ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

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Engineering Evaluation of the Main Water Quality Control Plant Stockton, California

NATIONAL FIELD INVESTIGATIONS CENTERS
DENVER, COLORADO AND CINCINNATI, OHIO

DECEMBER 1974

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INTRODUCTION

On October 30, 1974, Region IX, USEPA, requested technical assistance from the National Field Investigations Center-Denver (NFIC-D) in the interim audit of the Stockton, California Main Water Quality Control Plant. An engineering evaluation of the design and construction methods was requested in a memorandum to the Regional Administrator, October 18, 1974, from the Manager, Western Area Audit Group (See Appendix).

EPA Grant No. C060695, the subject of the audit, covers the enlargement and modifications of existing treatment facilities. The total cost of the project was $15.2 million ($8.3 million Federal funds). Six contracts were awarded under this grant; three contracts have been completed and three are in the active status. The areas where technical assistance was requested and the contractors involved include:

Project	Construction Contractor
Sludge Lagoons	C. N. Peterson Co.
Trickling Filter Modifications	Caputo-COAC
Building Additions and Modifications	C. S. Plumb

The City of Stockton retained the consulting engineering firm of Brown and Caldwell to provide (1) design services, (2) inspection and construction, (3) preparation of O&M Manuals, and (4) miscellaneous assistance. The engineering firm was given the responsibility for managing the project.

This report represents the results of the engineering investigations conducted by NFIC-Cincinnati and NFIC-Denver personnel. The conclusions herein represent our best engineering judgement. The report deals specifically with the questions listed in the memo of October 18.

SUMMARY AND CONCLUSIONS

The Western Area Audit Group asked specific questions concerning construction practices, design errors, plant operating problems, structural integrity, validity of change orders, and whether approved plans and specifications were followed. The detailed discussions of the specific questions are contained in ENGINEERING EVALUATIONS; the conclusions from the investigations are summarized below.

A. Sludge Lagoons

The construction of the lagoons was accomplished according to specifications. The telescoping weirs do not function as designed and leak excessively. The consultant engineering firm specified an allowable clearance between the weir and the riser unit; the contractor did not fabricate the weirs to these specifications. The City will have to correct the problem at their expense.

The existing sludge drawoff suction line cleanouts were installed according to specifications, however the lagoons must be drained before they can be used. Draining the lagoon in order to utilize a cleanout does not constitute a good design, and a safety hazard remotely exists since isolation valves were not included upstream of the cleanouts. There is also a potential for back siphonage of lagoon contents into the City water supply through the sludge piping system (Detail J/G3, contract drawing G3).

The sump pump in the sludge pumping station should be capable of pumping 60 gpm against a head of 20 feet as required in the specifications, based on our calculations. A pressure test on the pump discharge piping should be conducted to verify if the pump is capable of discharging at the specified 20 feet of head at 60 gpm. The most cost effective original design should have had the sump pump discharge back into the lagoon rather than into the supernatant withdrawal piping.

Coning occurs when the sludge is pumped from the lagoon. No instrumentation or visual aids such as a sludge density meter or sight glasses were included to permit the operator to know when coning occurs.

Dredging is the most effective method of removing sludge from the lagoons since the suction port can be moved to the solids, thus eliminating the coning effect. However, operating and capital costs for such systems are higher.

The seven change orders for the sludge lagoons and the 43 change orders for trickling filter modifications are currently being evaluated by the California State Water Resources Control Board and a report will be issued to the audit group. A parallel investigation by NFIC personnel would be redundant at this time. It is proposed that NFIC review the completed report and submit comments to the audit group.

B. Trickling Filter Modifications

With the exception of specific items discussed below, it is our conclusion that the construction work was accomplished in accordance with approved plans and specifications.

The leakage experienced in the walls of trickling filter No. 4 was the result of basic design error complicated by "hurry up" construction techniques to make the filter operational for the 1973 canning season.

There is no reason to believe that trickling filters Nos. 5 and 6 cannot be operated to full capacity. The filters may not be operated at maximum capacity at all times due to energy costs required to lift the wastewater to the top of the filters; a portion of the wastewater is treated in the three 6-foot depth trickling filters. It would appear that the leakage now experienced in the walls of filters Nos. 5 and 6 will not be as great as in filter No. 4.

The effluent leakage through the filter walls could have the effect of attacking and leaching the mortar joint to the point where only the silicon remains. The wetting and drying of the rebars exposed to oxygen would accelerate corrosion of the bars and weaken adherence between concrete grout and the rebars. However, this could take a number of years before it would significantly affect the structure. The existing foundation will withstand the additional weight of the concrete blocks resulting from the effluent leakage.

Concrete blocks as specified in this contract are not noted for their ability to withstand absorption. At the time of the original design, the concrete block construction was probably the least costly alternative.

The "thudding" noise occurs in the two 30-inch check valves installed on the discharge pipes from recirculation pumps. The possible causes for the noise and vibration problems include improper installation, insufficient spring tension, and improper design of the structure. The problem should be corrected before structure fatigue occurs.

Pump operational problems and the determination of who will correct the problems are currently being negotiated by the pump suppliers and the consulting engineers. The consultants suspect that the pumps were supplied with the wrong pitched impellers. Pump No. 5 draws approximately 15 amperes more than pump No. 6. If the current drawn exceeds the rated amperage, the circuit breaker will disengage. Any modification to the circuit breaker to increase the amperage above the rated amperage will decrease the motor life. If the problem is not corrected soon, the increased amperage will break down the insulation in the motor and it will have to be replaced.

If the doors of the main electrical substation are left open and access to unauthorized personnel is not controlled, then both State and Federal safety requirements are being violated. Equipment deterioration due to dust and moisture will occur.

The walls of filter No. 4 did have numerous open mortar joints. Corrective action has been delayed until a decision is reached on the wall leakage problem. The exterior wall surfaces of filters Nos. 5 and 6 had full joints. The interior walls below the filter media could not be inspected.

C. Building Additions and Modifications

After review of the concrete specimen data, those that failed and those that passed specified criteria, it is concluded that the poured concrete now meets the strength requirements. The maintenance building will not be structurally affected by retention of the manhole adjacent to the building.

An 80% compaction vs a 95% compaction on the sandy material underneath the sewer pipe should have relatively little effect on the pipe.

The brick veneer on the operations building is for aesthetic purposes. Since the cavity between the brick and existing wall is grouted to a height of 8 feet, it should prevent any movement if a vehicle hits it. The reduced grouting above the 8 ft. height should present no safety hazard.

METHODS OF INVESTIGATION

An on-site inspection of the treatment facilities was made on November 21, 1974 by Victor Jelen, NFIC-Cincinnati, David Brooman, NFIC-Denver, and Barrett Benson, NFIC-Denver. Treatment plant personnel were interviewed on November 22 from 8:30 am to 11:30 am to ascertain the exact nature of operating problems experienced with the sludge lagoons and trickling filters. Representatives of the City and Brown and Caldwell were interviewed and construction records examined from 11:30 to 6:30 pm on November 22. Personnel present included:

Mr. Thomas J. Dosh, Director of Public Works, Stockton;
Mr. Art Vieira, Superintendent, MWQCP, Stockton;
Dr. David Caldwell, President, Brown & Caldwell;
Mr. Albert R. Huff, Area Supervisor, Brown & Caldwell;
Mr. Paul J. Kramer, Resident Engineer, Brown & Caldwell;
Mr. Frank Wilson, Assistant Resident-Engineer, Brown & Caldwell;
Mr. Victor Jelen, NFIC-C;
Mr. David Brooman, NFIC-D;
Mr. Barrett Benson, NFIC-D.

Two inspectors, Mr. Jose Casillas and Mr. Mike Pooley, were also interviewed by NFIC personnel, from 7 pm to 10 pm on November 22.

In all interviews, the discussions were limited to the areas listed in the October 18 memo.

ENGINEERING EVALUATIONS

The evaluations are divided into three sections, Sludge Lagoons, Trickling Filter Modifications, and Building Additions and Modifications. Each specific question raised by the auditors is stated and is followed by the discussion.

A. Construction of Sludge Lagoons

Question No. A-1

"During the course of our audit, several operational problems concerning the sludge lagoons have been brought to our attention. We therefore would appreciate an independent technical determination as to whether the construction work completed on the sludge lagoons is acceptable and has been accomplished in accordance with the approved plans and specifications."

Discussion

With the exception of the difficulties with the telescopic weirs (Question A-2), the capacity of the pump station sump pump and the repair of malfunctioning variable speed drive controls on the sludge pumps (Question A-4), the construction work completed on the sludge lagoons was accomplished in accordance with the approved plans and specifications.

The major operational problems encountered to date with these lagoons are attributable to poor quality control in the construction of the telescopic weir assemblies and inherent problems with the removal of thickened sludge from the lagoon bottom. The weir assemblies may possibly be remedied in the field by the City. If these remedies do not solve the problem, a redesign may be required. The sludge removal problems are more complex.

Sludge removal, pumping, and transport is a major engineering challenge. Digested sewage sludge, if allowed to settle for a sufficient period of time, will separate into two distinct phases, a liquid or supernatant layer, and a concentrated solids layer. Influent digested sludge from the digester to the lagoons would normally have a solids concentration in the range of 3.5 to 4.5%. Although no data was available for review, it could be expected that the solids concentration at the lagoon bottom and in the sludge drawn off through the sludge suction piping would be in the range of 8-10%. The increased solids concentration causes the concentrated sludge to act like a viscous mass rather than a fluid. It is more difficult to pump, has thioxotropic properties which cause it to react like a gel, and will assume a natural angle of repose under water. The latter property causes it to deposit in banks under the supernatant surface rather than to flow evenly in the lagoon to form a layer of equal thickness. It also causes coning at submerged suction lines (discussed in Question A-4).

To overcome the sludge property of natural angle of repose, sludge containment vessels (e.g., digesters) are often constructed with conical bottoms with drawoff piping near the cone apex. In the interviews with the consulting engineers, the use of steep lagoon sides was discussed. The consultants said that this sort of design was considered, but rejected due to excessive ground water contamination problems, a reasonable explanation considering the proximity of the San Joaquin River to the plant site. They designed multiple withdrawal pipes (four per lagoon) to offset the coning problems. It is questionable whether this approach is totally satisfactory since the coning effect is localized near the suction pipe opening. New sludge added to the lagoon will fill in these coned areas and be removed during the next pumping cycle. The old, established sludge will not reach the cone influence area. The effective sludge residence time in the lagoon is thus effectively reduced.

To overcome these problems some municipalities utilize actual mobile dredging equipment for removal of concentrated sludge from lagoons. The Metropolitan Sanitary District of Greater Chicago has over 200 acres of sludge lagoons in Fulton County, Illinois. A commercial river channel dredge is used to remove the concentrated solids from the lagoons. Dredging is the most effective method of removing the concentrated sludge from lagoons because the suction port can be moved to the solids rather than attempting to make the solids flow to the suction port. The operating and capital costs for such systems are, of course, higher.

Question No. A-2

"Visual observations and discussions have indicated that the telescopic weir in one of the sludge lagoons was not operating properly. We would like to have the extent of this problem reviewed. If possible, we would also like technical comments as to the cause of the problem and a determination as to who has the responsibility to correct it."

Discussion

1. There are two digested sludge holding lagoons. The west lagoon is designated Lagoon No. 1 by plant personnel, the east lagoon, Lagoon No. 2. Each lagoon has two digested sludge inlet pipes, four digested sludge drawoff pipes, and two supernatant drawoff pipes. The telescopic weirs in question (four total) are located on the supernatant drawoff piping systems.

Detail A/G5, Contract Drawing G5, (Appendix) illustrates the design of the four telescopic weir units. The discharge weir unit has a specified outside diameter of 29-7/8 inches and is to fit inside a riser pipe with an inside diameter of 30 inches. A fabrication note on Section 1/G5 specifies that the weir and riser pipe should be "Fabricated for uniform clearance of 1/16" plus or minus 1/32" over the entire circumference." This tolerance is apparently specified to permit the weir to move within the riser pipe without binding and yet minimize the leakage between the two components when the weir unit is positioned above the minimum adjustable height.

The function of all of the telescopic weir units is to maintain the water surface elevation within the lagoons at any level between El.94.0 and El.98.0. During normal plant operating periods, the lagoons may be operated at a reduced level (e.g., near El.94.0) to provide additional volume for digester upsets, increased digested sludge volumes from seasonal loads, etc. as they occur. As the sludge blanket in the lagoons increases, for instance during the rainy season when the sludge drying beds cannot be loaded heavily or frequently, the lagoons may be operated at higher elevations to maintain the desired sludge solids/supernatant layer separation. Also, by positioning the two weirs in a given lagoon at different elevations, the flow pattern through the lagoon can be changed, withdrawing supernatant from either the northeast or southeast corner of the lagoon.

This operational flexibility is dependent on the weirs not leaking appreciable quantities of water through the annular space between the weir unit and the riser pipe. When such leakage does occur, and the leakage rate exceeds the lagoon influent rate, it becomes impossible to maintain the lagoon surface elevation above El.94.0, the top of the riser pipe, by use of the telescopic weirs.

During the site inspection, the tops of the telescopic weirs in Lagoon No. 1 were at elevations approximately 3" (NE weir) and 9" (SE weir) above the lagoon water surface. If at least one of these weirs was leaking, then this weir/lagoon surface elevation discrepancy would exist. Conversely, if both weirs were watertight, then the lagoon level should have been at the elevation of the NE weir provided that (1) evaporation and concentrated sludge drawoff rates did not exceed digested sludge influent rates and (2) the weirs were not raised to higher elevations just prior to the inspection.

Both weir assemblies in Lagoon No. 2 were totally submerged during the site inspection. This situation results when both valves are closed on the 8" supernatant drawoff lines downstream from the telescopic weirs. Since the weirs were submerged, visual examination of their leakage potential could not be made. Discussions with plant operating personnel have verified that all four telescopic weirs leak excessively and that it was necessary to install the above-mentioned valves to control the lagoon elevations and discharge flow rates.

The cause of the problem appears to be one of poor fabrication of the weir units and/or the riser pipe units. The 1/16" ± 1/32" allowable clearance between the weir and riser units was apparently not met.

