

January 15, 1991

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NRC

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: **Docket No. 50-206**
Responses to NRC Questions on Intake Structure Degradation
San Onofre Nuclear Generation Station, Unit 1 (TAC No. 74168)

Reference: Letter, J. E. Tatum, NRC, to Harold B. Ray, SCE, "Intake Structure Degradation - San Onofre Nuclear Generation Station, Unit No. 1", dated August 13, 1990.

This letter provides responses to NRC questions on the status of the SONGS 1 intake structure. The NRC is reviewing the intake structure after corrosion of rebar and delamination of concrete was discovered in the mid 1980's. The questions resulted from an NRC visit to the SONGS site during the week of July 9, 1990.

The NRC request encompasses nine topics including intake structure construction details, past and future inspections, ground water chemistry, soil contaminants, chloride penetration into the structure, adequacy of strap plate retaining bolts, and non-destructive examination methods for evaluating the condition of concrete at increased depths. The requested information is provided in the enclosure. Each of the NRC questions are repeated for clarity, followed by our response.

The intake structure has been thoroughly inspected several times in the past. The most recent inspection was completed in July, 1990. We have had good results and believe that our answers to the NRC questions demonstrate the acceptability of our program for long-term use of the intake structure.

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Add: John Bradford
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Encl attached

January 15, 1991

If you have any remaining questions on this matter, please contact me.

Very truly yours,



F. R. Nandy
Manager, Nuclear Licensing

INTAKE.SN2

Enclosure

cc: J. B. Martin, Regional Administrator, NRC Region V
C. Caldwell, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3
C. D. Townsend, NRC Resident Inspector, San Onofre Unit 1

bcc: (See attached sheet)

RESPONSES TO THE NRC'S "REQUEST FOR ADDITIONAL INFORMATION
RE: INTAKE STRUCTURE DEGRADATION
SAN ONOFRE NUCLEAR GENERATION STATION, UNIT 1
DOCKET NO. 50-206"

1. REQUEST

Provide your assessment of the source of water appearing at the junction of South and West walls. Evaluate the consequences of sustained water leakage (ground water) on the rebar and wall integrity.

RESPONSE

The source of the water was determined to be water seeping from conduits for non-safety related equipment that terminate in an electrical junction box. The junction box is at Elevation (+)12'-2" which is above the ground water high level of (+)6.8 ft. When the junction box cover was removed, the water was traced to surface drainage that originates near the MOV gates and fish basket hoist controls and flows through the conduits to the junction box (see Figure 1). Therefore, the water is not ground water seeping through the concrete wall, but rather surface water running down conduits and wetting the surface of the concrete. The water flows have been intermittent and have not caused any corrosion as evidenced by the lack of rust stains and spots on the wall in the vicinity of the junction box. The moisture near the junction of the south and west walls is not affecting the structural integrity of the rebar or the concrete walls.

2. REQUEST

A review of the construction drawings of the intake structure walls and slabs indicated that water-stops were not used at the wall-slab junctions. Evaluate the consequences of water passage (in-to-out or out-to-in) on the rebar and the long-term integrity of walls and slabs.

RESPONSE

Although water stops were not used at construction joints, the construction joints and the subsequent placement of adjacent concrete was completed to assure leak tight joints. The procedure was performed as delineated in Sections 95 and 103 of the Concrete Manual (Eighth Edition) published by the U.S. Department of the Interior Bureau of Reclamation. The procedure specifies wet sand blasting (or equivalent operation) of the existing concrete at a construction joint, cleaning and presoaking of the joint prior to placement of adjacent concrete, and the use of mortar in the first layer of placement. The mortar is a "starter mix" grout consisting of maximum aggregate size of No. 4 with 5000 PSI minimum compressive strength, or an approved pump mix meeting the minimum strength requirements designated for the placement. The U.S. Bureau of Reclamation has indicated in the concrete manual that these procedures produce monolithic watertight construction joints.

