

REHABILITATION OF A STORM WATER RETENTION BASIN AND PUMP STATION¹

by

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Abstract: An area of tidal lands along San Francisco Bay was mined previously for sand and gravel to provide aggregate materials for the construction of military bases and highways. As the area became urbanized the quarries encountered difficulty operating within increasing environmental regulations. The land values increased and many operations were re-developed for residential and commercial construction. Drainage of storm water to prevent flooding and inundation was provided through the creation of drainage assessment districts. The districts are funded by assessing special taxes on properties within the district. This paper focuses on a situation at a specific site that has been negatively impacted by the operation and management of the drainage facility.

The district constructed a drainage system of stormwater sewers, canals, a detention basin and pump station. Following construction of the facilities insufficient maintenance of the system has resulted in inundation of private properties. The properties contained land previously classified as upland, which now has become wetland and as such comes under the jurisdiction of the U.S. Army Corps of Engineers and attendant regulatory controls. Development of the property is also hindered by public sentiment over the "new" wetlands. The property owner filed suit against the drainage assessment district claiming unlawful taking of the land. In settling the lawsuit an effective rehabilitation plan was designed by engineers representing the assessment district and the property owners to solve the problem of excessive sedimentation and ineffective pumping. Excavation was initiated recently and the project is proceeding. A series of drawings and photographs of the dredging operations and installation of an auxiliary pump system will be provided.

Additional Key Words: drainage, wetlands, quarry

Introduction

The subject of this paper is an area of reclaimed tidal lands along San Francisco Bay in the city of San Rafael in Marin County, California (Figure 1). A large parcel of land (300 acres) was to be improved by construction of roads including a large interstate highway. The configuration of the land included steep hillsides and marshy lowlands that were subject to occasional tidal inundation. Local government agencies determined that a drainage system was required to prevent flooding and inundation of highways, infrastructure, and private land. A Drainage Assessment District was created and funded by assessing special taxes on properties served by the

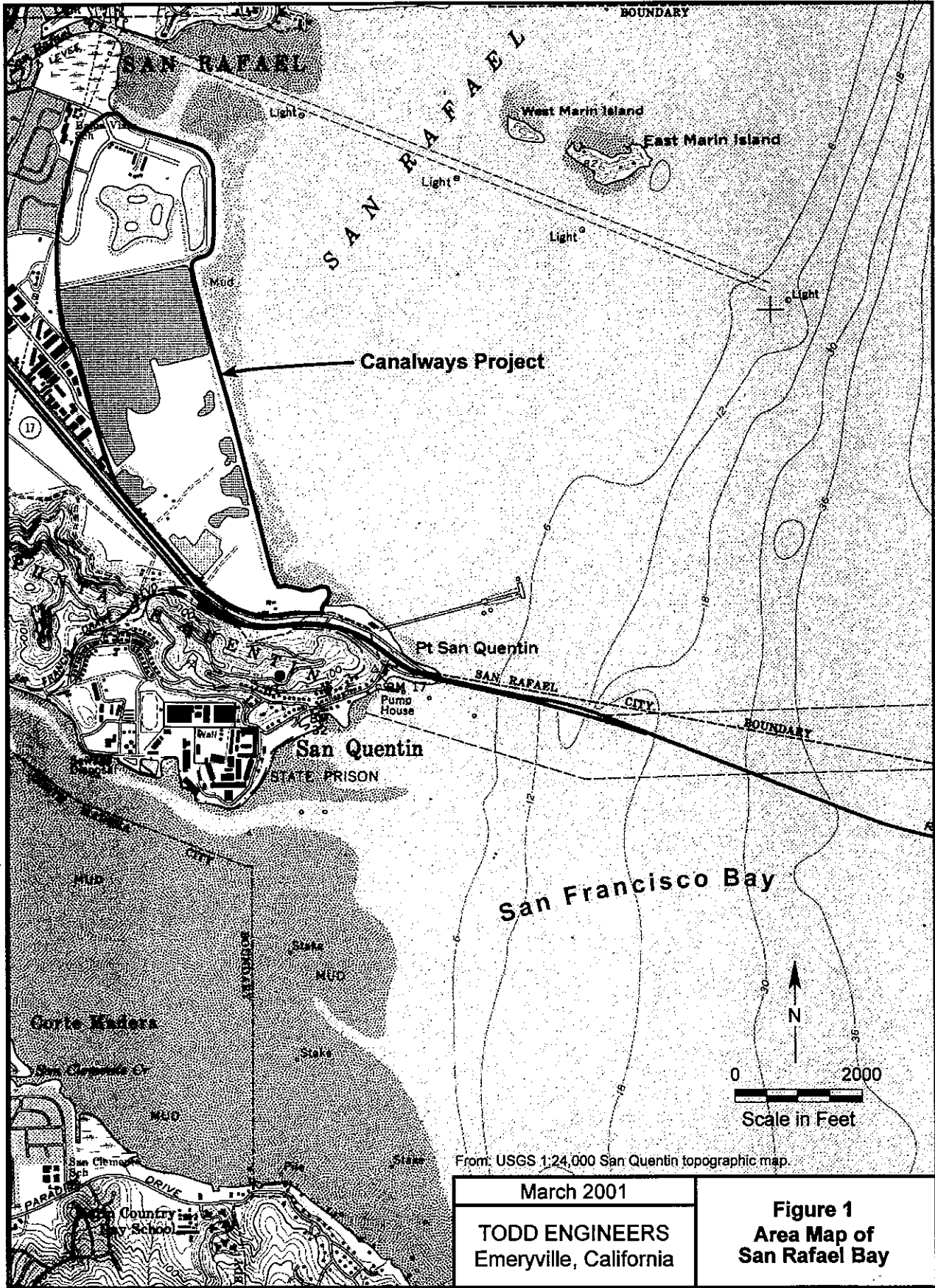
District. The District constructed a drainage system of stormwater collection sewers, canals, a detention basin, and pump station. The system was constructed, assessments were initiated, and taxes collected on an annual basis (Figure 2).