The contractor (C. N. Peterson Company) tried to correct the weir leakage problem with gaskets previous to the installation (by the City) of the valves. These gaskets failed and caused operational problems due to binding. The City plans to weld a stainless steel cap ring onto the riser pipe. This ring will have an inside diameter 1/8 inch larger than the field measured outside diameter of the corresponding weir unit. Post modification testing of the individual weirs will determine if the leakage problem is sufficiently reduced to eliminate further design modifications. It is our understanding that the City will bear the expense of the cap ring modification since the contractor paid the City for the installation of the valves. In our opinion, if the modifications achieve the specified 1/16" ± 1/32" clearance between the ring cap and weir, the contract requirements will be satisfied.

In the design of a similar telescopic weir assembly for the trickling filter modification contract at Stockton, the consulting engineer called for three O-ring gaskets on the riser pipe unit (Section 2/M2, Contract Drawing M2). These gaskets form a seal between the weir and riser units. The detailer did not specify clearance tolerances for this telescopic weir unit, nor did he even specify the weir outer diameter or length. Gasket composition and method of attachment are also not specified.

If the ring cap modifications for the lagoon telescopic weirs do not solve the leakage problem, the consulting engineer should be brought to task for improper design and required to change the weir design to solve the problem.

Question No. A-3

"It was observed that the clean-out valves for the sludge lagoons were located in the pump station which were considerably below the lagoon water level. It was explained that the pumping station would be flooded if the clean-out valves were uncapped. In addition, it was suggested that the cleanouts served no useful purpose since the lagoon would have to be drained before any clean-out work could be performed. We would like a technical determination as to whether clean-out valves are usable without creating a safety hazard to personnel in the pumping station. If this is a problem, we would appreciate a determination as to whether it was attributable to a design error or to the quality of construction and how it can be corrected".

Discussion

The plan view and section 1/M1 of the sludge pumping station are from Sheet M1 of the contract plans and specifications (Appendix). The eight 8-inch diameter pipes pass through the east and west walls of the pump station (four pipes through each wall) at a centerline (℄) elevation of 85.00. These eight pipes are the sludge drawoff pipes from lagoons 1 and 2. Just inside the station walls, each pipe is connected to an 8-inch diameter pipe Y with a victaulic cap and coupling on the Y leg.

These Y's were designed for use as clean-out ports in case the sludge drawoff pipes should become severely clogged. The existing sludge suction line cleanouts were installed according to specifications.

Shut-off (isolation) valves were not specified <u>between</u> the clean-out Y's and the incoming sludge piping. Rather the shut-off valves were specified downstream from the cleanouts. Since the normal operating surface level of the lagoons is El.94.0 to El.98.0, the static pressure head which exists at the victaulic caps is computed as follows:

minimum static head = 94.0'-85.0'-1.5' (Sin 45°)

= 7.9 ft = 3.4 psig

maximum static head = 98.0'-85.0'-1.5 (Sin 45°)

= 11.9 ft = 5.2 psig

The column of water formed by the lagoon contents exerts a constant pressure (assuming the pipe is not plugged) of between 3.4 and 5.2 pounds per square inch on the clean-out caps. Since there are no isolation valves between the lagoons and the clean-out points, it is not possible to open the cleanouts once the lagoons are filled without the lagoon contents entering the pump station structure. However, if the particular pipe is clogged, lagoon material cannot flow in the pipe. If the pipe is severely clogged and a rodding tool is used to clean out the line via the clean-out port, once the obstruction is removed, the pressure head would force the lagoon contents through the pipe into the station.

As designed and installed, the clean-out ports cannot serve a useful purpose unless the particular lagoon is drained. Each of the victrauliccaps has been stenciled with a warning "DRAIN POND BEFORE REMOVING". Although the warning may deter an unfortunate mishap, it does not constitute a fail-safe situation. To drain the lagoon, it would be necessary to isolate it from service and transfer its contents via the station pumps to either the drying beds or the other lagoon. Alternately, the lagoon contents could be drained by portable pump to the other lagoon or to a landfill. The consulting engineers stated that the Y connections were only to be used for cleanouts once the lagoon was drained. The Y's would allow the operator to clean the pipe from either the station end or lagoon end without having to break into the pipe in the pump station. In our opinion, draining a lagoon to be able to utilize a cleanout does not constitute a good design and a safety hazard remotely exists since isolation valves were not included in the design.

Provisions were made by the design engineers to bring City water and compressed air to the pumping station structure. A two-inch water line is tapped into the lagoon sludge drawoff piping. It is common practice at treatment plants to use compressed air and/or water pressure to blow out sludge lines which are not excessively clogged. Plant personnel report that this technique has been already utilized with success on this piping. However, pressure gages should be installed on the backflush piping so that the operators can evaluate the back pressure being applied to the clogged pipe.

For a fail-safe design, the cleanouts should have been routed above the surface elevation of the lagoons or valved upstream. Due to the structural configuration of the pump station, it would be difficult to revise the existing piping to accomplish this. Also, since there are no isolation valves on the cleanouts, it would be difficult to connect extensions to the existing cleanouts without flooding the structure.

As a possible solution, a special cap and isolation valve could be installed on the leg of the Y and eliminating the vitraulic cap. The special cap would require packing around the cleanout port to allow use of a cleaning rod. However, since the cleanouts would only be used in rare instances, modifications are not warranted at this time.

Three items of concern about the air and water piping systems are listed below. One, no connection to an air supply is indicated on the drawings. Rather, the terminus of this pipe is indicated as a cap located near the existing City water hydrant (Detail J/G3, Contract Drawing G3). Two, a hose bib or coupling is not specified on the sludge suction piping which could be used for connection from the existing air line to the clogged sludge suction line. Three, a vacuum breaker in the 2" water line connection to the sludge piping is not indicated between the sludge-piping connection and the City water hydrant. A cross connection is thus developed by this design and the potential for back siphonage of lagoon contents into the City water supply does exist.

Question No. A-4

"Plant operating personnel commented that they were unhappy with operations of the sludge lagoon from several standpoints. One of these was that the sump pump was not able to effectively remove sludge. Another was that the pumping station was causing problems since it had a greater capacity than could actually be used. We would appreciate a technical evaluation of the validity of the above problems and how they can be corrected."

Discussion

Sump Pump - The sump pump referred to is located in the southwest corner of the sludge pumping station (Contract Drawing M1). Its function is not to pump sludge, but to remove from the station any spills, wash-up water, foundation leakage, etc. which may be collected by the floor drain system.

The discharge piping from this sump pump (pipe 3"SD) is routed overhead in the station, through the south station wall, under the berm roadway between the two lagoons, and tied in the 8" supernatant line from lagoon No. 1's southeast telescopic weir (Detail M/G3 on Drawing G4). The sump pump is thus supposed to discharge the station sump contents through this line to the 8" supernatant line which was originally designed for gravity flow.

The City has installed two 8" shut-off valves on the two 8" supernatant "gravity" lines. When these valves are closed, supernatant completely fills these 8" lines and the telescopic weir riser pipes up to the elevation of the lagoon surfaces (El 94.0 to 98.0). Therefore the sump pump must pump against a static head between 13.5 and 17.5 feet with the current operational mode. In the gravity mode, it would have had to pump against a static lift of approximately 11.5 feet. On page C38 of the actual contract specifications, the sump pump is specified as follows:

> "(2) <u>Pump</u>
>
> Sump pump shall be of the submersible motor-driven, non-clog type. Pump shall be capable of discharging 60 gpm against a total head of 20 feet when driven by a 4-pole motor of at least 2 horsepower. . ."

The specified pump, if operating correctly, should be capable of pumping against the maximum static head of 17.5 ft discussed above. Calculations for dynamic head (i.e., pipe and fittings resistance to 60 gpm flow) indicate a maximum dynamic head of approximately 2.5 ft. Therefore, if the sump pump was pumping 60 gpm against the static head of Lagoon No. 1 at maximum surface elevation of 98.0, the total pumping head should be approximately 20.0 ft., the specified pump head. Based on these calculations, the sump pump should be capable of discharging the sump contents (if the contents don't exceed 60 gpm) through the existing piping to Lagoon No. 1 via the southeast telescopic weir. A pressure test on the pump should be conducted to verify if the pump is capable of discharging against the specified 20 ft of head at 60 gpm.

A suggested alternate to the existing piping scheme is to run the discharge line to a discharge point above the surface of Lagoon No. 1 near the pump station. There is no reason that the sump contents cannot be returned directly to the lagoon. The discharge point should be at a point higher than the maximum lagoon surface elevation of El 98.0. If the pump is capable of discharging 60 gpm against 20 ft of total head, a static lift of 17.5 ft plus a dynamic head of < 2.5 ft (reduced from existing value because of reduced equivalent pipe length) should be no problem. Had the design engineer anticipated the non-gravity flow situation with the 8" supernatant line, he probably would have preferred to discharge the sump back to the lagoon in the original design. A question could be asked as to whether this alternate should not have been the most cost effective original design.

Capacity of Pumping Station - Direct questioning of plant operating personnel revealed no "pumping capacity" problems with the sludge pumping equipment. The pumping problems which were mentioned are as follows:

1) A vernier adjustment on the sludge pump motors was broken and hence the variable speed pumps were not variable. This item is on the contractors punch list and will be corrected before he is issued final payment.

2) The sludge pumps must be turned up to maximum speed before they will pump sludge from the basins. Digested sludge forms a dense, thixotropic mass when it is allowed to settle for a period of time. This mass would tend to form in and over the sludge suction piping after each pumping cycle. It is conceivable that the pumps must be turned up to maximum speed initially in order to free this obstruction and refluidize the sludge solids. This fact should be included in the plant operations manual. Once the sludge begins to flow however, it should be possible to reduce the speed of the pump to obtain the desired flow rate.

3) The sludge pumps will pump dense solids when first activated but soon the solids density falls off and eventually only supernatant can be pumped. This is not an uncommon occurrence when sludge is pumped from a containment via a fixed suction pipe. The phenomenon is called "coning". As the sludge over the pipe is pumped away, the sludge remaining in the vicinity of the pipe opening assumes its natural angle of repose instead of flowing as a liquid into the pipe. The result is an inverted cone of sludge with its apex at the pipe opening. When this occurs, supernatant breaks through and is drawn into the suction pipe diluting the sludge solids.

Each of the lagoons was designed with four drawoff pipes at different locations in the lagoon. When coning is detected with one drawoff pipe, the operator should switch to an alternate pipe location. No instrumentation or visual aids are included in the design to permit the operator to know when coning is occurring at a particular sludge drawoff pipe. Radio communication between men positioned at the sludge pump discharge at the sludge drying beds and the pump station operator could be established. However, this would tie up two men during the pumping operation. A sludge density meter and/or sight glasses could be provided to facilitate the detection of sludge coning.

Question No. A-5

"A total of seven change orders have been initiated under the C. Norman Peterson contract and approved by the resident engineer and the City. These change orders were not submitted to the California

State Water Resources Control Board (SWRCB) for approval until September 4, 1974, although some of the change orders pertained to work performed in later 1973. We would appreciate a technical determination of the acceptability of these change orders and a determination as to whether the work included on the change orders has actually been performed. In this regard, it should be noted that the SWRCB has assigned a civil engineer, Mr. Joe Rodriquez, to review the validity of the change orders."

Discussion

As noted in the question, the seven change orders on this contract plus those pertaining to other contract work at this plant site are being evaluated by Mr. Rodriquez. Mr. Rodriquez is to submit a report on his findings, including recommendations as to approval or disapproval of the change orders, to the Western Area Audit Office.

NFIC personnel met with Mr. Rodriquez on November 15, 1974 and again on November 21, 1974 to discuss these change orders. He is still attempting to obtain from the City of Stockton all required back-up information which pertains to the change orders. Mr. Rodriquez' expertise and method of approach appear compatible with the NFIC investigation. Any additional parallel investigation by NFIC personnel would be redundant at this time. It is proposed that NFIC personnel review the completed report prepared by Mr. Rodriquez and submit comments on it to audit personnel.

B. Trickling Filter Modifications

Question No. B-1

"During our review, several operating problems concerning the trickling filters were quite evident. In order to ascertain the full extent of these problems, we would like a technical evaluation as to whether the construction work completed on the trickling filters is acceptable and has been accomplished in accordance with the approved plans and specifications."

Discussion

Certain inaccessible details could not be evaluated. Examples of such items include electrical conduit, the filter underdrain system, interior filter wall surfaces below the media level, construction details inside the filter recirculation distribution structure, etc. Likewise, time was not available to fully evaluate all possible operating modes of the systems, nor was it appropriate for NFIC personnel to dictate the plant operating modes. However, with the exception of the specific items discussed in Question Nos. B-2 through B-10 which follow, the overall conclusion reached after NFIC's site inspection and review of the facilities operating history is that the contractor has made a conscientious attempt to construct the filters and attendant systems according to the contract plans and specifications.

The filter wall leakage problems discussed in Question Nos. B-2 through B-6 and the check valve/recirculation pump problems discussed in Question No. B-7 are the most significant areas where contractor and/or equipment supplier error may have been committed.

Question No. B-2

"There is substantial effluent leakage and green algae growth on the outside wall of trickling filter No. 4. Although this situation has existed for almost one year, the leakage has not been eliminated. In view of the substantial problem, we would appreciate a technical determination as to whether the problem was the result of poor construction or basic design errors."

Discussion

After inspection of the filter in question and having had discussions with the job inspectors, the consulting engineers, and the wall coating material suppliers, it is the opinion of NFIC that the leakage experienced is the result of basic design error complicated by "hurry up" construction techniques in order to place the filter in operation by the beginning of the 1973 food processing season. The problem essentially comes down to the original choice of the interior wall sealing material and, once this choice was made, improperly defining in the specifications the method of wall surface preparation which would be compatible with this choice.

The following sequence of quotes from the contract specifications must be followed in order to unravel the painting requirements for the interior surfaces of the filter walls: Page C60; SECTION C8-PAINTING

"(2) Concrete and Masonry Surfaces

Concrete and masonry surfaces of trickling filter distribution structure No. 1 and trickling filters Nos. 4, 5 and 6 shall be painted as specified in Section C8.06."