The flow of water through the joints is generally from the outside (ground water) into the structure due to the hydrostatic pressure gradient. The average ground water elevation of (+)4.5' is above the sea water level during normal plant operation. Sea water flow into the joints could conceivably cause corrosion, but the recent Cycle 11 inspection did not reveal any evidence of corrosion around the joints. Also, when the intake structure was dewatered in 1984, no water in-leakage from the construction joints was observed. Based on the joint construction method, the lack of corrosion signs in the joints and the absence of water leakage through the joints while the structure was dewatered, the integrity of walls and slabs at the joints has not been affected because water-stops are not used.

3. REQUEST

The procedures established for the ongoing inspection seem to be adequate. However, additional instruction should be provided for the inspection of underwater areas where the access is limited (underside of slabs, tunnels and joints between the pipe-tunnel and cast-in-place section), and for inspection of wall-slab junctions.

RESPONSE

Special attention was given to limited access areas and wall-slab junctions during the recent Cycle 11 surveillance. These limited access areas included the underside of slabs, tunnels, joints between the pipe-tunnel and cast-in-place section, and wall-slab junctions. All of these areas were visually inspected by underwater divers. The divers were directed by civil engineers using headset intercoms and a remote video camera and followed the established inspection procedure for the intake structure.

The results of the surveillance are given in the inspection report entitled "Third Surveillance Report for SONGS Unit 1 Intake Structure (Cycle 11 Refueling Outage)", dated October 1990. This report is included as Attachment A for information. The ceiling revealed some continued signs of corrosion (i.e., rust staining and minor cracks), but were concentrated in areas that were previously repaired or in locations where the inside rebar is not required to ensure the structural integrity of the intake structure. A few scattered areas of minor rust indications were observed in the pipe-tunnel transition area, as well as the wall-slab junctions. However, none of these areas exhibited the symptoms of high rebar corrosion that were observed during the 1984 inspection. The discoloration of the concrete and the rust spots were fewer in number, randomly spaced, and not concentrated. The rust spots did not follow a vertical or horizontal pattern that coincided with rebar locations as was observed in 1984.

In summary, the Third Surveillance Report documents the result that no indications of unacceptable corrosion levels were observed in the limited access areas during the Cycle 11 inspection. These areas will continue to be monitored during future inspections.

4. REQUEST

Provide information on ground water chemistry (mainly chlorides, sulfates and pH-value) near the sea wall and near the pump support structure. Also, provide your assessment of the effects of ground water seeping into the intake structure walls and slabs.

RESPONSE

During the Return-To-Service effort in 1984, core samples were taken completely through the walls and floor of the intake structure to determine if lamellar cracking and corrosion of the outermost layer of rebar were occurring. The samples indicated that the outside reinforcing steel is in excellent condition with no signs of corrosion or delamination of the concrete on the outside face. This is consistent with the low chloride concentrations measured in the ground water immediately adjacent to the walls and floor. The measured ground water chloride levels are shown in Table 1.

TABLE 1

CORE LOCATION	CHLORIDE CONCENTRATION (PPM)
El. (-)24' on the east wall of north pump pit on the pump centerline	294
El. (-)24' on the north wall of the north pump pit on the Saltwater pump centerline	160 165
El. (-)24' on the north wall of the intake conduit 6' east of stop gate	260 250
El. (-)24' on the south wall of the south pump pit 10'-5" ± east of the traveling screen slot	210 140 205
North pump pit floor 2 ft. east of the Saltwater pump centerline	155 135

The measured chloride concentrations of the ground water are well below the 19,000 ppm generally accepted as the chloride content of sea water. The outside surface of the structure is constantly under the minimum ground water table of Elevation (+)3 ft., which limits the access of oxygen. As such, its environment is not conducive to corrosion. All core samples have indicated that the outside reinforcing steel is in excellent condition with no signs of corrosion. There were no indications of delamination of the concrete on the outside face. The measured chloride content in the concrete cores represents approximately 20 years of exposure to the ground.

Therefore, the measured low levels of chloride in the concrete and in the ground water, and the good condition of the concrete as substantiated by concrete cores support the conclusion that the outside reinforcing steel and exterior surfaces of the walls have been unaffected by ground water seepage and will continue to be unaffected in the future.

No sulfate concentrations or pH values of the ground water were measured in the immediate area of the intake structure. Backfill soil samples at San Onofre indicate a low sulfate level (see response to Request No. 5).

