ft/ft		H_f (ft)	
1200	7.66 ✓	0.91 ✓	0.0005	.026	0.05	2.6
1600	10.21 ✓	1.62 ✓	0.00144	.044	0.14	4.4
2000	12.77 ✓	2.53 ✓	0.0033	.066	0.33	6.6
2400	15.32 ✓	3.64 ✓	0.0065	.092	0.65	9.2

10" Φ pipe ; L = 50' A = 0.545 ft²

1200	4.90 ✓	0.37 ✓	0.00007	.0087	0.003	0.44
1600	6.54 ✓	0.66 ✓	0.0002	.015	0.01	0.75
2000	8.17 ✓	1.04 ✓	0.0005	.022	0.02	1.1
2400	9.80 ✓	1.49 ✓	0.0010	.031	0.05	1.55

Totals

1200	1.28 ✓	0.05	3.04
1600	2.28 ✓	0.15	5.15
2000	3.34 3.57	0.35	7.7
2400	5.13 ✓	0.70	10.75

from Hazen-Williams formula

8" Φ pipe 10" Φ pipe

$$S = \left[\frac{V}{1.318(C)R^{.63}}\right]^{1.85} \Rightarrow \left[\frac{V}{55.48}\right]^{1.85} ✓ \Rightarrow \left[\frac{V}{63.71}\right]^{1.85} ✓$$

C = 130 for D.I. (DUCTILE IRON)

R = d/4 = 0.167 (8" Φ pipe)

= 0.208 (10" Φ pipe)

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COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ____ of ____
Originated By: ______ Date: ______ Checked By: ______ Date: ______

Q(gpm)	$H_{(min)} = 5' + H_v + H_f$		$H_{(max)} = 10.5' + H_v + H_f$	
1200	6.33	9.32	11.83	14.82
1600	7.43	12.43	12.93	17.93
2000	8.69	16.27	14.19	21.77
2400	10.83	20.88	16.33	25.88

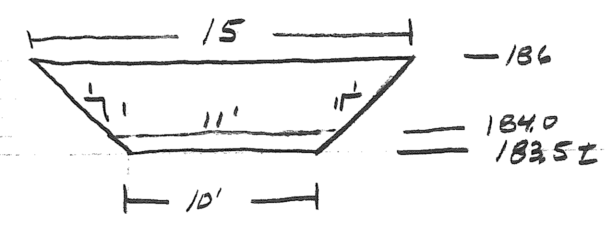
COMPUTATION SHEET

Project Title: ______ **Project No.** ______
Description: ______ **Sheet** ____ **of** ____
Originated By: ______ **Date:** ______ **Checked By:** ______ **Date:** ______

The stand pipe (6' ϕ CMP) for the pump station has a base elevation of 180.5. Two identical pumps are located in the stand pipe. Pump # 1 goes on when the water level is at 183.0 and goes off when the water level is at 180.5. Pump #2 goes on when the water level is at 184.0 and off when the water level is 183.0.

When the water level is at 184.0 each pump will be pumping approximately 2000 gpm (4.45 cfs). The storage volume in the retention basin between elevations 184.0 and 186.0 must be greater than the volume of water on the hydrograph above 8.9 cfs.

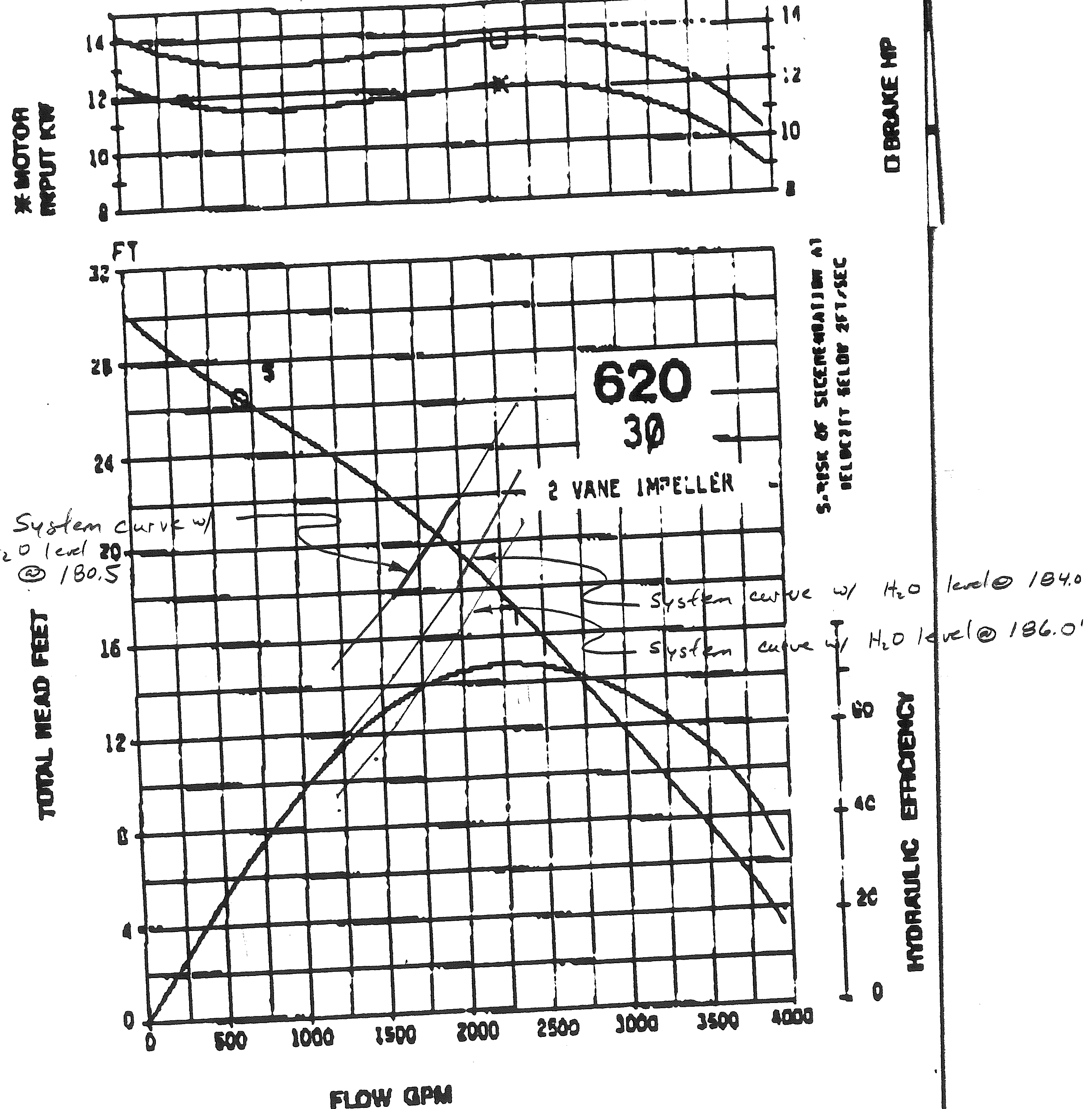
- Calculate storage volume between 184.0 & 186.0
  basin length is 450 ft (station 0+75 to 5+25)
  cross-section is as shown



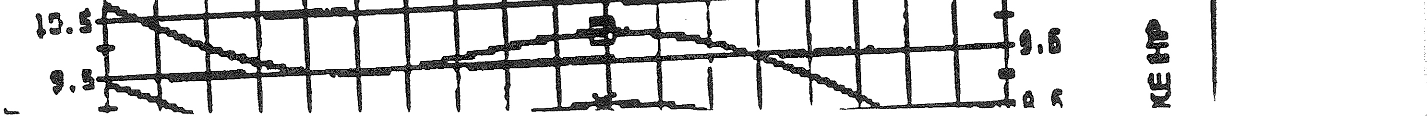
Volume storage is $(450)\left(\frac{15+11}{2}\right)(2) = 11{,}700$ c.f.