Page C66, Subsection C8.06 Finish Schedule

"(2) Trickling Filters

(b) Modified Filters Nos. 4, 5 and 6 — Paint System

Modified Filters Nos. 4, 5 and 6	Paint System
Walls, existing and new	
Outside and top ring beam	D
Inside	B"

The inside walls of the modified filters are thus to recieve Paint System B.

Page C63, Subsection C8.05 Paint Systems

"(3) Coal Tar Epoxy (System B)

(a) Surface. Concrete or masonry, interior or exterior corrosive hydrogen sulfide atmosphere, black.

(b) Surface Preparation. As specified in sub-article (8.04(1)(c).

(c) Coatings

1. Amercoat Alternate. Prime coat shall consist of one coat of coal tar epoxy resin coating, Amercoat No. 78 resin. Finish coats shall consist of two coats of coal tar epoxy resin coating, Amercoat No. 78 alternating red and black colors.

2. Engard Alternate. . .

3. Koppers Alternate. . .

(d) Notes:

1. All surfaces shall have aged 60 days and dried to a maximum moisture content of 14 percent prior to application of any paint.

2. Prime coat shall be thinned and applied at the rate of approximately 200-300 square feet per gallon depending on surface condition. Finish coats shall be applied at the rate of 100 square feet per gallon.

3. Drying time shall be as recommended by the paint manufacturer."

Note: The Engard and Koppers alternates were not quoted verbatim for the sake of brevity and since the Amercoat alternate was the one used on Filter No. 4. These alternates were essentially the same as the Amercoat alternate, the Engard alternate using Engard 463 Black and the Koppers alternate using Koppers 300-M Black.

Page C61, C8.04 Construction

"(c) Preparation of Concrete and Masonry Surfaces. All concrete and masonry surfaces which require coating or painting shall be dry and shall be prepared by light 'brush-off' sandblasting. Sandblasting shall be sufficient to remove all dirt, dust, efflorescence, oil and grease stains and other foreign substances and shall provide adequate surface roughening for good adhesion between the concrete and coating or paint. All cavities and voids shall be repaired and all surfaces troweled to finish required."

In the specification quote above, no specific surface finish material is detailed for the interior walls of Filter No. 4, said surface finish coat to be applied prior to the Amercoat prime and finish coats. NFIC personnel contacted the technical development personnel at the manufacturers of Amercoat (Ameron Products) in Brea, California to determine if this was a proper application of Amercoat No. 78. The following information was obtained:

1) Amercoat No. 78 can be used as a water resistant coating on concrete block walls. It is not intended to be a waterproofing seal where water pressure against a surface is anticipated. It will however form a "water barrier" against droplets, vapors, etc., when applied correctly and on a surface which has been correctly prepared.

2) Amercoat No. 78 becomes non-flexible as it cures. Although it can withstand minor tension and compression strains, it will crack under substantial stress.

3) The most significant point discussed is that Amercoat No. 78 must be applied only to surfaces which have been completely prepared to remove all major and pinhole void spaces. For major cracks, gouges, holes, etc., troweling of Ameron New Clad 109 epoxy paste filler material is recommended. For minor or pinhole voids a squeegee application of Ameron New Clad No. 1871 is recommended.

4) A thinned primer coat of Amercoat No. 78 coal tar epoxy will not adequately seal all pinhole voids such as those which comprise the interstitial matrix of a concrete block. In many cases the visible pinhole is only the minor diameter of an interior void. Insufficient sealing material gets through the pinhole to coat the interior surface of the void.

From the above discussions, it can be concluded that the interior wall surface preparation specified in the contract documents was incorrect and/or incomplete. All surface voids were not required to be filled by squeegee application of New Clad No. 1871 (or equal). In fact, the question may be raised as to whether the pointed grout joints between the masonry blocks do indeed form "large voids" which should have been filled with New Clad No. 109.

The choice of Amercoat No. 78 or any other coal tar epoxy resin for this application is debatable. Considering that this material cures to a relatively inflexible coating subject to cracking under stress and impact, a better choice would have been an epoxy vinyl coating with a silicone-based sealant. However, had the brick surface been properly prepared to eliminate voids, the Amercoat No. 78 coating would have provided an adequate seal.

NFIC personnel discussed the Amercoat No. 78 application procedures with both the job inspectors and the consulting engineers. Several contract specification omissions committed by the contractor were noted as follows:

1) Alternating colors of black-red-black were not utilized with the prime and two finish coats of Amercoat No. 78.

2) The block wall surface was not light sandblasted prior to coating application.

3) The mortar block wall and concrete cap beams were not allowed to age for 60 days before the Amercoat No. 78 was applied. Similarly adequate tests were not conducted to determine if the moisture content of the walls was less than 14 percent before the coating was applied. Excess moisture inhibits bond between coating and surface.

4) Adequate drying time was not allotted between coats of Amercoat No. 78. The inspector reported that the two finish coats were applied during the same day.

These contractor omissions would have contributed significantly to an unsatisfactory coating application had the surface been properly prepared initially. However, the surface void problem overshadows these considerations.

A last item evaluated by NFIC personnel regarding the Amercoat No. 78 coating concerns the final inspection techniques employed by the inspectors and consulting engineers. The consulting engineers maintain that the inspector was told to perform a low voltage holiday check on the completed coating prior to final acceptance. The inspector stated that though such equipment was available on site, he was never instructed to use it on the masonry walls. When the consulting engineer's representative was questioned as to the technique involved with the low voltage holiday detection system on masonry or concrete, he stated that one pole of the detector is connected to a reinforcing rod in the structure and the opposite pole to the wet sponge used to scan the coating surface. Sufficient moisture exists in the concrete block or concrete structure to complete the electrical circuit should a coating imperfection be detected.

NFIC personnel discussed this procedure with the technical development personnel at Ameron Products. They stated that low voltage holiday detectors are not recommended for inspection of Amercoat No. 78 coatings on any material surface. Only high voltage (15,000 volt) spark test equipment is recommended for such testing.

Question No. B-3

"It has been suggested that the modified trickling filters (Nos. 4, 5, and 6) will not operate at their designed capacity. We would like a determination as to whether the filters can operate at their full capacity. If filters Nos. 5 and 6 can operate at full capacity for any length of time, could the effect on the outside walls of these filters be the same as on filter No. 4?"

Discussion

The plant operating personnel were specifically questioned by NFIC personnel on repeated occasions as to whether the filter units Nos. 4, 5 and 6 have operated and will operate at their design capacity (it was assumed that design capacity means the maximum hydraulic capacity of 24 MGD per filter). The plant personnel repeatedly answered that the units could perform at rated hydraulic capacity and that acceptable BOD removals of 65-70% through the filters were routine occurrences. In general, these personnel appeared satisfied with the wastewater treatment being obtained by the units. They also stated that at no time were filters Nos. 5 and 6 run at reduced flow rates to "cover" for any leakage problems with the filter walls. The filters are operated to meet the treatment demand on plant.

During the site visit, only filters Nos. 5 and 6 were operating. Filter No. 4 was down due to repairs to the structural members of the rotating distribution arms. The sewage flow rates through the plant were quite low, in the range of 10-16 MGD. The speed reducers on the variable speed pumps which supply filters Nos. 5 and 6 were adjusted to a setting of approximately 1300 rpm which corresponds to a pumping rate of approximately 13 MGD. Visual observation of the spray distribution patterns atop both filters indicated that an even pattern of liquid was being applied to the filter media, all distribution pipe ports were open and spraying wastewater, and the spray pattern was reaching the inner wall surface. Visual examination of the exterior wall surfaces revealed several leakage spots on these walls also. The leakage was by no means as severe as that exhibited by filter No. 4.

It is logical that during the canning season, when plant flow rates are at a maximum and all filters must be run at higher application rates, more wastewater per unit time will be splashed against the interior wall surfaces of the filters. Wall leakage which exists under low flow conditions will be magnified by increased flow rates, but it was not possible to ascertain to what degree. The Sikaflex lining material utilized on the interior walls of filters Nos. 5 and 6 appears to have significantly reduced the leakage problem. Although filters Nos. 5 and 6 have been in operation one year less than filter No. 4, it would appear that leakage will not be as great as on filter No. 4.

The design for these trickling filters and recirculation pumps systems did not include any flow measuring devices. After the primary effluent flow meters, there are no downstream flow measuring devices for the secondary treatment system. Without such devices it is not possible to accurately determine the flows being applied to each trickling filter, the recirculation rates, or the relative flow split between the old and new trickling filters. It was not possible during the time available for this evaluation for NFIC personnel to accurately determine if the specified hydraulic capacities can be achieved by the filters themselves and/or their attendant pumping units. However, there was no reason to believe that the filters could not be operated to full capacity. The filters may not be operated at maximum capacity at all times due to the cost of the energy required to lift the wastewater to the top of the filters. A portion of the wastewater is currently treated in the three 6-foot depth trickling filters.

Question No. B-4

"We would also like a determination as to what effect the effluent leakage will have on the structural strength of the outside concrete block walls of filter No. 4."

Discussion

The organic acids contained or generated in the leaking sewage could have the effect of attacking and leaching the mortar joint to the point where only the silicon remains. The wetting and drying of the rebars exposed to oxygen would accelerate corrosion of the bars and weaken adherence between the concrete grout and rebars. However, this could take a number of years before it would significantly affect the structure.

A review of the construction details shows vertical rebars every 4 ft. around the perimeter of the filter and the holes in the block filled with concrete grout. This in effect constitutes a reinforced concrete pillar running the height of the wall every 4 ft. This pillar is tied into the existing foundation wall by drilling and grouting at the bottom and given support at the top by a reinforced concrete cap beam that runs around the entire filter, tying it together at the top.

Details of the wall construction are shown by Drawing Sheet No. S 7 trickling filters Nos. 4, 5, 6 sections.

As determined by a review of the drawing and construction pictures and questions of inspectors and the resident engineer, the walls were constructed as per specs and drawings. However, as previously discussed in Question B-2, the leakage is a result of design error.

Question No. B-5

"In connection with B.4 above, we would appreciate a determination of the ability of the existing concrete wall and foundation of filter No. 4 to withstand the additional weight resulting from the effluent leakage. This is important since the concrete block walls were built on the old filter foundation."

Discussion

A maximum additional weight due to absorption of the leakage was computed to be about 200# per lineal ft. or 16.67 #/lineal in. or 2.08 #/sq. in. on the old concrete foundation.

This would increase the loading from 13.02 #/sq. in. to 15.1 #/sq. in.

A review of the "Soils Investigations Report" by J. H. Kleinfelder and Associates, indicates the soil bearing capacity will easily withstand the additional loading.

It is our opinion that there is sufficient design safety factor to absorb this additional loading without significant impact.

Inspection of the foundation walls of filter No. 4 that is already loaded with the additional weight shows no sign of weakening.

Question No. B-6

"In view of the leakage of the concrete block walls, we would appreciate knowing whether cement blocks are generally noted for their ability to withstand absorption. In addition, we would appreciate any comments which you may have as to whether there is a less costly and more effective way to construct high trickling filter towers."

Discussion

Part A - Concrete blocks of the expanded shale type specified for this contract are not noted for their ability to withstand absorption. To verify the extent of absorption which can be expected from a typical block, portions of a sample block from the job site were obtained during the NFIC site visit. These samples were returned to the NFIC-Cincinnati laboratories and subjected to the ASTM testing procedures for water aborption. The additional weight due to absorption is discussed in Question No. B-5.

Part B - An alternate to the masonry brick for constructing a high trickling filter tower wall is to utilize a structural steel support skeleton with corregated fiberglass panels for wall sheeting. The advantages of such an installation include relatively low weight, ease and speed of construction, and relatively low cost. The disadvantages include poor aesthetics, leakage at joints, and the potential for cracking of the fiberglass due to ultraviolet radiation exposure.

To overcome the ultraviolet and aesthetics problems, a sandwich wall construction has been utilized on some filters. The interior wall surface is constructed of regular fiberglass below the filter media surface and special ultraviolet resistant fiberglass above the media. The exterior wall surface can be pebble board, rough hewn plywood, etc. These walls are light-weight but considerably more expensive.

Another alternate method is to pour monolithic reinforced concrete walls. Advantages of this method include aesthetics and durability. Disadvantages include increased weight, forming costs and labor time, and overall cost. However, since there is little horizontal load, the method is not justifiable.

A high wall trickling filter was built in Ontario, Oregon using double T prestressed reinforced concrete sections. There are no leaks and the cost was equivalent to fiberglass plus steel framed walls. This type of construction may not have been compatible with the Stockton plant due to the weight limitations of the existing foundation.

The masonry brick alternate chosen for this particular contract combines low wall weight with high aesthetic value. Its major disadvantages are time of construction and the obvious leakage problems encountered. The latter problem can be minimized with the appropriate choice and/or application of wall sealing compound.

Of the four possible methods of wall construction discussed, the concrete block alternative was probably the least costly at the time of the original design.

Question No. B-7

"We observed that the recirculation pumps for the trickling filters make a tremendous thudding noise when they are turned off. In addition, it was stated that the pumps were continually going out of operation. One of the reasons given was that the motors on the trickling filter recirculation pumps were operating at a higher amperage than they were designed. We would appreciate an evaluation of the significance of the pump problems and a determination of the effect the high amperage will have on the pump motors."

Discussion

Part A - The "thudding" noise was heard by the NFIC personnel. Not only is the noise very loud, but the entire filter distribution structure and surrounding ground surface tremble when the noise occurs.

The problem can be traced to the two 30-inch check valves installed on the discharge pipes from recirculation pumps Nos. 5 and 6 (Section 1/M2, Contract Drawing M2). When the recirculating pumps shut off, back pressure against the valve leaf plates forces the plates against the valve seats with the resulting noise and vibration.

The following contract specification details all check valves used in this contract: Page C56, Section C7-Piping and Pipelines,

Subsection C7.02 Materials

"(8) Valves

(b) Check Valves. Check valves shall be double-leaf, swing type valves with flat faces for mounting between two pipe flanges. Leafs shall be spring loaded. Valve body shall bear on flange faces of adjacent piping and not on cement-mortar lining. Valve shall have cast-iron bodies with aluminum-bronze plates. Trim including stops, pins, and springs shall be 316 stainless steel. Resilient seal shall be Buna N synthetic rubber. Valves shall be Mission Duo-Check or equal".