5. REQUEST

Provide information on the results of the chemical contaminant tests (chlorides, sulfates) of backfill soils. Also, provide your assessment of the effects of these contaminants leaching into the intake structure walls and slabs.

RESPONSE

The backfill soil chemical analysis tests revealed the following levels of chlorides and sulfates:

Sulfates - 2 to 5 ppm
Chlorides - 7 to 48 ppm

The complete results of the backfill soil chemical analysis from Section B-II of "Erosion Study for the Proposed Units 2 and 3 San Onofre Generating Station, San Onofre, California" by Woodward-McNeill and Associates, dated January 30, 1974, is included as Attachment B.

The concentration of the sulfates measured in the backfill soil is much less than the 1000 ppm limit specified in ACI 201 for Type II cement. Type II cement was used throughout the intake structure and no sulfate-caused deterioration was observed in the core samples.

The chloride concentration measured in the backfill soil is considerably less than the ground water level of approximately 300 ppm. This low chloride concentration in the soil has very little effect on the intake structure walls and slab. As stated in the response to Request No. 4, the outside walls and floor had been exposed to these levels of contaminants for approximately 20 years and no corrosion had occurred on the outside rebar over that time span, as verified by the core samples taken in 1984. Therefore, no change in the condition of the concrete and reinforcing steel is expected due to the insignificant levels of contaminants leaching into the intake structure walls and slabs.

6. REQUEST

Identify those areas most likely to be susceptible to corrosion and degradation based on existing chloride levels and dissolved oxygen. More explanation (as discussed during the meeting) of the chloride penetration curves should be provided.

RESPONSE

Based on past experience and the results of our inspections, the areas of the intake structure that are most susceptible to corrosion and degradation are the pump bays and sections located in the tidal zone (i.e., wet-dry conditions). Both of these areas are exposed to relatively high oxygen levels which are caused by turbulence from pump operation, and by water level fluctuations that produce cyclic wet-dry conditions. The oxygen levels present in these areas, along with the high chloride concentrations found in sea water (19,000 ppm) are the main constituents that make up a corrosive environment.

The pump bay walls and ceilings were repaired with strap plates in 1984. Repair details are designed for other areas that may require repairs in the future. Structural evaluations are performed after each surveillance to determine the need for repairs. Figure 2 shows the areas which require inside rebar to withstand design loads and repairs if deemed necessary during future surveillances.

The chloride penetration curves included in the submittal from M. O. Medford (SCE) to W. A. Paulson (NRC), titled "Intake Structure Degradation and Repair, San Onofre Nuclear Generating Station Unit 1", dated October 18, 1984, are graphical representations of the amount of chloride found in the concrete core samples. These curves are included in this writeup as Figures 3, 4, and 5. The sea water on the inside of the concrete (left side of graphs) has a chloride content of approximately 19,000 ppm and the ground water on the outside of the concrete (right side of graphs approximately 30" from the inside surface) contained about 300 ppm of chloride. The inside and outside reinforcing steel are located approximately 3.5" and 26" (i.e., 3.5 to 4 inches from the structure's exterior surfaces) from the inside surface of the concrete, respectively. The core numbers correspond to the core sample numbers included in the October 18, 1984 submittal. All core samples were taken through the entire thickness of the walls and floor except Core 25 which is a partial depth core. The penetration curves indicate, as expected, that the percentage by weight of chloride is highest at the inside rebar and is very low at the outside rebar that is exposed to the ground water.

A few of the cores exhibited very high chloride contents near the inside rebar. These chloride concentrations were about 2 to 2½ times higher than that in the 0 to ½ inch segment directly adjacent to the

circulating sea water. This phenomena can be explained by the following considerations:

- o As the sea water slowly penetrates into the concrete, the chloride reacts with the cement paste producing calcium chloride, potassium chloride, aluminum chloride, iron chloride, complex chloroaluminates and hydrates of the above. As these reactions occur, the sea water which has penetrated into the concrete is depleted in chloride, but over a period of time it once again reaches equilibrium with the body of the sea water. With this process, the chloride contents in the concrete can reach levels well above the sea water chloride content.
- o Near the surface of the concrete in contact with sea water, another phenomenon is occurring. Many of the chloride salts that have been produced are water-soluble to some extent and these will be slowly dissolved out. Thus, this region will gradually become depleted in the paste components (and in chloride). With this factor, the near surface concrete can show a lower chloride content than the concrete deeper into the wall.
- o The corroding anode (rebar) attracts negatively charged chloride ions during the corrosion process. This factor also contributes to the high chloride levels at the region of the bars.