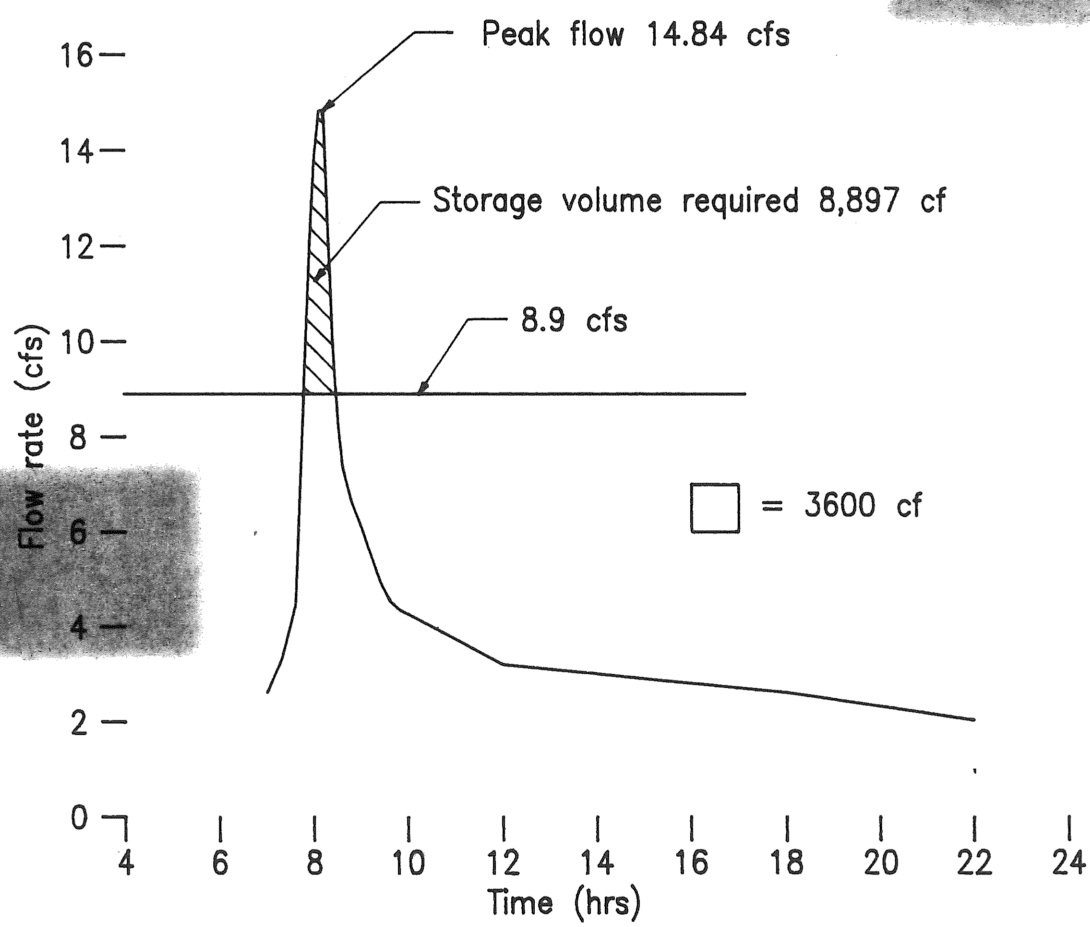
From hydrograph Volume of runoff storage required is 8,897 cf

Available storage is 1.3 times the required storage



PUMP CURVE FOR FLYGT CS-3152
SUBMESIBLE WASTEWATER PUMP



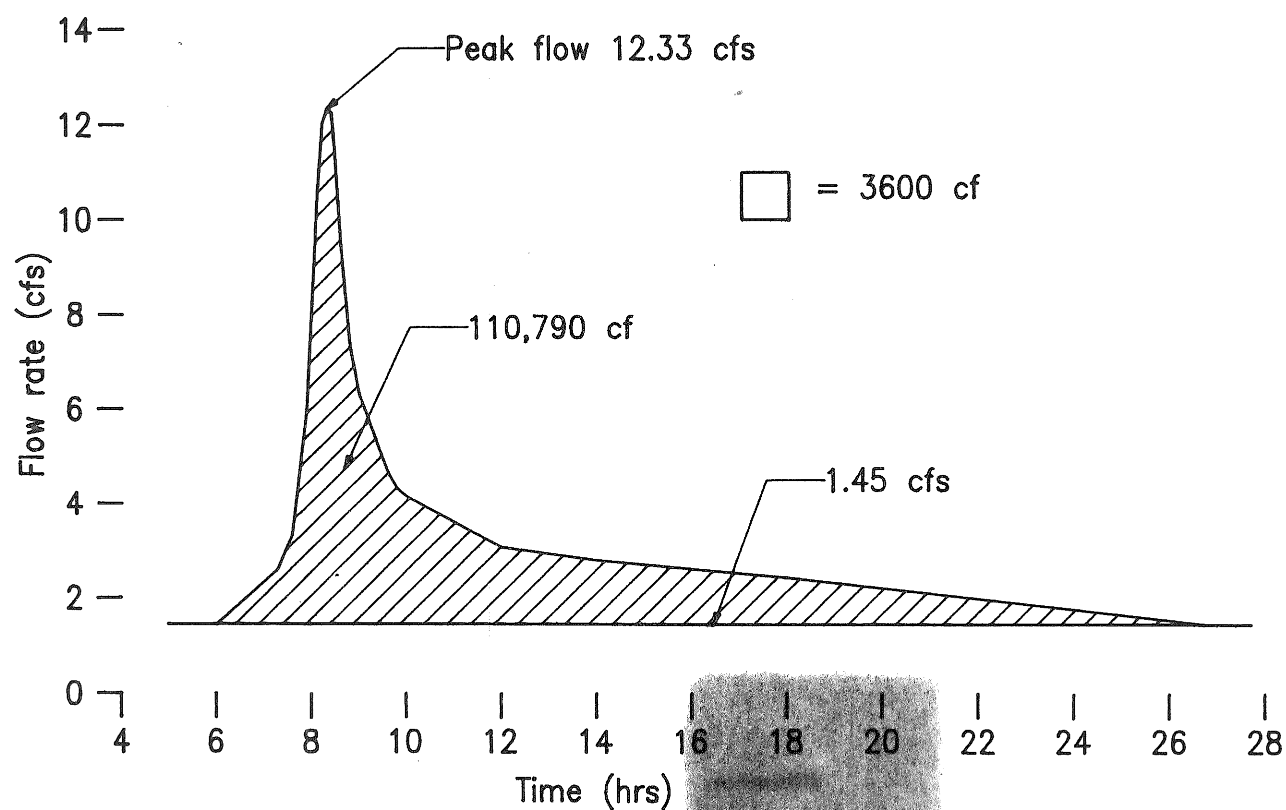


COVERED COMPOST FIELD HYDROGRAPH
AND STORAGE VOLUME

COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ___ of ___
Originated By: ______ Date: ______ Checked By: ______ Date: ______

When the compost field is uncovered the water will flow to the compost field sump where it is pumped to the pond. A screen removes suspended solids after the water is pumped but prior to the water being discharged into the pond. The sreen has a maximum flow rating of 650 gpm (1.45 cfs). Therefore, during storms with peak flow rates greater than 1.45 cfs water will be stored in the ditches of the compost field. During the 1-in-25 year 24 hr storm, 110,790 cf of storage is required.