The actual installed 30" check valves at this location are MB-12-5081-SF units produced by Gulf Valve Company of Houston, Texas. NFIC personnel discussed the installation and apparent problems with company representatives. They offered the following possible causes for the noise and vibration problems:

1) Valve installed improperly
2) Insufficient spring tension
3) Improper design of structure

Each is discussed herein.

1) The leaf check valve must be installed in the horizontal pipe with the leaf shaft in a vertical position. If the shaft is horizontal, the lower leaf tends to fall by gravity to its seat position, whereas the upper leaf is retarded by both gravity and the spring tension. Unequal seating of the leaves occurs.

2) In some installations, the normal tension springs supplied with the valve units are insufficient to retard the leaf closing under backflow conditions and the leaves close with substantial force against their seats. Gulf Valve Company personnel said they would be agreeable to send the contractor heavy duty springs to replace the existing springs if these will remedy the problem. They have made similar modifications before.

3) In this particular structure configuration, recirculation pumps Nos. 5 and 6 directly oppose each other. It is conceivable that in addition to the static water pressure head acting on the check valves, the discharge pressure of the opposing pump is being transmitted at least in part, across the structure to act against the opposing check valve. This additional pressure would tend to counteract the retarding springs of the valves. However, the design engineers have equipped the pump's discharge piping with 60° downturned fittings, apparently in an attempt to minimize this effect.

It would be possible to evaluate the effect of opposing pumps on the check valves by operating only one of the pumps at a time, switching it on and off, and monitoring the noise and vibration level at the corresponding check valve. Both pumps would then be operated, alternating their on-off cycles, and the noise/vibration levels re-evaluated. The static water level in the structure should be maintained constant in both test phases by operating the original recirculation pumps Nos. 1, 2, 3 and 4. If a substantially higher noise/vibration level was obtained with the pumps in the alternating operation mode, then it could be concluded that the check valves are being influenced by the discharge pressure of the opposing pump. Additional discharge baffling and structural changes would be necessary at that point.

Whatever the cause of the check valve malfunction, it is imperative that it be remedied quickly. Both structural damage and damage to the vertical pumps and attendant piping will occur if this problem is left unattended.

Part B - The pump operational problems alluded to in this question pertain to the new recirculation pumps Nos. 5 and 6. In discussions with the plant operating personnel, the consulting engineers, and the inspectors, it was mutually agreed that pump No. 5 has repeatedly thrown the circuit breakers on its electrical system requiring manual restart of the pump by the plant operators. This situation occurs several times per day, especially during the warm weather periods.

The consulting engineers mentioned that they have this problem under consideration and are currently negotiating with pump suppliers, Johnston Pump Company of Glendora, California for correction of the situation. The consultants suspect that the pump(s) were supplied with the wrong pitched impellers. Johnston counters with the suspicion that the trickling filter distribution structure was designed incorrectly, the resulting effect being flow patterns which create vortexing at the suction of the pump. The consultants did acknowlege that pump No. 5 draws approximately 15 amperes more than pump No. 6 under theoretically similar pumping conditions.

Each of the above-mentioned conditions, i.e., the possibility of improper impeller pitch and that of suction vortexing could result in excessive current being drawn by the pump motors. If the current drawn exceeds the rated amperage of the motor, the circuit breaker will throw out. Any modification to the circuit breaker to increase its amperage above that of the rated amperage of the pump motor so as to minimize the pump shut down problem would only disguise the operational problem and lead to a decreased motor life. NFIC personnel were assured by plant operating personnel that no such modification has been made. Continued operation of the pumps at the higher amperage levels will cause a breakdown in the motor winding and insulation. When this occurs, the unit will have to be replaced.

It was not within the scope of this evaluation for NFIC personnel to determine the cause of the pump malfunction, only that the problem existed. It does exist and all parties questioned acknowledged it. It is recommended that the current discussions between the consulting engineer and pump supplier be accelerated and remedial action initiated. In addition to the incorrect pump impeller pitch and suction vortexing possibilities currently being considered, the hydraulic profile for the overall trickling filter distribution structure/dual 60" conduit line/ secondary sedimentation tank distribution structure configuration should also be re-evaluated over the wide range of flow conditions which exist at this plant. Extremes in raw sewage flow rate range from 35-40 MGD during the three-month summer canning season down to 10-15 MGD during the non-canning season. Recirculation ratios can also be varied over a wide range. These hydraulic load changes will affect the flow paths within the recirculation distribution structure and the operating characteristics of the recirculation pumps.

The pump motor cut-out problem discussed herein, will accentuate the valve noise/vibration problem discussed in Part A above.

Question No. B-8

"The doors to the main electrical substation which carry over 12,000 volts are continually left open. We would like to know whether this situation violates any State or Federal safety requirements and what effect, if any, this would have on the equipment located in the substation."

Discussion

The Federal requirements for electrical safety are regulated by the National Electric Code; the State requirements are specified in Title 8 of the California Administrative Code. The CAL-OSHA program is enforced by the California Division of Industrial Safety. Both Codes are violated if access to unauthorized personnel is not controlled by means of locked doors, walls, screens, fences, or other approved means. If access is controlled, the fact that the doors are left open does not in itself constitute a hazard or safety violation.

The plant site is fenced, however access to the site is not controlled, as the gate is left open. The electrical substation is not fenced or isolated from personnel on the plant grounds. Since access is not controlled, if the doors are continually left open, then both Codes are violated in our opinion.

Equipment deterioration will occur due to dust and moisture. If the doors are left open, this deterioration may be accelerated.

Question No. B-9

"A total of 43 change orders have been initiated by the contractor, Caputo-COAC, in the modification of the trickling filters. These change orders have been approved by the resident engineer and the City, but they have been only recently submitted to the SWRCB for approval. We would appreciate a technical determination of the acceptability of these change orders and a determination as to whether the work included on the change orders has actually been performed. In this regard, it should be noted that the SWRCB has assigned a civil engineer, Mr. Joe Rodriquez, to review the validity of the change orders."

Discussion

As previously discussed under Question No. A-5, Mr. Rodriquez of the California State Water Resources Control Board is conducting an extensive review of all change orders submitted by the City of Stockton on this project. Any parallel investigation of them by NFIC personnel would be redundant. NFIC review of Mr. Rodriquez's report to the Western Area Audit Group upon completion of same is desirable.

Question No. B-10

"An early inspection of the trickling filter walls indicated that "the walls of subject filters reveals there are joints that are not 'full joints.' It was also found that the incidence of voids in the walls is high." The contractor promised to correct the deficiencies, however, plant personnel indicated that these corrections were not fully accomplished. In view of the leakage which has occurred on filter No. 4, we would like a verification as to whether the above deficiencies were corrected."

Discussion

NFIC personnel conducted visual inspections of the exterior walls of trickling filters Nos. 4, 5, and 6. These inspections revealed that the walls of filters Nos. 5 and 6 were essentially free of open mortar joints between the masonry bricks. The walls of filter No. 4 did have numerous open mortar joints, the cause of which could not be accurately determined due to the fact that the filter had been in operation for over a year. Possible explanations of the open joints include:

1) The joints were not completely mortared during construction.

2) The mortar grout has washed out of the joints due to leaching of the cement binder by leaking wastewater.

3) On the portion of the wall of filter No. 4 where the Xypex waterproofing compound test patch was applied, it appears that the mortar has been chiseled in several locations. City personnel stated that on severe leak spots the Xypex material is applied in crystalline form and physically driven into the area. This technique may account for the open grout joints observed in this particular wall area.

NFIC personnel also visually inspected the visible portions of the interior wall surfaces for filters Nos. 4, 5 and 6. Since the trickling filter plastic media was completely installed in these filters at the time of site visit, the inspection was limited to the upper 3.5 feet of the wall surface. No open joints were noted during this inspection on filters Nos. 5 and 6; open joints were found in filter No. 4.

The open joints noted on the exterior wall of filter No. 4 were discussed with Mr. Paul Prout of the City of Stockton, Department of Public Works. He acknowledged the existence of the open joints and stated that any corrective action to them was being delayed until a decision could be reached on the entire filter wall leakage problem.

C. Building Additions and Modifications

Question No. C-1

"The contractor has continually failed to follow approved plans and specifications in the placement of his concrete. For example, the contractor has cured his concrete with a curing compound rather than the water cure method required by the specifications. It was also noted that some of the poured concrete did not meet the minimum compressive strength of 3,000 pounds per square inch at the end of 28 days as required by the specifications. Additionally, the concrete used in the project has failed to meet the 0.04 percent maximum allowable shrinkage requirement included in the specifications. Further, the contractor has not obtained advance approval for his rebar layout prior to the pouring of concrete as required by the specifications. We would like an opinion of the acceptability of the poured concrete in light of the contractor's failure to follow the approved plans and specifications."

Discussion

A review of the concrete specimen data, those that failed and those that passed specified criteria, leads the writer to express the opinion that the poured concrete is acceptable and meets strength requirements. The use of a curing compound is an acceptable method in curing the concrete and can be used in place of the water cure method after 72 hours, if approved by the resident engineer.

Pertaining to the item of advanced approval by the engineer of reinforcing steel (rebar) layout drawings submitted by the contractor, all persons interviewed agreed that it was not uncommon on this project for the contractor to place rebars and pour concrete without having received prior approval of submitted drawings.

The following excerpts from the contract specifications state the conditions of pre-approval of rebar placement drawings:

Pages C 24-25, Section C-3 - Concrete Work, Subsection C3.02 Material

"(3) Reinforcing Steel

Reinforcing steel shall consist of deformed bars of the size called for on the drawings. Steel shall conform to ASTM 615-40. Deformations shall conform to ASTM A305, A408. Mill certificates showing conformity with these requirements shall be furnished to the engineer for each melt. Wire reinforcements shall conform to ASTM A185.

Placing drawings and bending schedules shall be submitted to the engineer for review. Reinforcement shall be carefully formed as indicated on the drawings. Stirrups and tie bars shall be bent around a pin having a diameter of not less than three times the diameter of the bar. Except where specifically indicated otherwise on the drawings, bends for other bars shall be made around a pin having a diameter of not less than 8 bar diameters. All bars shall be bent cold."

Pages B 10-11, Section B3 - Specifications and Drawings

"B3.04 Information to be Furnished by Contractor

The contractor shall furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules and manufacturer's instructions as specifically required in the specifications, and all other information as reasonably may be required to demonstrate fully that the materials and equipment to be furnished and the manner of performing the work comply with the provisions and intent of the specifications and drawings. If the information shows any deviation from the contract requirements, the contractor shall, by a statement in writing accompanying the information, advise the engineer of the deviation and state the reason therefor.

B3.05 Review of Contractor's Information

When review and checking for acceptability is required of any drawings, method of work, or of any information regarding materials and equipment, the contractor shall prepare or secure, and submit for review at least 5 copies thereof. If the information thus submitted indicates the material and equipment is acceptable, the engineer will return 2 copies marked acceptable, otherwise 2 copies will be returned with an explanation of why the material or equipment is unacceptable and the contractor shall resubmit the information until it is acceptable. If the contractor wishes more than 2 copies returned, he may submit additional copies of the information for review, but in no event shall the contractor submit more than 7 copies of each item."

Page B 2, Section B1 - Definitions

"B1.15 Submitted

'Submitted';wherever and in whatever manner used, means submitted to the engineer for his acceptance."

It may be argued that nowhere in the quoted specifications is it stated that approval of rebar placement drawings is required prior to or in advance of a concrete pour. This is an error in the preparation of the specifications. However, prior approval of rebar placement drawings is a common construction requirement. Advanced approval permits the design engineer to insure that the steel to be placed truly conforms with the intent of the design drawings and calculations. It is not uncommon to find that the steel supplier and/or contractor misinterpreted said intent.

The approved steel placement drawings also provide a valuable aide to the field inspector. More detail is usually provided on these drawings than on the original contract drawings, especially where irregular forming and/or steel placement are required.

Finally, these drawings are a requirement of the specifications. Their submittal with ample lead time for approval by the engineer is the responsibility of the contractor. Contract specifications often specify the advanced lead time required for submittal of approval drawings by the contractor and the allowable turn around time for approval/disapproval by the engineer. These specificaitons do not state this and as a consequence may be negligent.

Question No. C-2

"In constructing an auxiliary maintenance building, a large manhole was discovered. The soils engineer for the project recommended that the manhole be filled with concrete or pea gravel to insure that it would not affect the loading of the building foundation. Since the recommendation has not been followed, we would like an independent opinion as to whether the building foundation has been adversely affected."

Discussion

The manhole referred to is poured concrete. Inspection shows no cracks or movement of any sort. The maintenance building foundation is about 8 ft. away at the closest point. It is of slab foundation construction and is not likely to be affected if manhole is retained in present condition.

Mr. Vieira, STP Superintendent, stated that since the manhole has an existing pipe connection that leads back to the head of the plant, they propose a future use for recirculation.

It is the writer's opinion that the maintenance building will not be structurally affected by retention of the manhole.

Question No. C-3

"Although the degree of soils compaction included in the specifications was not always being met by the contractor, the resident engineer has accepted the lesser degree of compaction. For example, the resident engineer approved an 80 percent compaction on the bedding material underneath a vitrified clay pipe although the specification called for a 95 percent compaction. We would like a technical opinion as to whether this can result in any structural deficiencies and also the Region's position in instances such as this where the contractor has not met the approved plans and specifications."

Discussion

To answer the general question, failure to meet compaction specs could result in structural failures depending on the situation. However, in the case cited under the sewer bedding an 80 percent compaction vs. a 95 percent compaction on the sandy material, we would not expect structural difficulties as a result of the reduced compaction of the soil. If movement of the pipe occurs, it could be detected by examining the pipe run in question between manholes.

Question No. C-4

"The resident engineer authorized the contractor to grout behind the brick veneer around the operations building to a height of 8 feet, instead of the full height of the brick veneer of 20 feet as required in the specifications. We would like an evaluation as to whether the reduced grouting will create any safety problems."

Discussion

The brick veneer on the existing operations building is for aesthetic purposes. The veneer is tied to the existing walls by drilling and placement of ties. Since the cavity is grouted to a height of 8 ft., it should prevent any movement should a truck accidently back into it. The reduced grouting above 8 ft. height should present no safety hazard.

Sheet No. A205 - Typical wall section on the maintenance building next to the operations building shows the design to be hollow backed.