One large 100 acre property referred to as Canalways is immediately adjacent to one of the drainage canals, the retention basin, and pump station. Following completion of the drainage system and operation for several years, siltation of the canals and retention basin has reduced greatly the capacity of the basin to retain stormwater. In addition, maintenance problems at the pump station resulted in inconsistent and inefficient pumping operations.

As a result of these two problems adjacent lands have become flooded again and subject to long periods of inundation (Figure 3). Portions of the property that were previously classified as uplands have now become wetlands, and thus come under the

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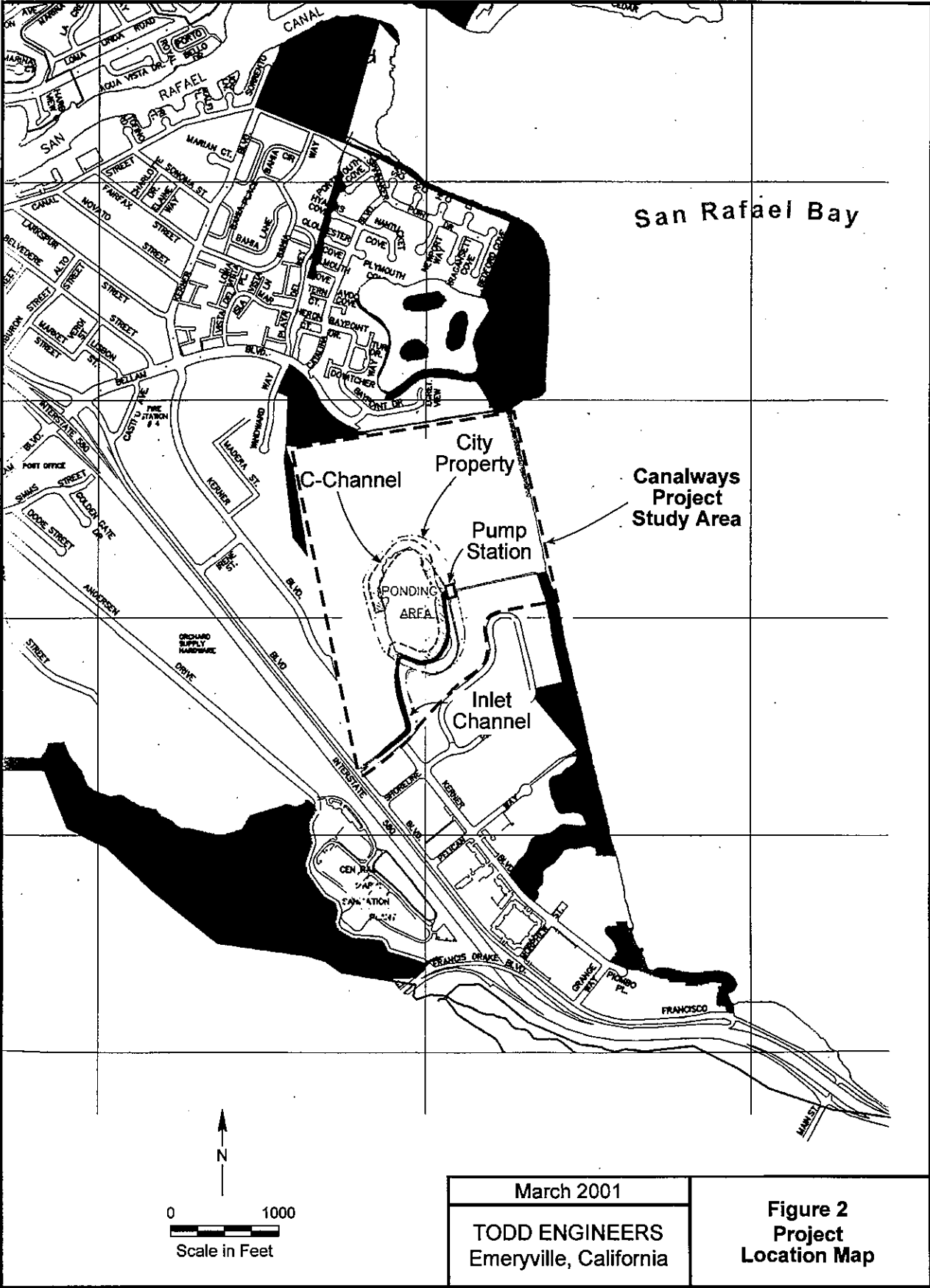




Figure 3. Inundated land north of pump station



Figure 4. Wetland vegetation

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jurisdiction of the U.S. Army Corps of Engineers and attendant regulatory conditions and controls. Development of the property is also hindered by public sentiment over these "new" wetlands (Figure 4). The owners of Canalways filed suit against the District claiming unlawful taking of the land.

Evaluation of the Problem

Todd Engineers was retained as consulting engineer by Canalways to evaluate hydrologic conditions, specify causes of the problems, and subsequently to work with District engineers and consultants to identify solutions. Design drawings of the retention basin and pump station were obtained from the District. Topographic contour maps and precipitation data were obtained from the City of San Rafael.

A water balance was conducted to determine the volume of stormwater generated that was discharged to the retention basin for selected return frequency storms. The results of those studies indicated that the as-built drainage canals and retention basin had sufficient capacity to accommodate storms up to 100 years return frequency.

A series of piezometers had been installed around the perimeter of the detention basin and groundwater elevation measurements were collected. The data indicated a very shallow groundwater table, varying in depth from one foot to a maximum of three feet, even during the dry summer and fall months.

Topographic surveys of the retention pond floor and adjacent banks were conducted by the

District civil engineers to prepare topographic contour maps. Examination of topographic data revealed that the entrance canal and basin had become filled with sediment to a depth of several feet, greatly reducing the storage capacity for storm water runoff (Figure 5). A study of the original pond design floor elevations compared to the current conditions showed accumulated sediment accumulation of about 5,000 cubic yards. An excavation plan was proposed to remove the accumulated sediment using a dragline and haul the sediment offsite for use as fill to repair damaged levees.

Examination of the pump station engineering drawings, specifications, and pump actuation control system revealed that the pumps had sufficient pumping capacity to perform as designed. The two pumps each have a rated installed capacity of 50 cubic feet per second (22,442 gpm) for a system total capacity of 100 cubic feet per second (44,884 gpm) (Figure 6).