UNCOVERED COMPOST HYDROGRAPH AND STORAGE VOLUME

COMPUTATION SHEET

Project Title: ____________________ Project No. ________
Description: ____________________ Sheet ____ of ____
Originated By: ____________ Date: ________ Checked By: ____________ Date: ________

Volume of Storage in Compost Field

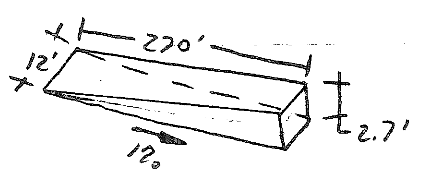
Contour	Area (s.f.)	Ave. Area (s.f.)	Elev. "Δ" (ft)	Volume (c.f.)	Σ Volume (c.f.)
186.0	0				
		390	0.5	195 ✓	195 ✓
186.5	780				
		1,840	0.5	920 ✓	1,115 ✓
187.0	2900				
		5,049	0.5	2,524.5 ✓	3,640 ✓
187.5	7198				
		10,373	0.5	5,186.5 ✓	8,826 ✓
188.0	13,548				
		19,353	0.5	9,676.5 ✓	18,502 ✓
188.5	25,157				
		37,619	0.5	18,809.5 ✓	37,312 ✓
189.0	50,080				
		74,937	1.0	74,937 ✓	112,249 ✓
190.0	99,793				
		125,860	1.0	125,860 ✓	238,109 ✓
191.0	151,926				

Storage volume = 238,109 less volume occupied by compost

There will 23 rows 12' wide with average length of 270'

$$Vol_{compost} = 23\left[(12)\tfrac{1}{2}(270 \times 2.7)\right] = 100,602 \text{ c.f.}$$

Storage volume = 238,109 − 100,602 = 137,507



VOLUME TAKEN BY COMPOST (NOT TOTAL COMPOST PILE)

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COMPUTATION SHEET

Project Title: ______ Project No. ______
Description: ______ Sheet ___ of ___
Originated By: ______ Date: ______ Checked By: ______ Date: ______

Volume of storage available is 137,507/110,790 = 1.24 times the available storage while maintaining 1' of freeboard between the compost field and the top of the perimeter berm.

to pump this stored water will take

110,790 cf / 1.45 cfs = 76,407 sec = 21.2 hours

or less than 1 day to pump the stored volume of the 1-in-25 year, 24 hour storm into the pond.

APPENDIX H - Rational Method and Conveyance Sizing Analysis

Table 1: Area Runoff Coefficients

Area	Coefficient
1 (Summer)	0.7
1 (Winter)	1
2	0.7
3 (Summer)	0.7
3A (Winter)	1
3B (Winter)	0.7
5	0.7
7	0.9

OVERLAND/CHANNEL FLOW TIME (KIRPICH) (min)

$$T_i \text{ or } T_t = (0.0078)D^{0.77}S^{-0.385}$$

Where: D=Watercourse Distance (ft)
S=Slope (ft/ft)

GENERAL NOTE:

1. Materials covered December 1 to April 1 (defined as "Winter") and prior to rain events, increasing runoff for these months.

PIPE CULVERT FLOW VELOCITY (fps)

$$v = \left(\frac{1.485}{n}\right)R^{\frac{2}{3}}S^{\frac{1}{2}}$$

Where: n= Manning's Roughness (0.011 for PVC)
R=Hydraulic Radius (1' Pipe=0.25ft)
(Divide by 60 for feet per minute)
(Divide length by velocity for T_t)

Table 2: Modified Rational Method Analysis-Compost Runoff Sump

Drainage Area	Area (ft^2)	Area A (acre)	Max Drainage Distance D (ft)	Slope Type	Max. Elevation Change (ft)	Average Slope (S_A)	T_t (minute) Local Flow Time[1]	T_C (minute) = $\sum T_t + T_{C,upstream}$	I (inch/hr)[2]	∑(CA) from Flow Start	Q=∑(CA)I (ft^3/s)
Areas 1, 2, 3, 5, 7 (Summer) to Compost Runoff Sump											
(Determination of Longest Flow Time Path)											
Area 1[3]	60812	1.40	288	Overland	6.18	2.15%	2.68				
			42	Culvert, (2) 1-ft PVC	N/A	2.00%	0.09	2.77	3.36	0.98	3.28
Area 2+3+7 (Overland)	274611	6.30									
(+Area 7)	35958	0.83	524.00	Overland	N/A	1.00%	5.70	8.47	2.30	6.13	14.11
Area 5[4]	138882	3.19	778	Overland	N/A	0.85%	8.23				
(Independent of 1,2,3,7)			186	Ditch (As Overland)	N/A	1.00%	2.57	10.80	2.41	2.23	5.38
								(Area 5 flow dictates Tc)			
(Determination of Flow Continuing to Sump)											
Area 1,2,3,7 Contributing to Ditch Flow	274611	6.30									
(+Area 7)	35958	0.83	426.00	Ditch (As Overland)	N/A	0.50%	6.35	17.14	1.90	8.36	**15.89**
Areas 2, 3B, 5, 7 (Winter) to Compost Runoff Sump											
(Area 5 flow dictates Tc)											
Area 5[4]	138882	3.19	778	Overland	N/A	0.85%	8.23				
(Independent of 2,3B,7)			186	Ditch (As Overland)	N/A	1.00%	2.57	10.80	2.41	2.23	5.38
Area 2,3B,7 Contributing to Ditch Flow	136138	3.13									
(+Area 7)	35958	0.83	426.00	Ditch (As Overland)	N/A	0.50%	6.35	17.14	1.90	5.16	**9.81**

Table 3: Modified Rational Method Analysis-Retention Basin

Drainage Area	Area (ft^2)	Area A (acre)	Max Drainage Distance D (ft)	Slope Type	Max. Elevation Change (ft)	Average Slope (S_A)	T_t (minute) Local Flow Time[2]	T_C (minute) = $\sum T_t + T_{C,upstream}$	I (inch/hr)[3]	∑(CA) from Flow Start	Q=∑(CA)I (ft^3/s)
(Summer) to Retention Basin											
No areas drain to retention basin during summer under proposed future Facility layout.											
Area 1, 3A (Winter) to Retention Basin											
Area 1[3]	60812	1.40	288	Overland	6.18	2.15%	2.68				
			42	Culvert, (2) 1-ft PVC	N/A	2.00%	0.09	2.77	3.36	1.40	4.69
Area 3A	138473	3.18	524.00	Overland	N/A	1.00%	5.70	8.47	2.30	4.57	**10.52**

[1]Local flow time overland and ditch flow from Kirpich equation for simplicity and to provide conservative runoff values.

[2]Intensity (inch/hr) taken from NOAA Atlas 14, Volume 6, Version 2, Saint Helena station intesity/duration values for 25-year storm.

[3]Area 1 drains through 2, 1-foot PVC pipes set under the access road each with a combined estimated flow rate of approximately 6 cfs at half-full, n=0.011. The rational method calculated flow of 3.28 cfs retained for downstream analysis based on the minimum recommended T_c of 5 minutes.

[4]Area 5 drains through an 18-inch HDPE corrugated pipe to the retention basin with estimated flow capacity of 6.6 cfs at half full, n=0.02 (per *Hydraulic Considerations for Corrugated Polyethylene Pipe* , Pipe Plastics Institute, 2000.) The rational method calculated flow of 5.38 cfs retained for downstream analysis.

Table 1: Upper Valley Sump Pumps

Location	Size	Model	Head (ft)	Capacity
Compost Sump To Water Reuse Pond	7.5 HP	Barnes 4SE7534L	25	540 GPM
	5 HP	Goulds WS5032D4	25	450 GPM
Retention Basin To Creek	25 HP	Ebara Model 300DL(F)U6184	8	2500 GPM
	25 HP	Ebara Model 300DL(F)U6184	8	2500 GPM
Groundwater Sump to Creek or Compost Sump	3 HP	Goulds WS3032D3	14 (0 to Compost Sump)	400 GPM

Table 2: Pump Discharge During 25-Year, 24-Hour Storm

Pumping Station	Max. Storm Flow (ft3/s)[1]	Max. Storm Flow (GPM)[1]	Pump Capacity (GPM)	Total Storm (acre-feet)[2]	Total Storm Flow (gal)	Hours to Discharge
Compost Runoff Sump (Summer)	15.89	7133	990	5.78	1883419	31.7
Compost Runoff Sump (Winter)	9.81	4402	990	3.99	1300145	21.9
Retention Basin (Summer)	0.00	0	5000	0.37	120565	0.4
Retention Basin (Winter)	10.52	4722	5000	2.87	935192	3.1

[1]Max. storm flow from 25-year, 24-hour storm event rational method analysis.