APPENDIX

October 14, 1974

TO: Mr. Paul De Falco, Jr.
Regional Administrator
EPA, Region IX

FROM: Manager
Western Area Audit Group

SUBJECT: Request for Technical Assistance - Interim Audit of Stockton Main Water Quality Control Plant - EPA Project No. C050695

We are in the final stages of completing our interim audit of the City of Stockton's financial and management controls over the subject EPA grant. In this regard, we are currently in the process of reviewing the consulting engineering firm's (Brown and Caldwell) financial records supporting its billings for engineering services. In addition, we are summarizing the results of our review at the City of Stockton. Upon completion of this effort, we will provide you with an overall briefing of our audit results prior to the issuance of our written report.

As discussed with you previously, it was indicated that some engineering assistance would be required at a later date. We have now reached the point where this assistance is required. The areas where the technical support is required are listed on the attached pages.

We would appreciate it if the assistance can be provided and a written report of the results furnished to us by November 15, 1974. I believe that the work can be expedited if the engineer or engineers assigned will initially coordinate with Mr. Geary Pena of my staff.

If the above time frames are not acceptable or if you have any questions concerning this request, please do not hesitate to contact me.

TRUMAN RONALD BEELER

Enclosures

LIST OF AREAS WHERE TECHNICAL ASSISTANCE
IS REQUIRED UNDER CITY OF STOCKTON PROJECT NO. C060695

A. Construction of Sludge Lagoons

The contractor, C. Norman Peterson Co., has completed construction of the sludge lagoons and the Brown and Caldwell resident engineer accepted the contractor's work as "essentially complete" in April 1974.

1. During the course of our audit, several operational problems concerning the sludge lagoons have been brought to our attention. We therefore would appreciate an independent technical determination as to whether the construction work completed on the sludge lagoons is acceptable and has been accomplished in accordance with the approved plans and specifications.

2. Visual observations and discussions have indicated that the telescopic weir in one of the sludge lagoons was not operating properly. We would like to have the extent of this problem reviewed. If possible, we would also like technical comments as to the cause of the problem and a determination as to who has the responsibility to correct it.

3. It was observed that the cleanout valves for the sludge lagoons were located in the pump station which were considerably below the lagoon water level. It was explained that the pumping station would be flooded if the cleanout valves were uncapped. In addition, it was suggested that the cleanouts served no useful purpose since the lagoon would have to be drained before any cleanout work could be performed. We would like a technical determination as to whether cleanout valves are usable without creating a safety hazard to personnel in the pumping station. If this is a problem, we would appreciate a determination as to whether it was attributable to a design error or to the quality of construction and how it can be corrected.

4. Plant operating personnel commented that they were unhappy with operations of the sludge lagoon from several standpoints. One of these was that the sump pump was not able to effectively remove sludge. Another was that the pumping station was causing problems since it had a greater capacity than could actually be used. We would appreciate a technical evaluation of the validity of the above problems and how they can be corrected.

5. A total of seven change orders have been initiated under the C. Norman Peterson contract and approved by the resident engineer

and the city. These change orders were not submitted to the California State Water Resources Control Board (SWRCB) for approval until September 4, 1974, although some of the change orders pertained to work performed in later 1973. We would appreciate a technical determination of the acceptability of these change orders and a determination as to whether the work included on the change orders has actually been performed. In this regard, it should be noted that the SWRCB has assigned a civil engineer, Mr. Joe Rodriguez, to review the validity of the change orders.

B. Trickling Filter Modifications

The contractor, Caputo - COAC, has completed all modification work on three trickling filters with the exception of work applicable to five change orders. The Brown and Caldwell resident engineer in a letter dated April 5, 1974, indicated "all items of work required in the basic contract...were essentially complete on February 20, 1974."

1. During our review, several operating problems concerning the trickling filters were quite evident. In order to ascertain the full extent of these problems, we would like a technical evaluation as to whether the construction work completed on the trickling filters is acceptable and has been accomplished in accordance with the approved plans and specifications.

2. There is substantial effluent leakage and green algae growth on the outside walk of trickling filter No. 4. Although this situation has existed for almost one year, the leakage has not been eliminated. In view of the substantial problem, we would appreciate a technical determination as to whether the problem was the result of poor construction or basic design errors.

3. It has been suggested that the modified trickling filters (Nos. 4, 5, and 6) will not operate at their designed capacity. We would like a determination as to whether the filters can operate at their full capacity. If filters Nos. 5 and 6 can operate at full capacity for any length of time, could the effect on the outside walls of these filters be the same as on filter No. 4?

4. We would also like a determination as to what effect the effluent leakage will have on the structural strength of the outside concrete block walls of filter No. 4.

5. In connection with B.4. above, we would appreciate a determination of the ability of the existing concrete wall and foundation of filter No. 4 to withstand the additional weight resulting from the effluent leakage. This is important since the concrete block walls were built on the old filter foundation.

6. In view of the leakage of the concrete block walls, we would appreciate knowing whether cement blocks are generally noted for their ability to withstand absorption. In addition, we would appreciate any comments which you may have as to whether there is a less costly and more effective way to construct high trickling filter towers.

7. We observed that the recirculation pumps for the trickling filters make a tremendous thudding noise when they are turned off. In addition, it was stated that the pumps were continually going out of operation. One of the reasons given was that the motors on the trickling filter recirculation pumps were operating at a higher amperage than they were designed. We would appreciate an evaluation of the significance of the pump problems and a determination of the effect the high amperage will have on the pump motors.

8. The doors to the main electrical substation which carry over 12,000 volts are continually left open. We would like to know whether this situation violates any State or Federal safety requirements and what effect, if any, this would have on the equipment located in the substation.

9. A total of 43 change orders have been initiated by the contractor, Caputo - COAC, in the modification of the trickling filters. These change orders have been approved by the resident engineer and the city, but they have been only recently submitted to the SWRCB for approval. We would appreciate a technical determination of the acceptability of these change orders and a determination as to whether the work included on the change orders has actually been performed. In this regard, it should be noted that the SWRCB has assigned a civil engineer, Mr. Joe Rodriguez, to review the validity of the change orders.

10. An early inspection of the trickling filter walls indicated that "the walls of subject filters reveals there are joints that are not 'full joints.' It was also found that the incidence of voids in the walls is high." The contractor promised to correct the deficiencies, however, plant personnel indicated that these corrections were not fully accomplished. In view of the leakage which has occurred on filter No. 4, we would like a verification as to whether the above deficiencies were corrected.

C. Building Additions and Modifications

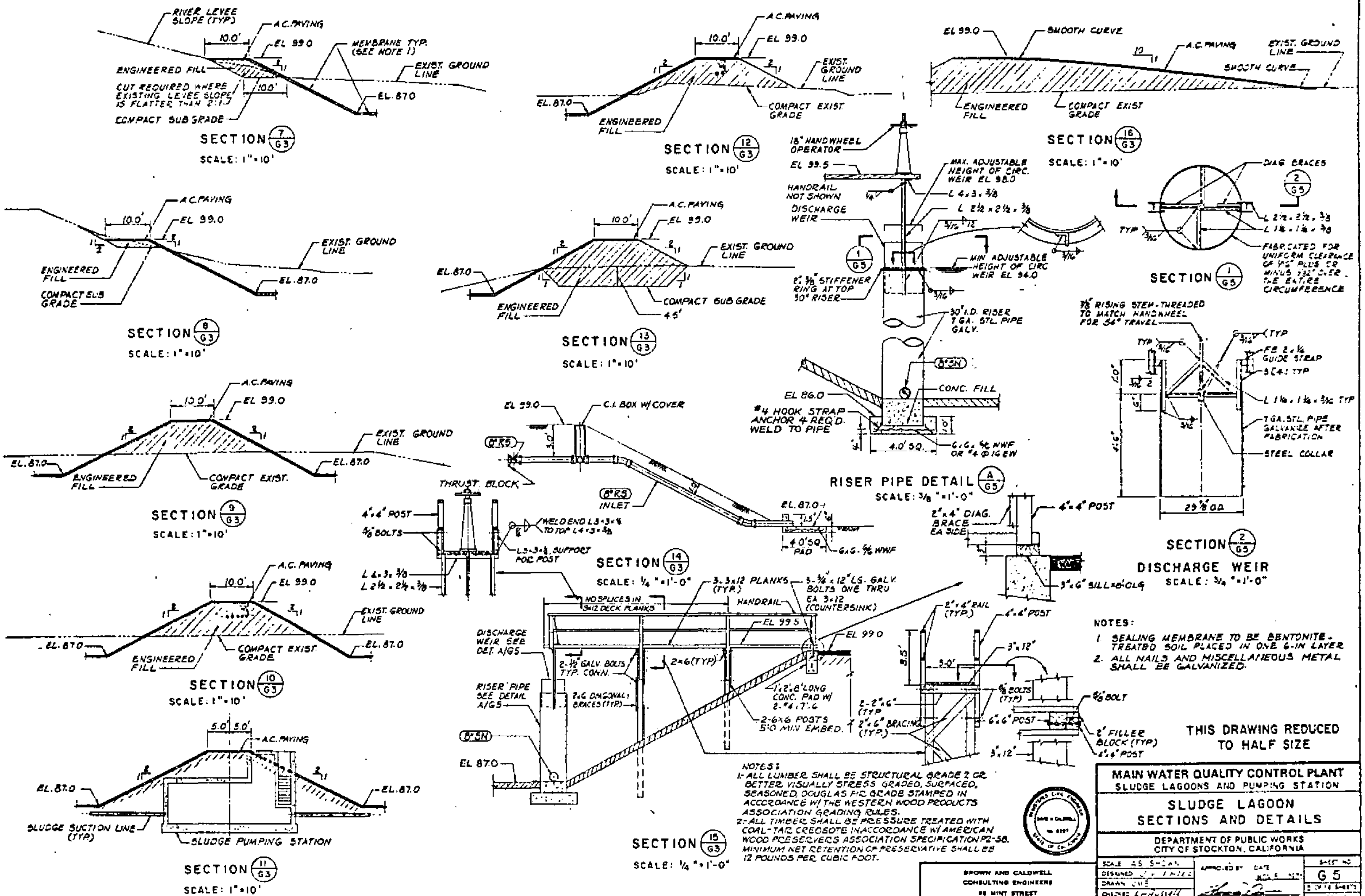
The construction contract concerning the building additions and modifications work is still in process. The construction contractor is C. S. Plumb Co.

1. The contractor has continually failed to follow approved plans and specifications in the placement of his concrete. For example, the contractor has cured his concrete with a curing compound rather than the water cure method required by the specifications. It wasl also noted that some of the poured concrete did not meet the minimum compressive strength of 3,000 pounds per square inch at the end of 28 days as required by the specifications. Additionally, the concrete used in the project has failed to meet the 0.04 percent maximum allowable shrinkage requirement included in the specifications. Further, the contractor has not obtained advance approval for his rebar layout prior to the pouring of concrete as required by the specifications. We would like an opinion of the acceptability of the poured concrete in light of the contractor's failure to follow the approved plans and specifications.

2. In constructing an auxiliary maintenance building, a large manhole was discovered. The soils engineer for the project recommended that the manhole be filled with concrete or pea gravel to insure that it would not effect the loading of the building foundation. Since the recommendation has not been followed, we would like an independent opinion as to whether the building foundation has been adversely affected.

3. Although the degree of soils compaction included in the specification was not always being met by the contractor, the resident engineer has accepted the lesser degree of compaction. For example, the resident engineer approved an 80 percent compaction on the bedding material underneath a vitrified clay pipe although the specification called for a 95 percent compaction. We would like a technical opinion as to whether this can result in any structural deficiencies and also the region's position in instances such as this where the contractor has not met the approved plans and specifications.

4. The resident engineer authorized the contractor to grout behind the brick veneer around the operations building to a height of 8 feet, instead of the full height of the brick veneer of 20 feet as required in the specifications. We would like an evaluation as to whether the reduced grouting will create any safety problems.



NOTES:

1. SEALING MEMBRANE TO BE BENTONITE-TREATED SOIL PLACED IN ONE 6-IN LAYER.
2. ALL NAILS AND MISCELLANEOUS METAL SHALL BE GALVANIZED.

NOTES:

1- ALL LUMBER SHALL BE STRUCTURAL GRADE 2 OR BETTER VISUALLY STRESS GRADED, SURFACED, SEASONED DOUGLAS FIR GRADE STAMPED IN ACCORDANCE W/ THE WESTERN WOOD PRODUCTS ASSOCIATION GRADING RULES.
2- ALL TIMBER SHALL BE PRESSURE TREATED WITH COAL-TAR CREOSOTE IN ACCORDANCE W/ AMERICAN WOOD PRESERVERS ASSOCIATION SPECIFICATION P2-58. MINIMUM NET RETENTION OF PRESERVATIVE SHALL BE 12 POUNDS PER CUBIC FOOT.