Pump motor actuation was controlled by pressure transducers set to start the lead pump at water elevation of 4.16 feet below mean sea level and to turn off when the water elevation dropped to 4.60 feet below sea level. The lag pump was set to start when the water surface had been lowered one half foot (Figure 7). It was determined that the actuator settings were allowing high water elevations in the pond because the settings were too high. Discussions with the pump manufacturer also indicated that the pump intakes could be lowered as much as two to three feet without cavitation. Lowering the actuation levels allowed lower pond water elevation.

Pond capacity calculations were made for one-foot water level increments. The capacity of the pumps compared to the pond capacity revealed that at shallow pond depths the pumps were subject to cycling on and off at an unacceptable frequency. High cycling frequencies damage controls and pump motors. Therefore a lower capacity (600 gpm) auxiliary pump could be installed in the wet well to operate at lower pond water levels. This modification would allow the pond water elevation to be lowered even further.

Results

Following a series of meetings and exchange of alternative design configurations of the retention pond and modifications to the pump station the following plans were agreed to.

- 1) The pond and entrance canal would be excavated to remove accumulated sediment.
- 2) The intakes of both primary pumps would be lowered and the controls reset to start the pump motors at a lower water elevation.
- 3) An auxiliary submersible pump would be installed to operate at lower pond water elevations.

Conclusions

As a result of the cooperation between the District engineers and those representing Canalways a solution was found to the flooding and inundation of Canalways land and that of other adjacent property owners. A settlement agreement was negotiated to avoid litigating at trial. The excavation of the detention basin pond has been completed (Figure 8) and the modifications to the pump station are scheduled to be performed in the near future (Figure 9), thus completing a successful rehabilitation project.