[2]Total storm flow from 25-year, 24-hour storm event water balance.

Table3: Culvert Analysis

Culvert	Max. Storm Flow (ft3/s)[1]	Max. Storm Flow (GPM)[1]	Capacity (GPM)[2,3]
Area 1 (Winter)	4.69	2105	2672
Area 5	5.38	2414	2962

[1]Max. storm flow from 25-year, 24-hour storm event rational method analysis.

[2]Area 1 capacity based on Pipe Culvert Flow Manning's equation.

[3]Area 5 capacity from Hydraulic Considerations for Corrugated Polyethylene Pipe (6.6 cfs).

PIPE CULVERT FLOW (cfs) (AREA 1 ONLY)

$$Q = \left(\frac{1.485}{n}\right) A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

Where:

n= Manning's Roughness (0.011 for PVC)
R=Hydraulic Radius (1' Pipe=0.25ft)
A=0.392ft^2 (Assume half-full pipe)
2 pipes present, double flow
(Multiply by 448.8 for gallon/minute)

NOAA Atlas 14, Volume 6, Version 2
Location name: Saint Helena, California, US*
Latitude: 38.5067°, Longitude: -122.4714°
Elevation: 262 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.60 (1.43-1.81)	1.96 (1.74-2.23)	2.44 (2.16-2.78)	2.83 (2.48-3.25)	3.36 (2.84-4.02)	3.78 (3.11-4.63)	4.20 (3.37-5.29)	4.64 (3.60-6.04)	5.24 (3.88-7.15)	5.71 (4.07-8.10)
10-min	1.15 (1.02-1.30)	1.40 (1.25-1.60)	1.75 (1.55-1.99)	2.03 (1.78-2.33)	2.41 (2.03-2.89)	2.71 (2.23-3.32)	3.01 (2.41-3.80)	3.32 (2.58-4.33)	3.76 (2.78-5.12)	4.09 (2.92-5.81)
15-min	0.924 (0.824-1.05)	1.13 (1.01-1.29)	1.41 (1.25-1.60)	1.63 (1.43-1.88)	1.94 (1.64-2.32)	2.18 (1.80-2.68)	2.43 (1.94-3.06)	2.68 (2.08-3.49)	3.03 (2.24-4.13)	3.30 (2.35-4.68)
30-min	0.700 (0.622-0.794)	0.856 (0.762-0.974)	1.06 (0.942-1.21)	1.24 (1.08-1.42)	1.47 (1.24-1.76)	1.65 (1.36-2.02)	1.84 (1.47-2.31)	2.03 (1.57-2.64)	2.29 (1.70-3.13)	2.50 (1.78-3.54)
60-min	0.518 (0.461-0.588)	0.635 (0.564-0.722)	0.789 (0.699-0.900)	0.915 (0.803-1.05)	1.09 (0.919-1.30)	1.22 (1.01-1.50)	1.36 (1.09-1.72)	1.50 (1.17-1.96)	1.70 (1.26-2.31)	1.85 (1.32-2.62)
2-hr	0.398 (0.354-0.451)	0.482 (0.428-0.548)	0.592 (0.524-0.674)	0.678 (0.596-0.782)	0.794 (0.670-0.950)	0.882 (0.726-1.08)	0.968 (0.776-1.22)	1.06 (0.820-1.37)	1.17 (0.868-1.60)	1.26 (0.897-1.79)
3-hr	0.341 (0.303-0.387)	0.412 (0.366-0.469)	0.502 (0.445-0.573)	0.574 (0.504-0.661)	0.668 (0.564-0.800)	0.739 (0.609-0.905)	0.808 (0.647-1.02)	0.877 (0.681-1.14)	0.968 (0.717-1.32)	1.04 (0.738-1.47)
6-hr	0.259 (0.230-0.294)	0.313 (0.278-0.356)	0.382 (0.338-0.435)	0.435 (0.382-0.501)	0.505 (0.426-0.604)	0.556 (0.458-0.681)	0.606 (0.485-0.763)	0.655 (0.509-0.853)	0.719 (0.533-0.981)	0.767 (0.546-1.09)
12-hr	0.184 (0.164-0.209)	0.226 (0.201-0.257)	0.278 (0.247-0.317)	0.320 (0.280-0.368)	0.374 (0.315-0.447)	0.414 (0.341-0.507)	0.453 (0.363-0.571)	0.492 (0.382-0.641)	0.544 (0.403-0.742)	0.582 (0.415-0.826)
24-hr	0.130 (0.117-0.148)	0.162 (0.146-0.185)	0.204 (0.183-0.232)	0.237 (0.211-0.272)	0.281 (0.243-0.330)	0.313 (0.267-0.375)	0.346 (0.288-0.423)	0.378 (0.308-0.474)	0.421 (0.332-0.546)	0.454 (0.347-0.606)
2-day	0.085 (0.077-0.097)	0.109 (0.098-0.124)	0.140 (0.125-0.159)	0.164 (0.146-0.188)	0.195 (0.169-0.230)	0.219 (0.186-0.263)	0.242 (0.202-0.296)	0.265 (0.216-0.332)	0.296 (0.233-0.384)	0.319 (0.244-0.425)
3-day	0.065 (0.059-0.074)	0.085 (0.076-0.096)	0.110 (0.098-0.125)	0.129 (0.115-0.148)	0.154 (0.134-0.182)	0.173 (0.147-0.208)	0.192 (0.160-0.234)	0.210 (0.171-0.263)	0.234 (0.184-0.304)	0.252 (0.193-0.337)
4-day	0.054 (0.049-0.062)	0.071 (0.063-0.080)	0.091 (0.082-0.104)	0.108 (0.096-0.124)	0.129 (0.112-0.152)	0.145 (0.123-0.174)	0.161 (0.134-0.196)	0.176 (0.144-0.221)	0.197 (0.155-0.255)	0.212 (0.162-0.283)
7-day	0.039 (0.035-0.044)	0.050 (0.045-0.057)	0.064 (0.057-0.073)	0.075 (0.067-0.086)	0.090 (0.078-0.106)	0.101 (0.086-0.121)	0.112 (0.094-0.137)	0.123 (0.101-0.155)	0.138 (0.109-0.179)	0.149 (0.114-0.199)
10-day	0.031 (0.028-0.035)	0.040 (0.036-0.045)	0.050 (0.045-0.058)	0.059 (0.053-0.068)	0.071 (0.061-0.083)	0.080 (0.068-0.095)	0.088 (0.074-0.108)	0.097 (0.079-0.121)	0.109 (0.086-0.141)	0.117 (0.090-0.157)
20-day	0.021 (0.019-0.023)	0.026 (0.024-0.030)	0.033 (0.030-0.038)	0.039 (0.035-0.045)	0.046 (0.040-0.054)	0.052 (0.044-0.062)	0.057 (0.048-0.070)	0.063 (0.051-0.078)	0.070 (0.055-0.090)	0.075 (0.057-0.100)
30-day	0.016 (0.015-0.018)	0.021 (0.019-0.023)	0.026 (0.023-0.030)	0.031 (0.027-0.035)	0.036 (0.031-0.043)	0.040 (0.034-0.048)	0.044 (0.037-0.054)	0.048 (0.039-0.060)	0.053 (0.042-0.069)	0.057 (0.044-0.076)
45-day	0.013 (0.012-0.015)	0.017 (0.015-0.019)	0.021 (0.019-0.024)	0.024 (0.022-0.028)	0.029 (0.025-0.034)	0.032 (0.027-0.038)	0.035 (0.029-0.043)	0.038 (0.031-0.047)	0.041 (0.033-0.054)	0.044 (0.034-0.059)
60-day	0.012 (0.010-0.013)	0.015 (0.013-0.017)	0.019 (0.017-0.021)	0.021 (0.019-0.025)	0.025 (0.022-0.030)	0.028 (0.024-0.033)	0.030 (0.025-0.037)	0.032 (0.026-0.041)	0.035 (0.028-0.046)	0.037 (0.029-0.050)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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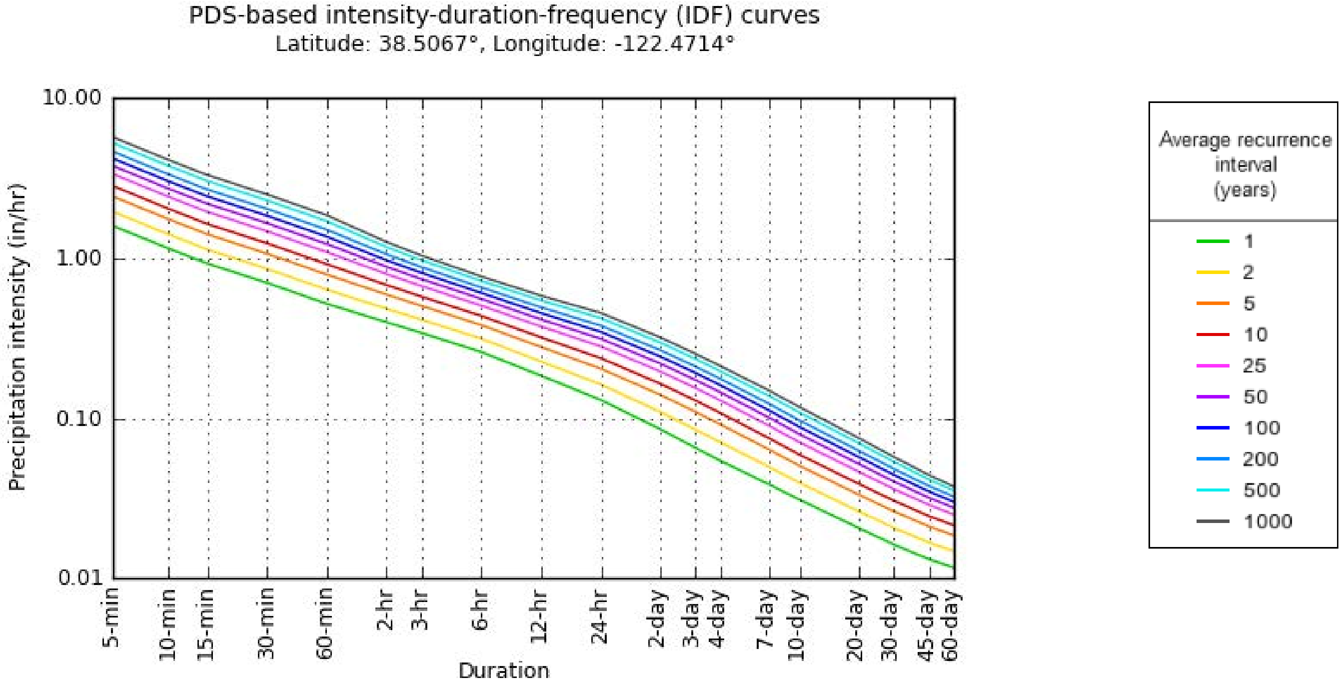
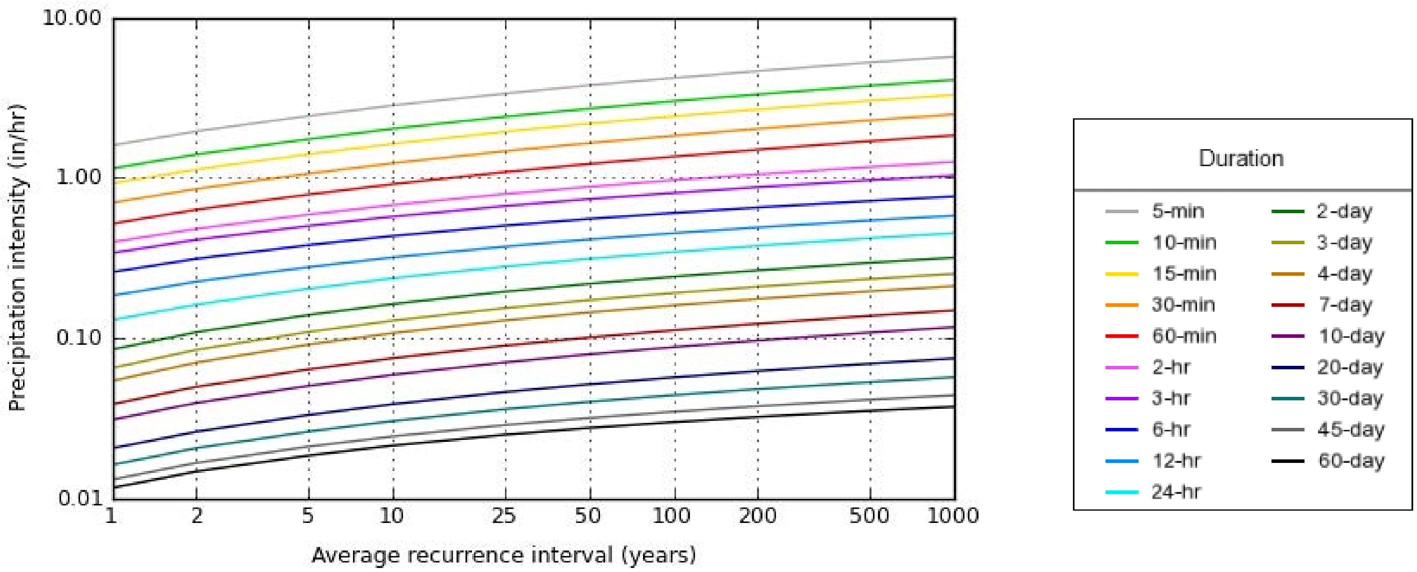
PF graphical





NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu May 19 20:31:37 2016

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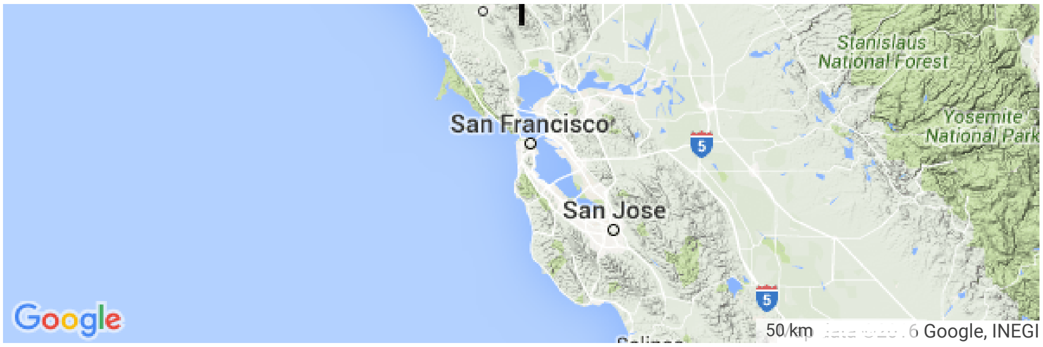
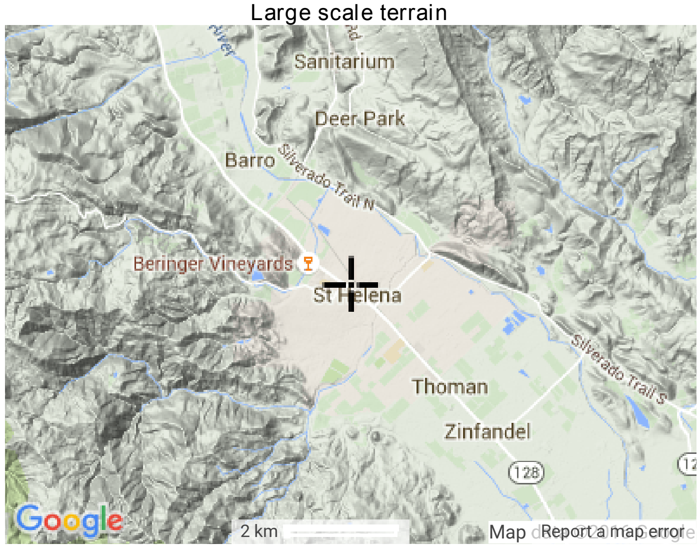
Maps & aerials