THIS DRAWING REDUCED TO HALF SIZE

MAIN WATER QUALITY CONTROL PLANT
SLUDGE LAGOONS AND PUMPING STATION

SLUDGE LAGOON SECTIONS AND DETAILS

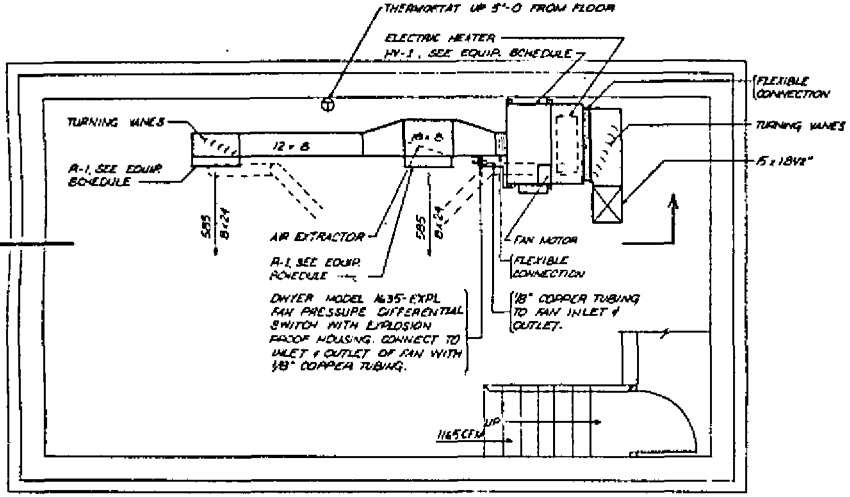
DEPARTMENT OF PUBLIC WORKS
CITY OF STOCKTON, CALIFORNIA

BROWN AND CALDWELL
CONSULTING ENGINEERS
66 MINT STREET
SAN FRANCISCO, CALIFORNIA

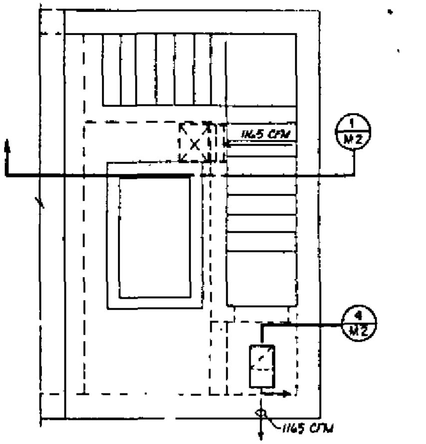
SCALE AS SHOWN

SHEET NO. G 5

F292B



FLOOR PLAN
SCALE: 3/8" = 1'-0"



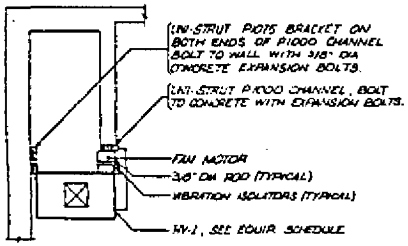
DECK PLAN
SCALE: 3/8" = 1'-0"

MARK	ITEM	MFG, SIZE, ETC.
EQUIPMENT SCHEDULE		
HV-1	HEATING AND VENTILATING UNIT	AMERICAN AIR FILTER MODEL [illegible] LOW PRESSURE, HORIZONTAL UNIT WITH THE FOLLOWING: A. ALUMINUM FORWARD CURVED FAN WITH 1165 CFM CAPACITY AT 1.0" W.G. STATIC PRESSURE. B. 1/2HP/460V/3PH/1750 RPM SQUIRREL CAGE MOTOR. C. ADJUSTABLE V-BELT DRIVE AND EXPANDED METAL BELT GUARD. DELIVER SPARE SET OF BELTS TO OWNERS. D. 16 KW, 480V/3PH ELECT. FINNED TUBULAR COIL WITH 2 CIRCUITS EACH RATED AT 8 KW. E. BUILT-IN AUTOMATIC RESET THERMAL CUTOUT * AND BUILT-IN MANUAL RESET THERMAL CUTOUT * F. COMPLETE UNIT U.L. APPROVED FOR NEC CLASS 1, DIVISION 2 LOCATION. G. SPRING-TYPE VIBRATION ISOLATORS FACTORY SIZED FOR 1" STATIC DEFLECTION. H. OPERATING WEIGHT APPROX. 300 LBS.
L-1	LOUVER	[illegible] METALS TYPE L-AA5-[illegible], ALUMINUM CONSTRUCTION, WITH ALUMINUM INSECT SCREEN. FINISH AS SELECTED BY ENGINEER.
F-1	AIR FILTER	GLASSAIRE 16 x 25 x 2 REPLACEABLE MEDIA FILTER WITH RETAINING FRAME.
R-1	SUPPLY AIR REGISTER	TUTTLE & BAILEY TYPE [illegible] DOUBLE DEFLECTING WITH VERTICAL FACE BARS, ALUMINUM CONSTRUCTION, OPPOSED BLADE VOLUME DAMPER. FINISH AS SELECTED BY ENGINEER. SET DEFLECTION TO 22° HORIZONTAL AND 30° DOWNWARD.

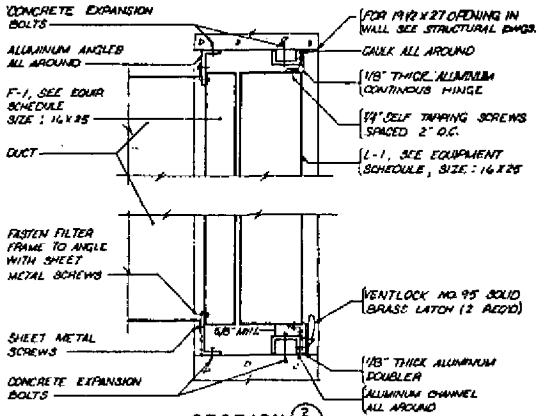
* EXPLOSION PROOF

NOTES

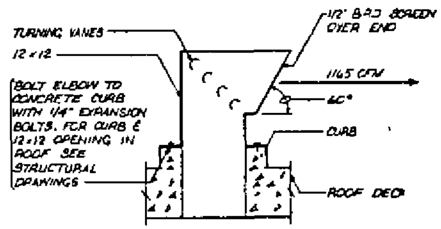
1. ALL DUCTWORK SHALL BE 22 GAGE ALUMINUM WITH 1" BAR SLIP JOINT.
2. INSTALL DOUBLE TURNING VANES AT ALL MITERS.
3. FLEXIBLE CONNECTIONS SHALL BE CANVAS, GLASS OR OTHER NON-COMBUSTIBLE MATERIAL WEIGHING NOT LESS THAN 15 OZ. PER SQUARE YARD.
4. AIR EXTRACTORS SHALL BE TUTTLE & BAILEY TYPE [illegible] OR THEIR EQUAL.
5. ALL DUCTWORK SHALL BE MADE AIRTIGHT BY TAPING WITH CANVAS AND ARABOL PASTE.
6. ALL DUCTWORK EXPOSED TO THE WEATHER SHALL BE WEATHERPROOF AND MADE WATERTIGHT.



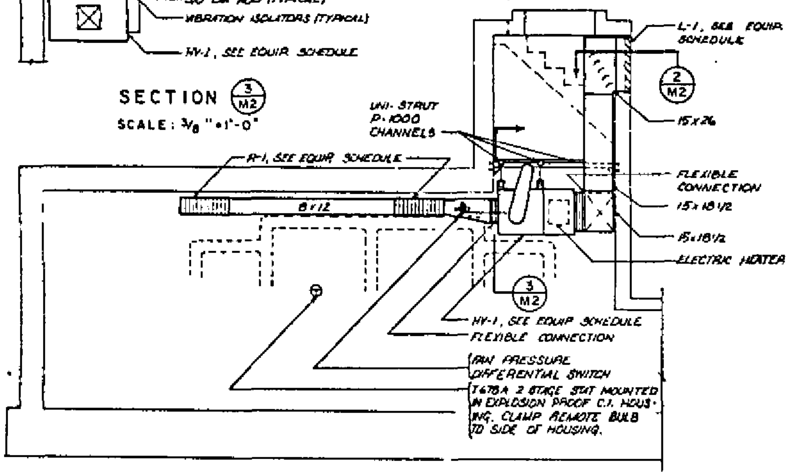
SECTION 3/M2
SCALE: 3/8" = 1'-0"



SECTION 2/M2
SCALE: 3" = 1'-0"



SECTION 4/M2
SCALE: 1" = 1'-0"



SECTION 1/M2
SCALE: 3/8" = 1'-0"

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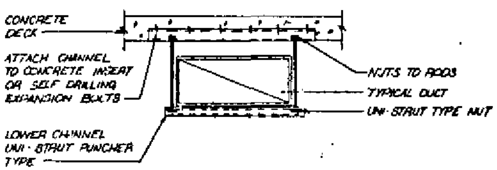


MAX. RECTANGULAR DUCT DIMENSION	ROD & EXP. BOLT SIZE	LOWER CHANNEL	HANGER SPACING
UP TO 12"	1/4"	1⅝" x 13/16" x 14 GA	8'-0"
13" TO 30"	3/8"	1⅝" x 1" x 12 GA	6'-0"

DETAIL A/M2
DUCT HANGER
N.T.S.

F292B

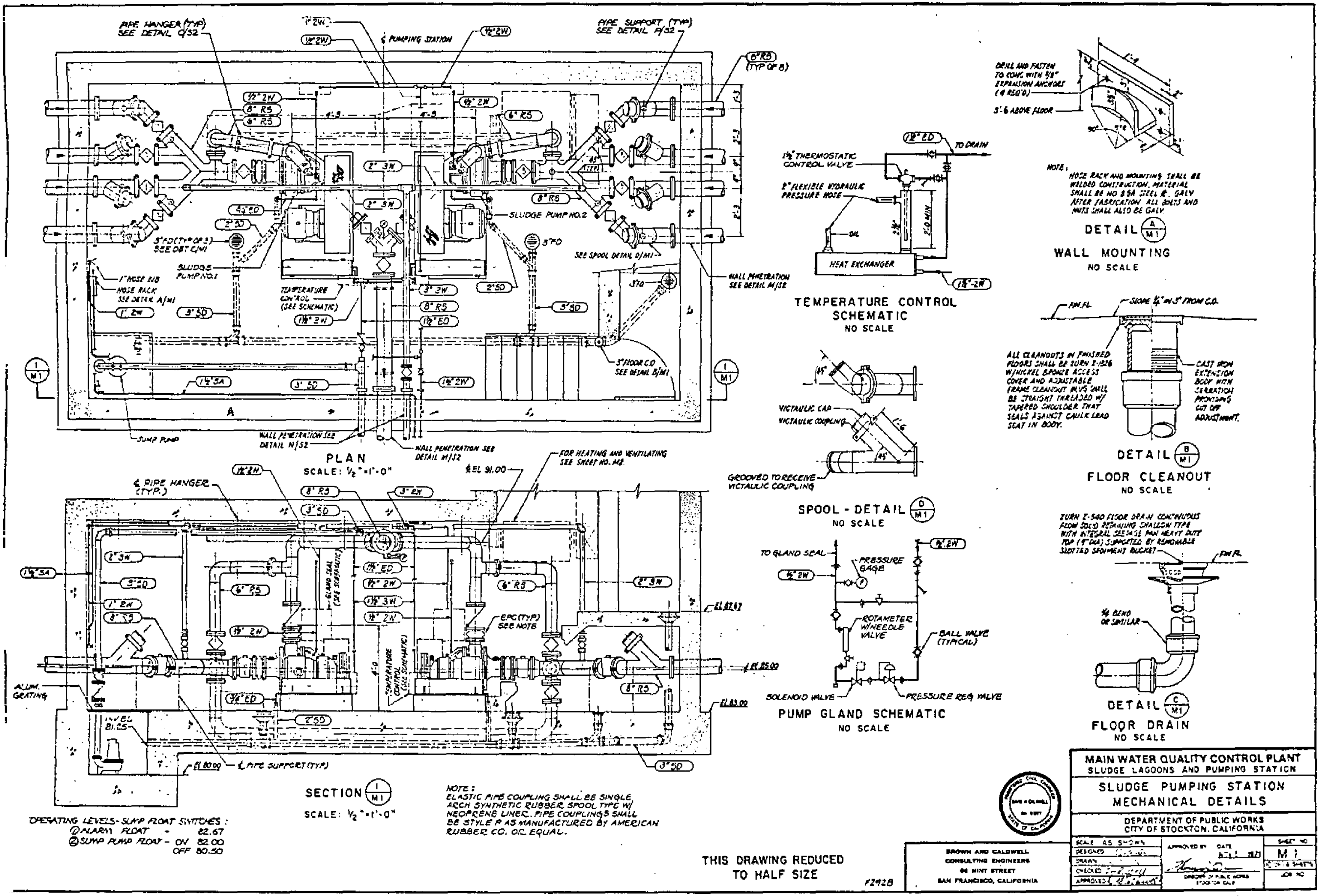
BROWN AND CALDWELL
CONSULTING ENGINEERS
66 MINT STREET
SAN FRANCISCO, CALIFORNIA

MAIN WATER QUALITY CONTROL PLANT
SLUDGE LAGOONS AND PUMPING STATION

SLUDGE PUMPING STATION
HEATING AND VENTILATION

DEPARTMENT OF PUBLIC WORKS
CITY OF STOCKTON, CALIFORNIA

SCALE AS SHOWN
DESIGNED [illegible]
DRAWN [illegible]
CHECKED [illegible]
APPROVED [illegible]
APPROVED BY: DATE
SHEET NO. M2