Figure 5. Sedimentation of detention basin

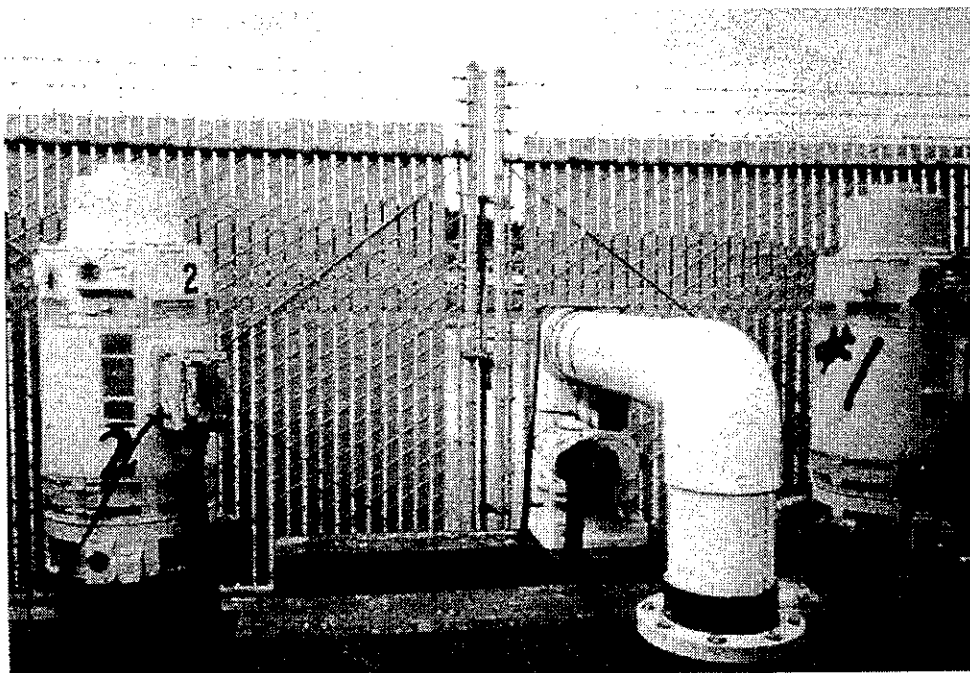
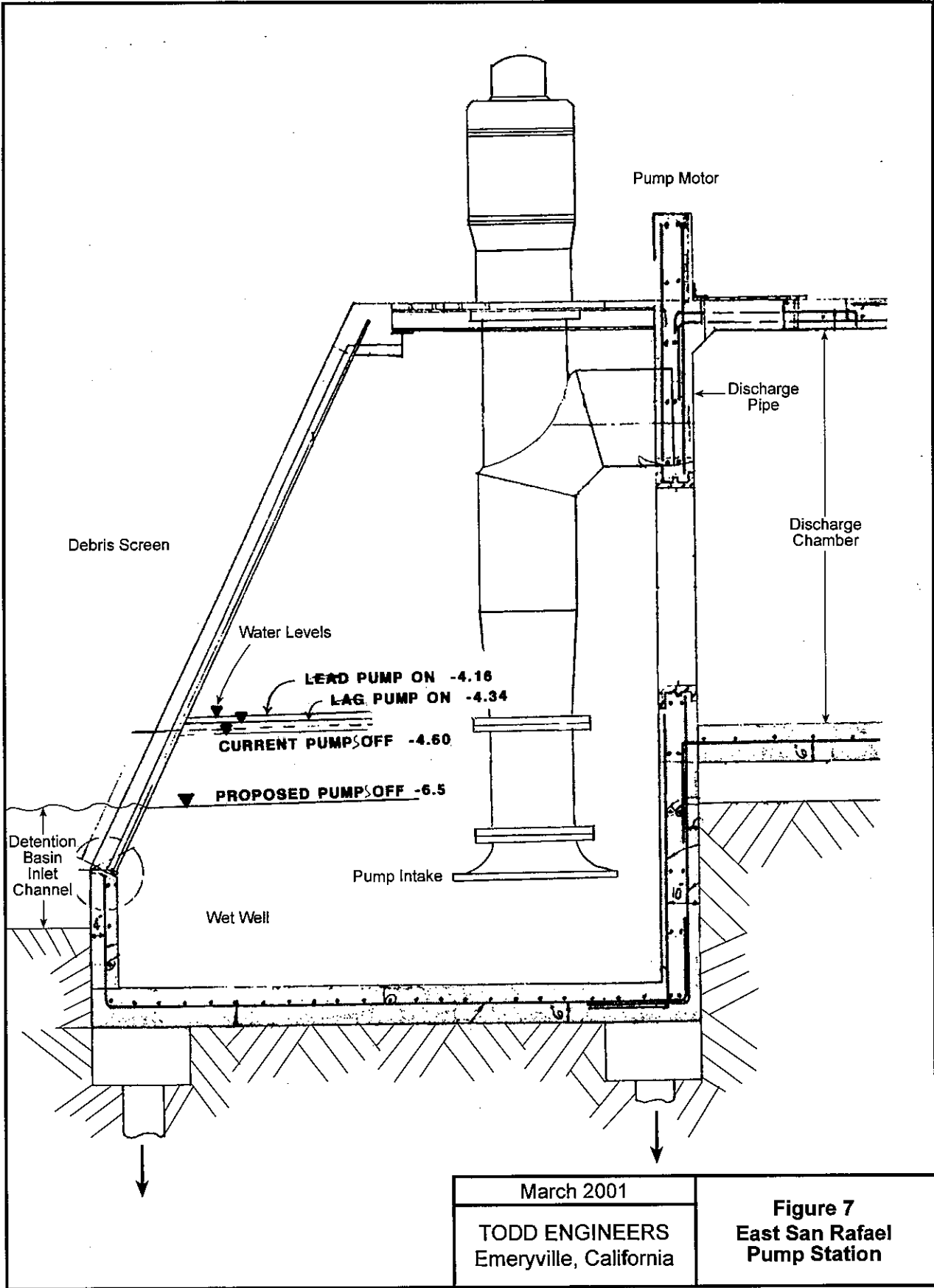


Figure 6. Pump motors

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Figure 7
East San Rafael
Pump Station



Figure 8. Excavation of detention basin inlet canal showing pump station in background



Figure 9. Pumpstation showing inlet canal

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