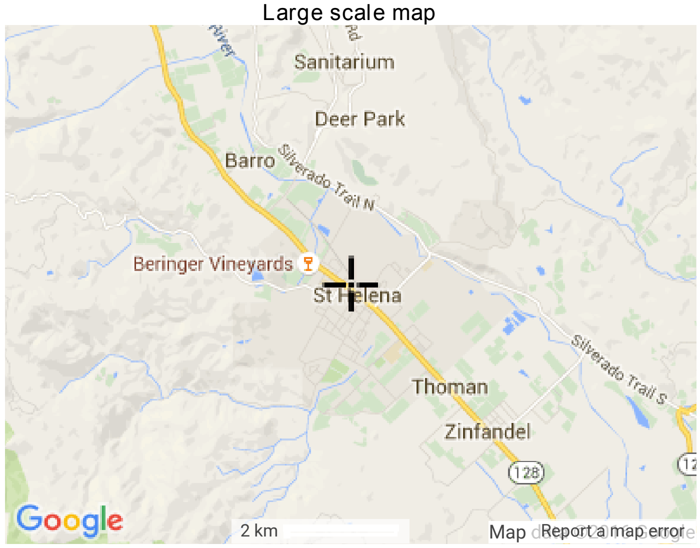
Small scale terrain



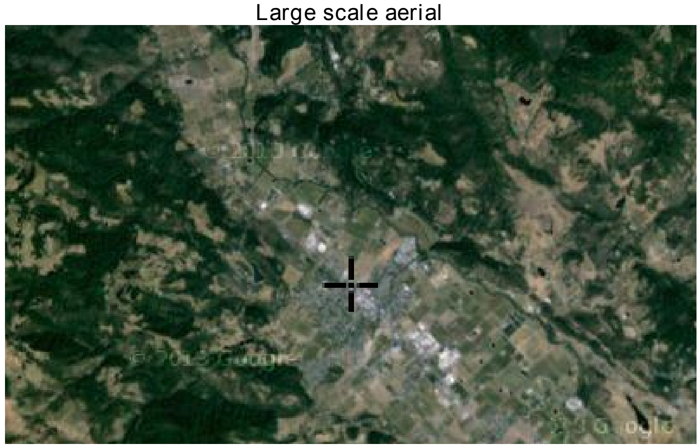
Large scale terrain



Large scale map



Large scale aerial



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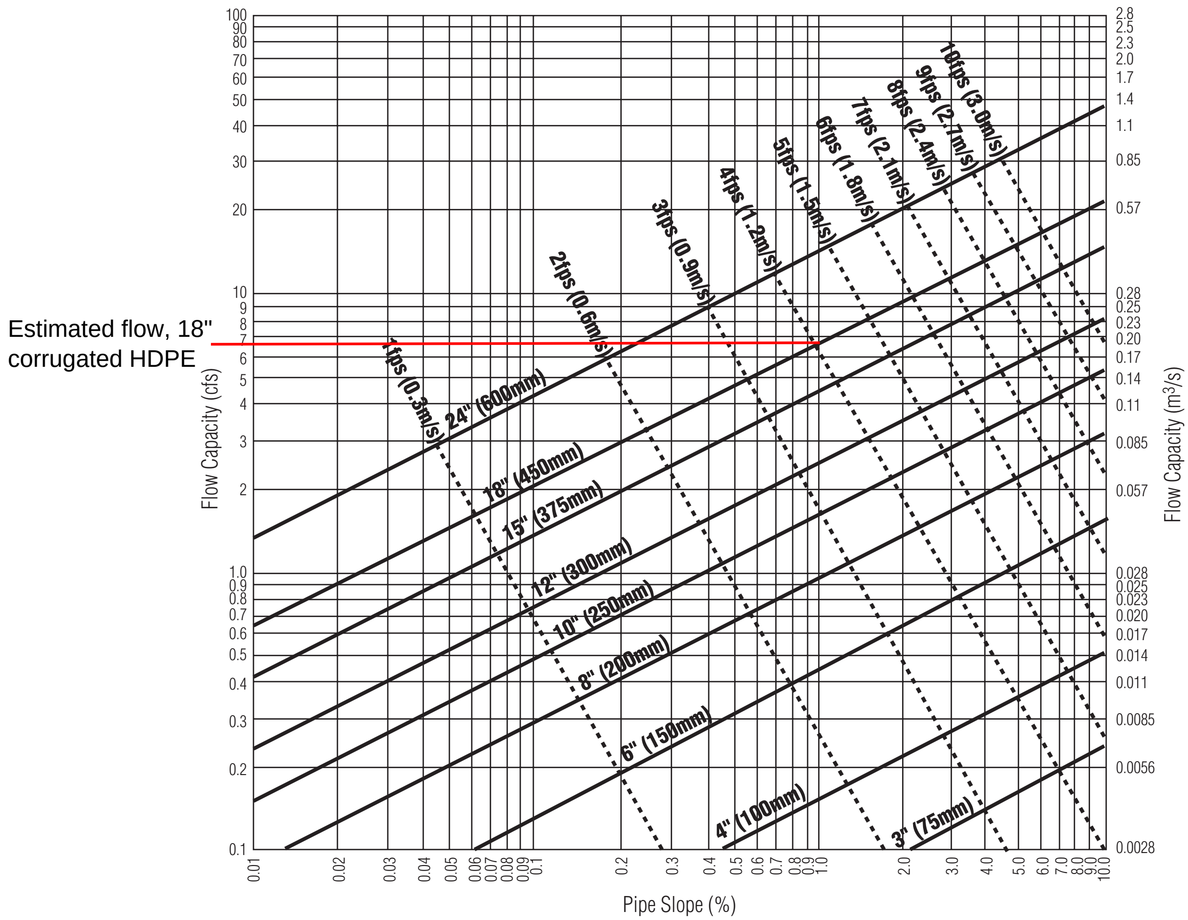
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Figure 2: Discharge Rates for Corrugated Polyethylene Pipe With a Corrugated Interior



Note: The "n" value changes from diameter to diameter for corrugated interior pipe because of differences in corrugation geometry. (4" - 6": 0.015; 8": 0.016; 10: 0.017: 12" - 15": 0.018; 18" - 24": 0.020)[1]

Solid lines indicate pipe diameter.

Dashed lines indicate approximate flow velocity.

Excerpt from: Hydraulic Considerations for Corrugated Polyethylene Pipe, Corrugated Polyethylene Pipe Association, Washington DC, 2000.