PLAN
SCALE: 1/2" = 1'-0"
SECTION 1/M1
SCALE: 1/2" = 1'-0"
PIPE HANGER (TYP) SEE DETAIL C/32
PIPE SUPPORT (TYP) SEE DETAIL F/32
℄ PUMPING STATION
6" RS (TYP OF 8)
SLUDGE PUMP NO. 2
SLUDGE PUMP NO. 1
1" HOSE BIB
HOSE RACK SEE DETAIL A/M1
TEMPERATURE CONTROL (SEE SCHEMATIC)
SEE SPOOL DETAIL D/M1
WALL PENETRATION SEE DETAIL M/32
WALL PENETRATION SEE DETAIL N/32
3" FLOOR C.O. SEE DETAIL B/M1
SUMP PUMP
FOR HEATING AND VENTILATING SEE SHEET NO. M2
℄ PIPE HANGER (TYP.)
℄ PIPE SUPPORT (TYP)
ALUM. GRATING
EPC (TYP) SEE NOTE
EL 91.00
EL 87.67
EL 85.00
EL 83.00
EL 80.00
NOTE: ELASTIC PIPE COUPLING SHALL BE SINGLE ARCH SYNTHETIC RUBBER SPOOL TYPE W/ NEOPRENE LINER. PIPE COUPLINGS SHALL BE STYLE P AS MANUFACTURED BY AMERICAN RUBBER CO. OR EQUAL.
OPERATING LEVELS - SUMP FLOAT SWITCHES:
① ALARM FLOAT - 82.67
② SUMP PUMP FLOAT - ON 82.00 OFF 80.50
TEMPERATURE CONTROL SCHEMATIC
NO SCALE
1½" THERMOSTATIC CONTROL VALVE
2" FLEXIBLE HYDRAULIC PRESSURE HOSE
HEAT EXCHANGER
TO DRAIN
SPOOL - DETAIL D/M1
NO SCALE
VICTAULIC CAP
VICTAULIC COUPLING
GROOVED TO RECEIVE VICTAULIC COUPLING
PUMP GLAND SCHEMATIC
NO SCALE
TO GLAND SEAL
PRESSURE GAGE
ROTAMETER W/NEEDLE VALVE
BALL VALVE (TYPICAL)
SOLENOID VALVE
PRESSURE REG VALVE
DETAIL A/M1
WALL MOUNTING
NO SCALE
DRILL AND FASTEN TO CONC WITH 3/8" EXPANSION ANCHORS (4 REQ'D)
3'-6 ABOVE FLOOR
NOTE: HOSE RACK AND MOUNTING SHALL BE WELDED CONSTRUCTION. MATERIAL SHALL BE NO 8GA STEEL R. GALV AFTER FABRICATION. ALL BOLTS AND NUTS SHALL ALSO BE GALV
DETAIL B/M1
FLOOR CLEANOUT
NO SCALE
SLOPE ¼" IN 3" FROM C.O.
ALL CLEANOUTS IN FINISHED FLOORS SHALL BE ZURN Z-1526 W/NICKEL BRONZE ACCESS COVER AND ADJUSTABLE FRAME. CLEANOUT PLUG SHALL BE STRAIGHT THREADED W/ TAPERED SHOULDER THAT SEALS AGAINST CAULK LEAD SEAT IN BODY.
CAST IRON EXTENSION BODY WITH SERRATION PROVIDING CUT OFF ADJUSTMENT.
DETAIL C/M1
FLOOR DRAIN
NO SCALE
ZURN Z-540 FLOOR DRAIN CONTINUOUS FLOW SOLID RETAINING SHALLOW TYPE WITH INTEGRAL SEEPAGE PAN HEAVY DUTY TOP (9" DIA) SUPPORTED BY REMOVABLE SLOTTED SEDIMENT BUCKET
¼ BEND OR SIMILAR
MAIN WATER QUALITY CONTROL PLANT
SLUDGE LAGOONS AND PUMPING STATION
SLUDGE PUMPING STATION
MECHANICAL DETAILS
DEPARTMENT OF PUBLIC WORKS
CITY OF STOCKTON, CALIFORNIA
BROWN AND CALDWELL
CONSULTING ENGINEERS
66 MINT STREET
SAN FRANCISCO, CALIFORNIA
SCALE AS SHOWN
SHEET NO M 1
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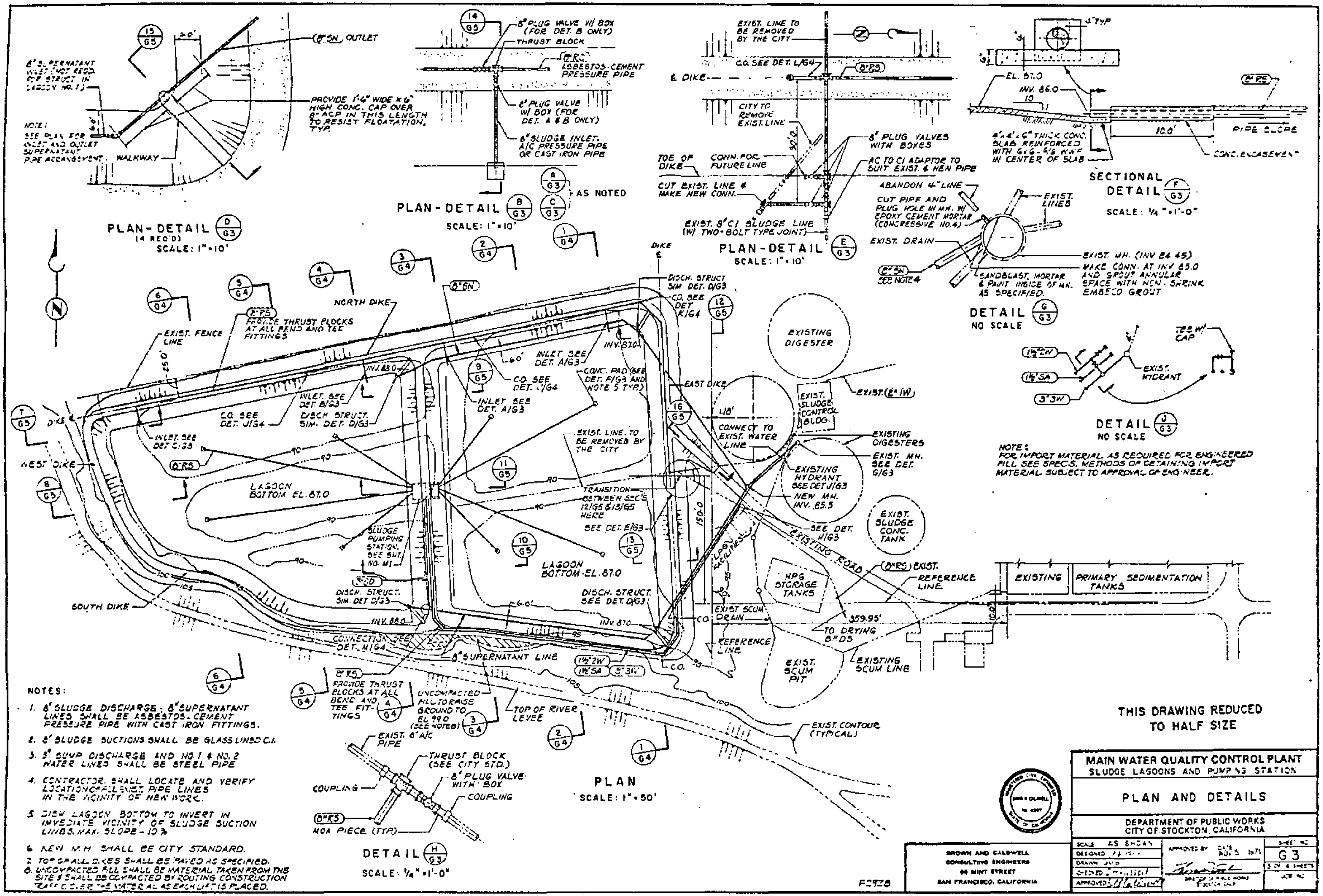
F2928



NOTES:

1. 8" SLUDGE DISCHARGE ; 8" SUPERNATANT LINES SHALL BE ASBESTOS-CEMENT PRESSURE PIPE WITH CAST IRON FITTINGS.
2. 8" SLUDGE SUCTIONS SHALL BE GLASS LINED C.I.
3. 3" SUMP DISCHARGE AND NO. 1 & NO. 2 WATER LINES SHALL BE STEEL PIPE
4. CONTRACTOR SHALL LOCATE AND VERIFY LOCATION OF ALL EXIST. PIPE LINES IN THE VICINITY OF NEW WORK.
5. DISH LAGOON BOTTOM TO INVERT IN IMMEDIATE VICINITY OF SLUDGE SUCTION LINES. MAX. SLOPE - 10%
6. NEW M.H. SHALL BE CITY STANDARD.
7. TOP OF ALL DIKES SHALL BE PAVED AS SPECIFIED.
8. UNCOMPACTED FILL SHALL BE MATERIAL TAKEN FROM THE SITE & SHALL BE COMPACTED BY ROUTING CONSTRUCTION TRAFFIC OVER THE MATERIAL AS EACH LIFT IS PLACED.

THIS DRAWING REDUCED TO HALF SIZE

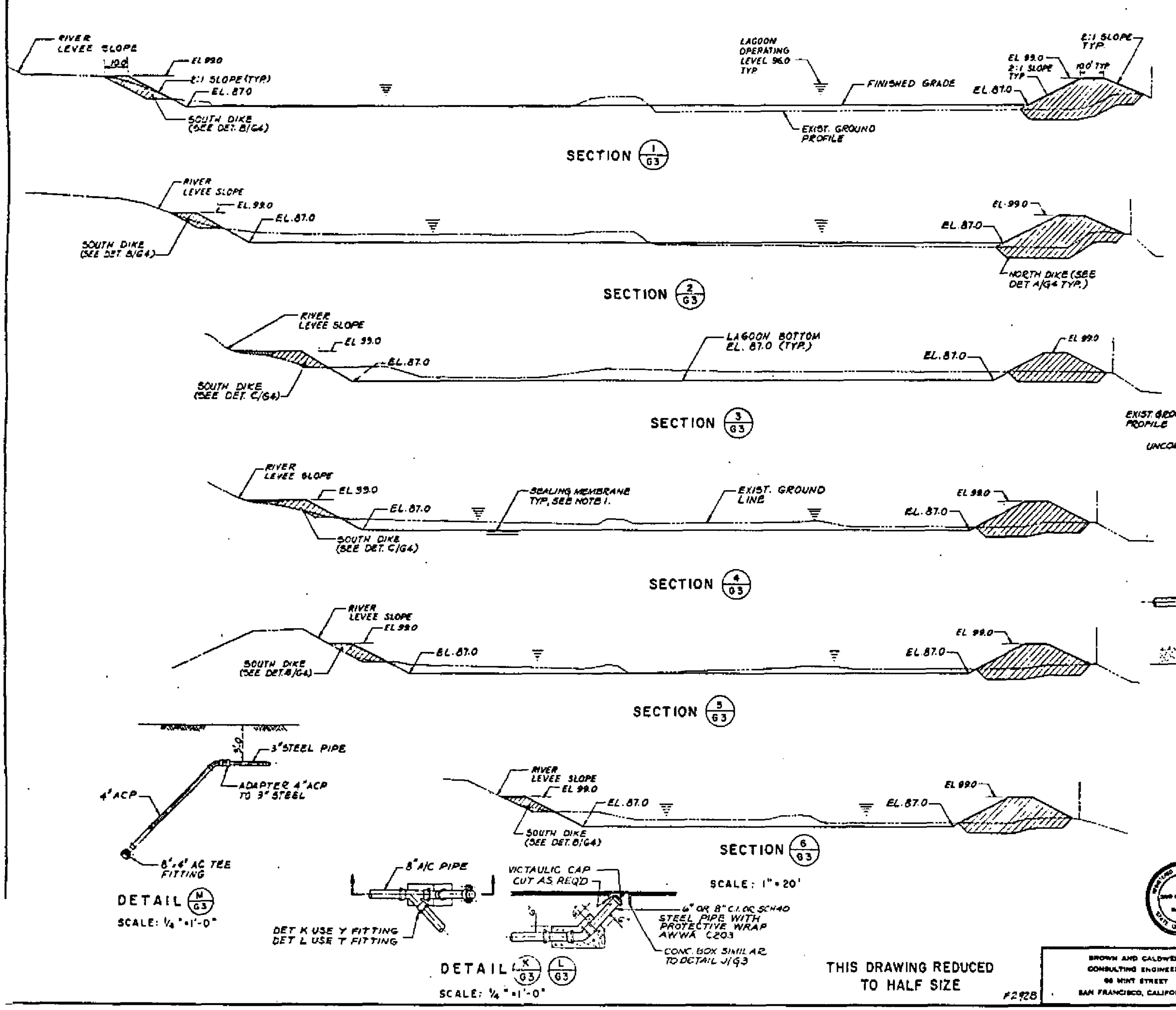
BROWN AND CALDWELL
CONSULTING ENGINEERS
66 MINT STREET
SAN FRANCISCO, CALIFORNIA

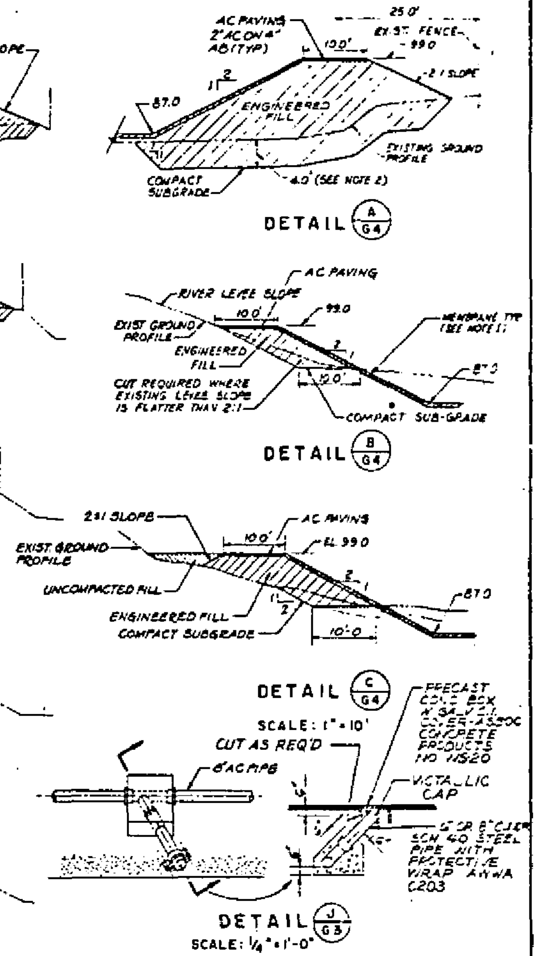
MAIN WATER QUALITY CONTROL PLANT
SLUDGE LAGOONS AND PUMPING STATION

PLAN AND DETAILS

DEPARTMENT OF PUBLIC WORKS
CITY OF STOCKTON, CALIFORNIA

SCALE AS SHOWN
SHEET NO. G3





NOTES:

1. SEALING MEMBRANE TO BE BENTONITE-TREATED SOIL PLACED IN ONE 6-IN. LAYER.
2. AT NORTH DIKE EXCAVATE & MIX BOTTOM 4 FT W/ OTHER SOILS TO OBTAIN SPECIFIED PLASTICITY INDEX AND GRADATION. RECOMPACT AS PART OF NEW DIKE FILL.

MAIN WATER QUALITY CONTROL PLANT
SLUDGE LAGOONS AND PUMPING STATION

SLUDGE LAGOON SECTIONS AND DETAILS

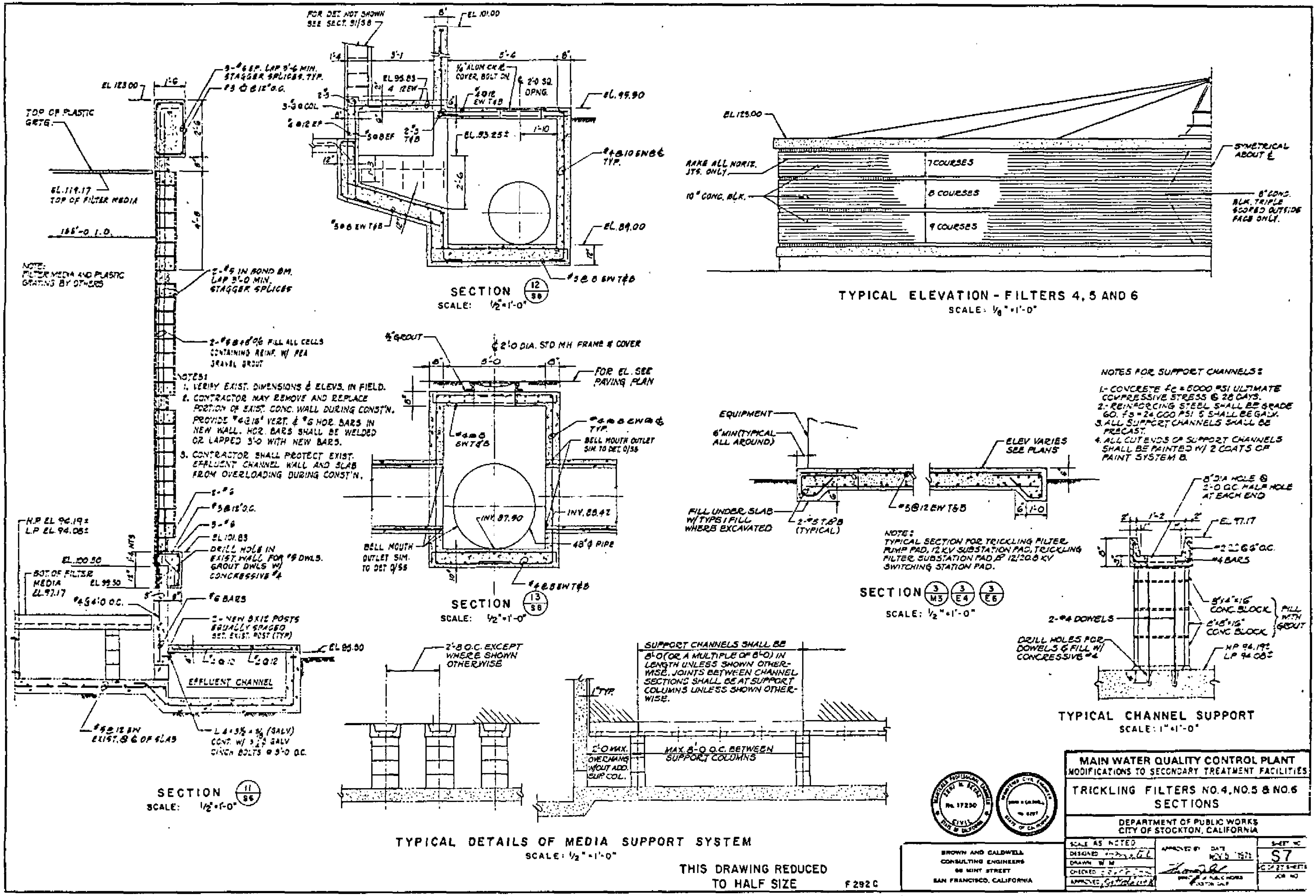
DEPARTMENT OF PUBLIC WORKS
CITY OF STOCKTON, CALIFORNIA

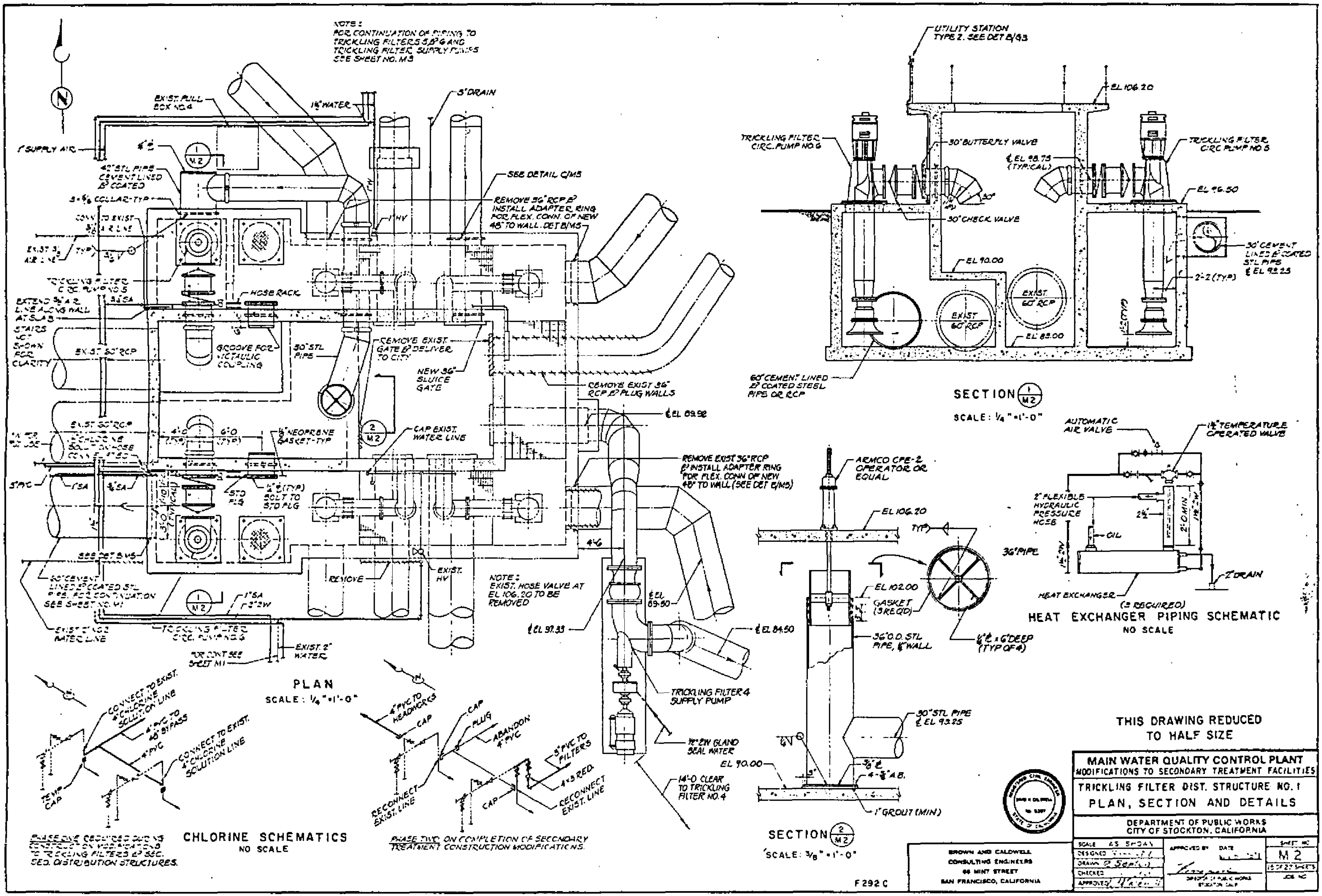
BROWN AND CALDWELL
CONSULTING ENGINEERS
66 MINT STREET
SAN FRANCISCO, CALIFORNIA

SCALE AS SHOWN

SHEET NO. G 4

#2928


SECTION 11/S6
SCALE: 1/2"=1'-0"
TOP OF PLASTIC GRTG.
EL.119.17 TOP OF FILTER MEDIA
NOTE: FILTER MEDIA AND PLASTIC GRATING BY OTHERS
2-#5 IN BOND BM. LAP 3'-0 MIN. STAGGER SPLICES
NOTES:
1. VERIFY EXIST. DIMENSIONS & ELEVS. IN FIELD.
2. CONTRACTOR MAY REMOVE AND REPLACE PORTION OF EXIST. CONC. WALL DURING CONST'N. PROVIDE #4@16" VERT. & #5 HOR. BARS IN NEW WALL. HOR. BARS SHALL BE WELDED OR LAPPED 3'-0 WITH NEW BARS.
3. CONTRACTOR SHALL PROTECT EXIST. EFFLUENT CHANNEL WALL AND SLAB FROM OVERLOADING DURING CONST'N.
EFFLUENT CHANNEL
SECTION 12/S6
SCALE: 1/2"=1'-0"
SECTION 13/S6
SCALE: 1/2"=1'-0"
48"Ø PIPE
TYPICAL ELEVATION - FILTERS 4, 5 AND 6
SCALE: 1/8"=1'-0"
7 COURSES
8 COURSES
9 COURSES
10" CONC. BLK.
SYMETRICAL ABOUT ℄
NOTES FOR SUPPORT CHANNELS:
1. CONCRETE f'c = 5000 PSI ULTIMATE COMPRESSIVE STRESS @ 28 DAYS.
2. REINFORCING STEEL SHALL BE GRADE 60. fs = 24,000 PSI & SHALL BE GALV.
3. ALL SUPPORT CHANNELS SHALL BE PRECAST.
4. ALL CUT ENDS OF SUPPORT CHANNELS SHALL BE PAINTED W/ 2 COATS OF PAINT SYSTEM B.
SECTION 3/M3 3/E4 3/E6
SCALE: 1/2"=1'-0"
NOTE: TYPICAL SECTION FOR TRICKLING FILTER PUMP PAD, 12 KV SUBSTATION PAD, TRICKLING FILTER SUBSTATION PAD & 12/20.8 KV SWITCHING STATION PAD.
TYPICAL CHANNEL SUPPORT
SCALE: 1"=1'-0"
SUPPORT CHANNELS SHALL BE 8'-0 (OR A MULTIPLE OF 8'-0) IN LENGTH UNLESS SHOWN OTHERWISE. JOINTS BETWEEN CHANNEL SECTIONS SHALL BE AT SUPPORT COLUMNS UNLESS SHOWN OTHERWISE.
MAX. 8'-0 O.C. BETWEEN SUPPORT COLUMNS
TYPICAL DETAILS OF MEDIA SUPPORT SYSTEM
SCALE: 1/2"=1'-0"
THIS DRAWING REDUCED TO HALF SIZE
BROWN AND CALDWELL CONSULTING ENGINEERS 66 MINT STREET SAN FRANCISCO, CALIFORNIA
MAIN WATER QUALITY CONTROL PLANT
MODIFICATIONS TO SECONDARY TREATMENT FACILITIES
TRICKLING FILTERS NO.4, NO.5 & NO.6 SECTIONS
DEPARTMENT OF PUBLIC WORKS CITY OF STOCKTON, CALIFORNIA
SCALE AS NOTED
S7
F 292 C


NOTE: FOR CONTINUATION OF PIPING TO TRICKLING FILTERS 5 & 6 AND TRICKLING FILTER SUPPLY PUMPS SEE SHEET NO. M3
EXIST. PULL BOX NO. 4
1½" WATER
3" DRAIN
1" SUPPLY AIR
40" STL PIPE CEMENT LINED & COATED
SEE DETAIL C/M5
REMOVE 36" RCP & INSTALL ADAPTER RING FOR FLEX. CONN. OF NEW 48" TO WALL. DET B/M5
HOSE RACK
GROOVE FOR VICTAULIC COUPLING
30" STL PIPE
REMOVE EXIST. GATE & DELIVER TO CITY
NEW 36" SLUICE GATE
REMOVE EXIST 36" RCP & PLUG WALLS
EXIST. 60" RCP
½" NEOPRENE GASKET-TYP
CAP EXIST. WATER LINE
REMOVE EXIST 36" RCP & INSTALL ADAPTER RING FOR FLEX. CONN OF NEW 48" TO WALL (SEE DET E/M5)
SEE DET B/M5
REMOVE
EXIST. HV
NOTE: EXIST. HOSE VALVE AT EL 106.20 TO BE REMOVED
EXIST. 2" WATER
TRICKLING FILTER 4 SUPPLY PUMP
½" 2W GLAND SEAL WATER
14'-0 CLEAR TO TRICKLING FILTER NO. 4
PLAN
SCALE: ¼" = 1'-0"
UTILITY STATION TYPE 2. SEE DET B/M3
EL 106.20
TRICKLING FILTER CIRC. PUMP NO. 6
30" BUTTERFLY VALVE
TRICKLING FILTER CIRC. PUMP NO. 5
30" CHECK VALVE
EL 96.50
EL 90.00
EXIST. 60" RCP
30" CEMENT LINED & COATED STL PIPE
EL 85.00
60" CEMENT LINED & COATED STEEL PIPE OR RCP
SECTION 1/M2
SCALE: ¼" = 1'-0"
AUTOMATIC AIR VALVE
1½" TEMPERATURE OPERATED VALVE
2" FLEXIBLE HYDRAULIC PRESSURE HOSE
OIL
36" PIPE
2" DRAIN
HEAT EXCHANGER
(3 REQUIRED)
HEAT EXCHANGER PIPING SCHEMATIC
NO SCALE
ARMCO CPE-2 OPERATOR OR EQUAL
EL 106.20
EL 102.00
GASKET (3 REQ'D)
36" O.D. STL PIPE, ½" WALL
30" STL PIPE ℄ EL 93.25
EL 90.00
1" GROUT (MIN)
SECTION 2/M2
SCALE: ⅜" = 1'-0"
CONNECT TO EXIST. 4" CHLORINE SOLUTION LINE
4" PVC TO HEADWORKS
CAP
PLUG
ABANDON 4" PVC
RECONNECT EXIST. LINE
4x3 RED.
CHLORINE SCHEMATICS
NO SCALE
PHASE TWO: ON COMPLETION OF SECONDARY TREATMENT CONSTRUCTION MODIFICATIONS.
THIS DRAWING REDUCED TO HALF SIZE
MAIN WATER QUALITY CONTROL PLANT
MODIFICATIONS TO SECONDARY TREATMENT FACILITIES
TRICKLING FILTER DIST. STRUCTURE NO. 1
PLAN, SECTION AND DETAILS
DEPARTMENT OF PUBLIC WORKS
CITY OF STOCKTON, CALIFORNIA
BROWN AND CALDWELL
CONSULTING ENGINEERS
66 MINT STREET
SAN FRANCISCO, CALIFORNIA
M 2
F 292 C