Series 4SE -L

Performance Curve

4.5, 7.5, 11.3 & 15HP, 1750RPM, 60Hz

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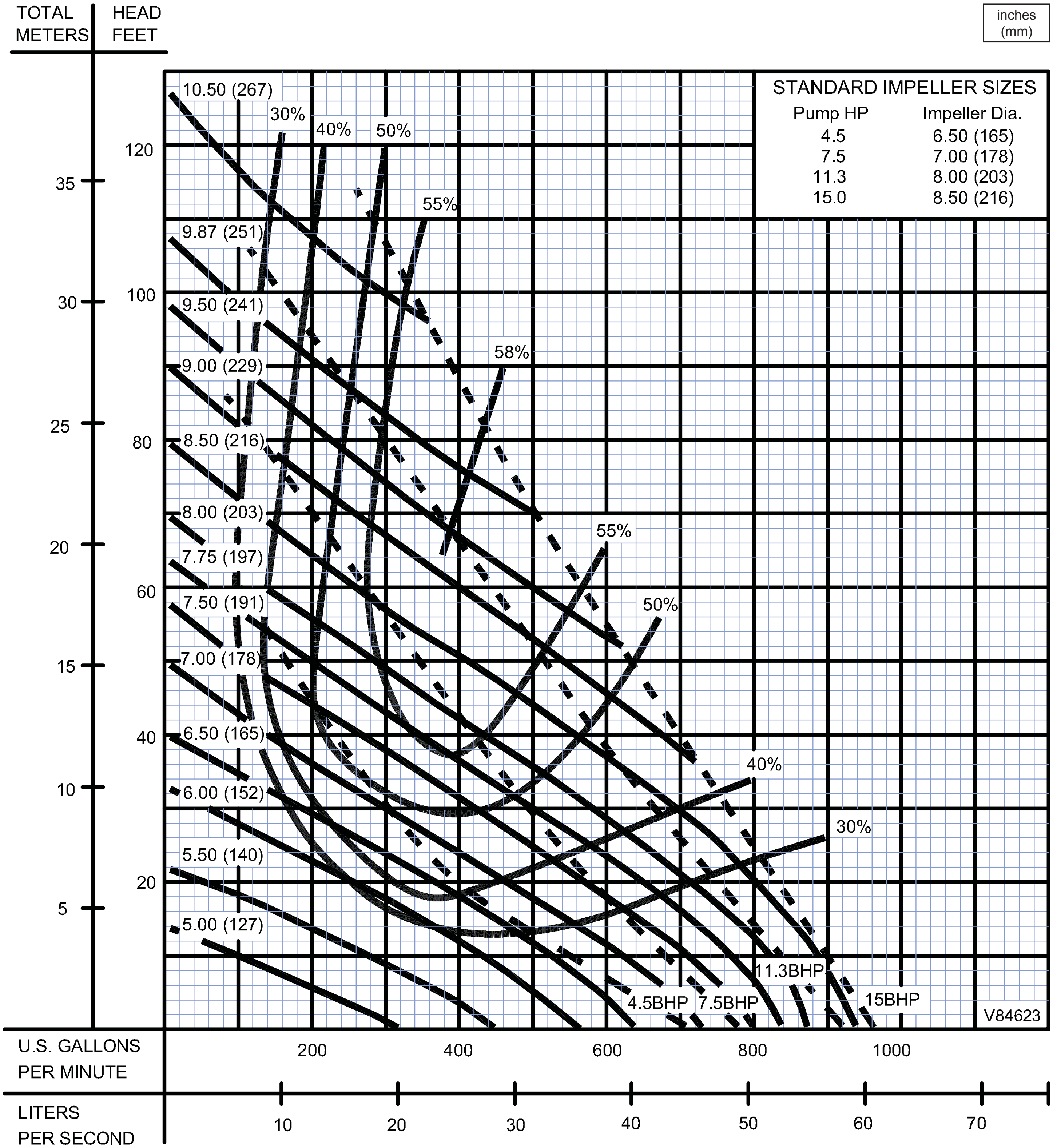

STANDARD IMPELLER SIZES

Pump HP	Impeller Dia.
4.5	6.50 (165)
7.5	7.00 (178)
11.3	8.00 (203)
15.0	8.50 (216)

Testing is performed with water, specific gravity 1.0 @ 68° F @ (20ºC), other fluids may vary performance

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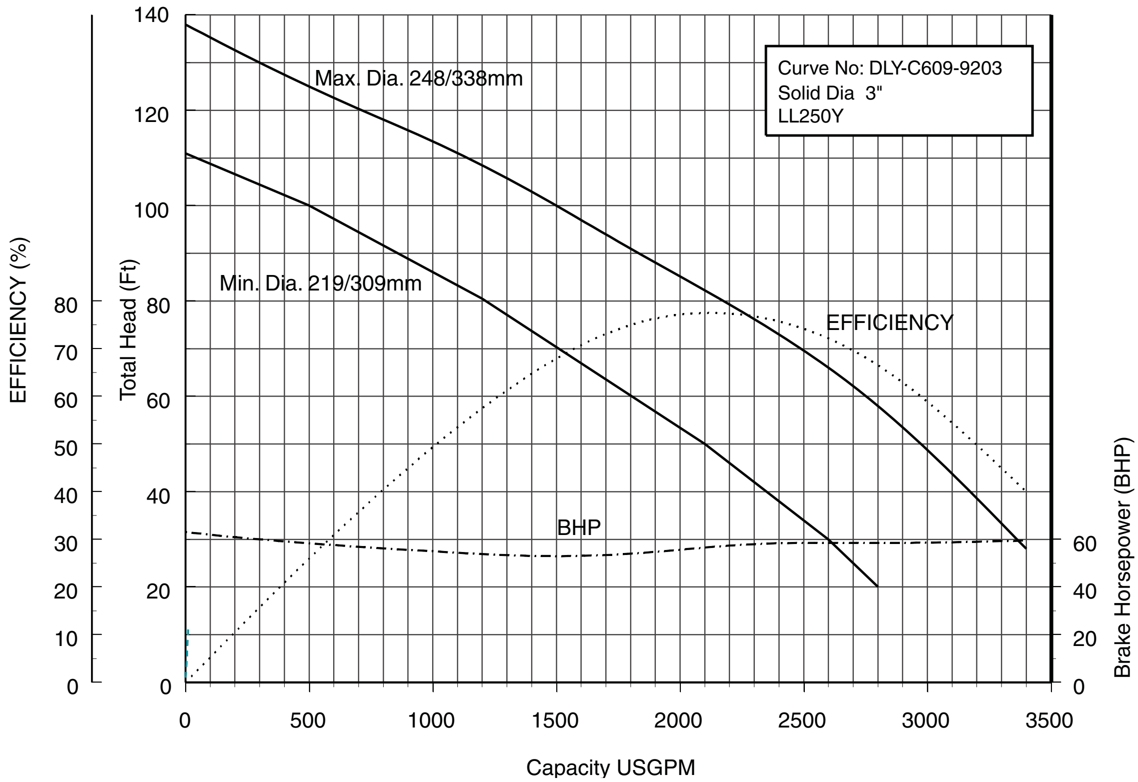
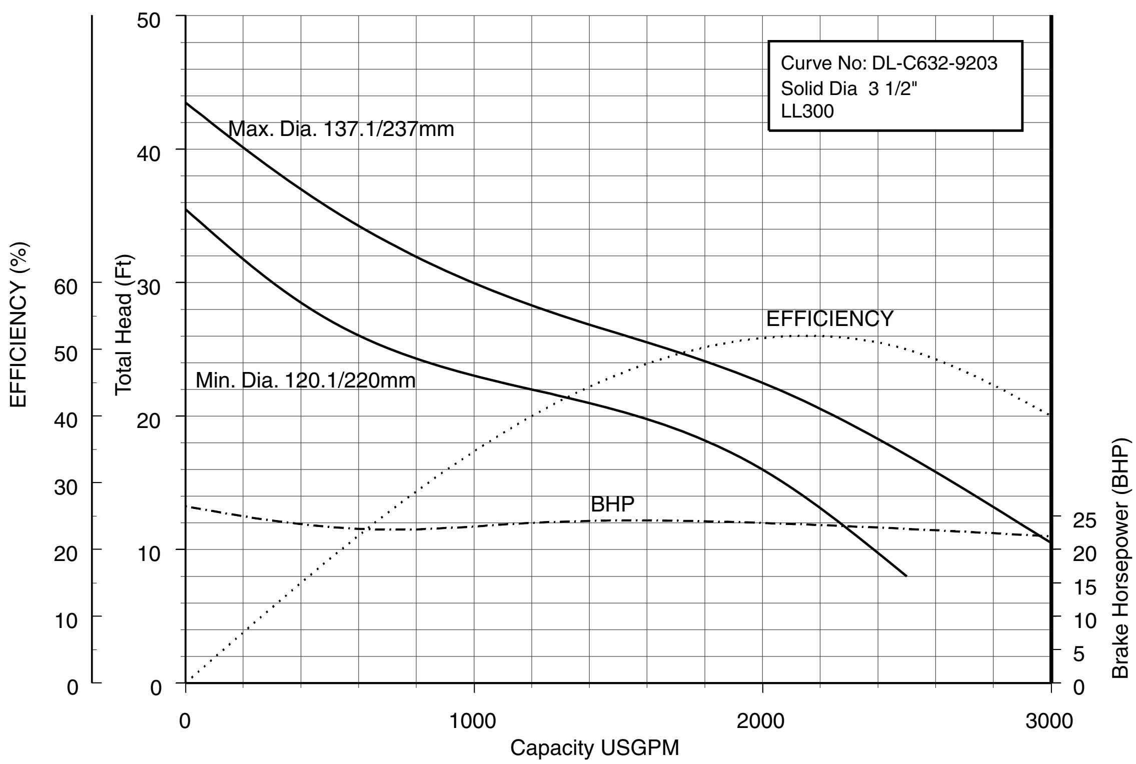
Performance Curves

Project:	GPM:	TDH:	EFF:	HP:	Chk'd:	Date:

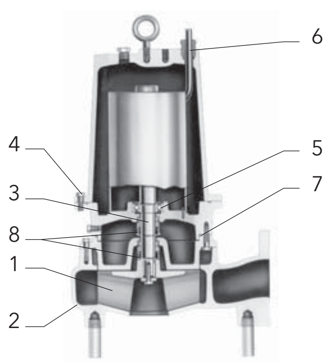
250DLF645 (60HP) Synchronous Speed: 1800 RPM — 10 inch Discharge



300DLF618 (25HP) Synchronous Speed: 1800 RPM — 12 inch Discharge



MATERIALS OF CONSTRUCTION



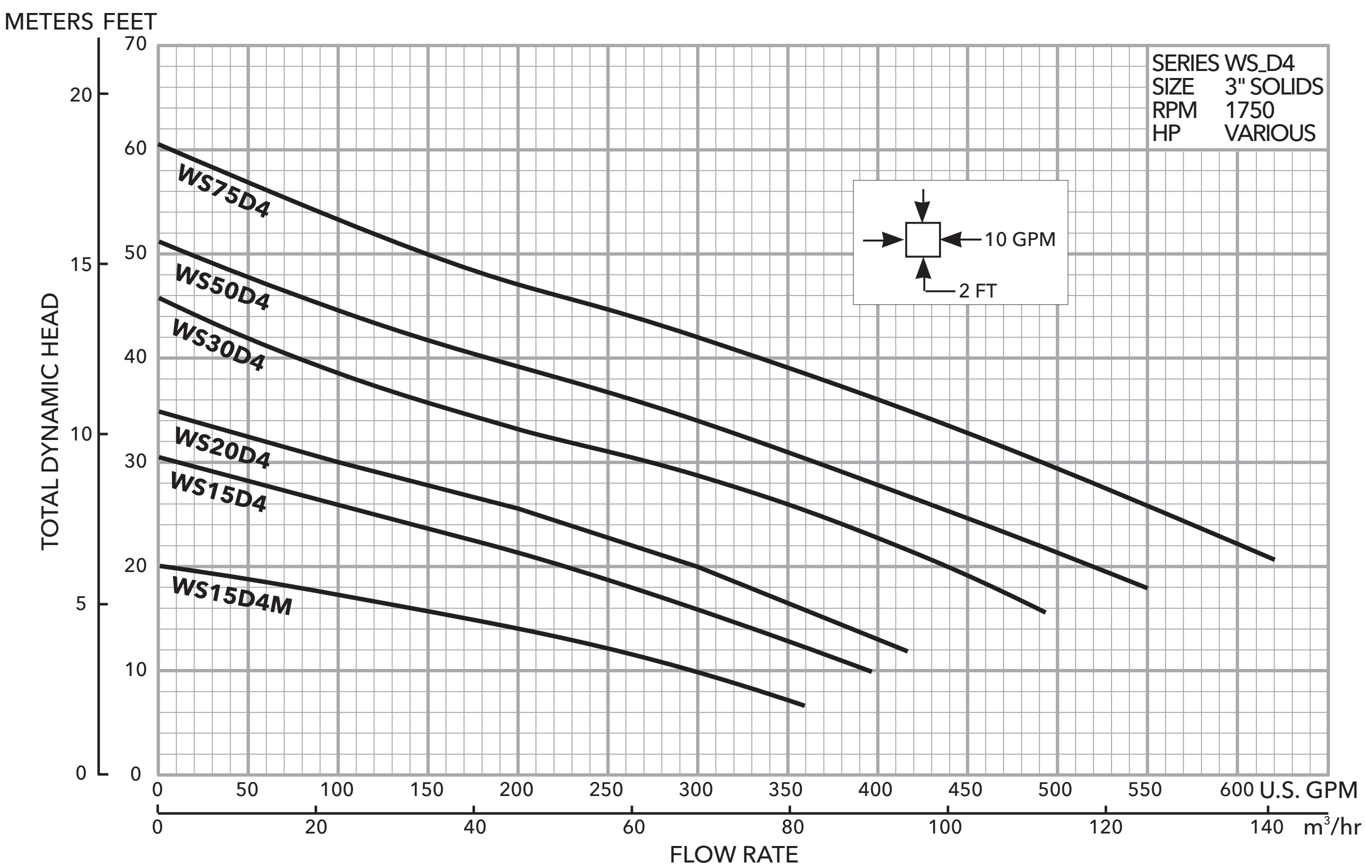
Item No.	Part Name	Material: Standard	Material: Optional
1	Impeller, non-clog	1003	1179
2	Casing	1003	
3	Shaft-keyed	300 Series SS	
4	Fasteners	300 Series SS	
5	Ball bearings	Steel	
6	Power cable	STOW, 20 feet	Additional lengths
7	O-ring	BUNA-N	

Item No.	Outer Mech. Seal	Service	Rotary	Stationary	Elastomers	Metal Parts
8	OPT	Heavy duty	Silicon Carbide	Tungsten Carbide	BUNA-N	300 Series SS
	STD	Mild abrasives	Silicon carbide		BUNA-N	300 Series SS

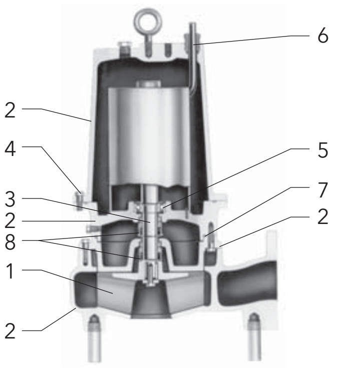
Material Code	Engineering Standard
1003	Cast iron – ASTM A48 Class 30
1179	Silicon bronze – ASTM C87600

PERFORMANCE RATINGS (gallons per minute)

Series No. ▶		WS15D4M	WS15D4	WS20D4	WS30D4	WS50D4	WS75D4
HP ▶		1½	1½	2	3	5	7½
RPM ▶		1750					
Total Head Feet of Water	10	300	395				
	15	170	320	370			
	20		230	300	440	520	
	25		120	205	365	440	
	30			100	270	360	510
	35				160	275	440
	40				80	175	355
	45					85	260
	50						155
	55						80



MATERIALS OF CONSTRUCTION



Item No.	Part Name	Material: Standard	Material: Optional
1	Impeller, non-clog	1003	1179
2	Castings	1003	
3	Shaft-keyed	300 Series SS	
4	Fasteners	300 Series SS	
5	Ball bearings	Steel	
6	Power cable	STOW, 20 feet	Additional lengths
7	O-ring	BUNA-N	

Item No.	Outer Mech. Seal	Service	Rotary	Stationary	Elastomers	Metal Parts
8	OPT	Heavy duty	Silicon Carbide	Tungsten Carbide	BUNA-N	300 Series SS
	STD	Mild abrasives	Silicon carbide		BUNA-N	300 Series SS

Material Code	Engineering Standard
1003	Cast iron – ASTM A48 Class 30
1179	Silicon bronze – ASTM C87600

PERFORMANCE RATINGS (gallons per minute)

Series No. ▶	WS15D3M	WS15D3	WS20D3	WS30D3	WS50D3
HP ▶	1½	1½	2	3	5
RPM ▶	1750				
Total Head Feet of Water: 10	160	300			
15	90	260	320		
20		210	280	350	435
25		160	235	310	400
30		100	185	265	360
35			130	210	325
40			60	160	280
45				100	230
50					170
55					115
60					60