Cores 27, 28, and 29 were taken on the south wall of the south pump bay and south screen well (Figure 4). These cores represent chloride concentrations in concrete that is exposed to sea water on both sides (intake on the north side and discharge on the south side of the wall). The relatively high chloride content measured at both the inside and outside rebar of the south wall indicate that corrosion could be occurring on both surfaces. The inspection of the discharge side of the south wall showed only minor signs of corrosion during the Cycle 11 outage. In contrast, the north side of the wall exhibited many indications of corrosion. As previously stated, the north side of the wall was repaired in 1984. The difference in the degree of corrosion on the north side is attributed primarily to the higher sea water oxygen levels caused by pumping turbulence in the pump bays.

7. REQUEST

The 1986 inspection revealed some spot delamination of the top of the base slab. This indicates that chloride related corrosion may occur even in the constantly submerged structure. Evaluate this condition in the context of results from item 6 and discuss the vulnerability of other submerged areas.

RESPONSE

The base slab corrosion indications were observed in the area around the stop gate and its associated embedded copper plate. Since the corrosion indications were small and very localized, we concluded that they were probably caused by chloride penetrating the seam between the concrete and the embedded plate. No other corrosion on the base slab has been observed. Nonetheless, the base slab is inspected for signs of degradation during each surveillance.

The entire intake structure, including continually submerged areas, is inspected during each surveillance for possible signs of corrosion and delamination. This inspection strategy recognizes that continual submergence does not necessarily prevent intake structure corrosion. The locations that have exhibited the most substantial corrosion indications are high oxygen areas such as the pump bays and the wet-dry cyclic areas in the screen wells. The pump bays are exposed to higher than average oxygen levels because of the turbulence caused by pump operation.

In summary, substantial levels of corrosion have occurred in areas exposed to high oxygen levels. However, all areas, including continually submerged areas, are inspected for corrosion indications and, if necessary, repaired during each refueling outage to ensure the structural integrity of the intake structure.

8. REQUEST

The reinforcing plates are anchored to the concrete walls by means of Monel bolts. They are likely to lose their preload due to relaxation and long-term surface degradation of the walls. Discuss the effectiveness of the bolts in assuring proper composite action when the preload is lost, or establish procedures which verify proper bolt preload during inspections.

RESPONSE

The strap plates do not require any preloading of the Monel anchor bolts to withstand the design loads. The design of the anchor bolts is based on both of the following methodologies:

- o Shear friction method as defined in ACI 318-77, Section 11.7.
- o Composite section method as defined in, "AISC Steel Construction Manual", Section 1.11.

In the shear friction method, normal reinforcement is provided to develop shear friction between the strap plate and concrete. The area of bolts that will function as normal reinforcement, A_{vf} , is determined from the following formula:

$$A_{vf} = V_n / \phi f_y \mu$$

where

- V_n = required shear strength (conservatively assumed as the yield strength of the plate)
- ϕ = strength reduction factor, 0.85
- f_y = yield strength of the bolt material
- μ = coefficient of friction.

No specific value for the coefficient of friction for concrete placed against coal tar epoxy coated steel plate is specified by the ACI code. The ACI code does specify 0.70 for concrete against bare steel. Considering the shear friction mechanism where the resistance to shear forces is developed by a concrete wedge pushed against the plate which, in turn, is kept in place by tensioning of the normal reinforcement (i.e., the bolts), a 0.7 factor is used. No pretensioning is required by this method. Pretensioning would have the effect of reducing the required amount of shear friction reinforcement (i.e., reducing the number of anchor bolts).

Following the AISC code composite design procedures and extrapolating the existing test data on common shear connectors to the bolt design selected, approximately the same number of required bolts was obtained

to develop the strength of the plate. AISC does not require any pretensioning of the shear connectors in composite design.

Although the above design methods do not require preload, bolt pretension using the turn-of-the-nut method was specified in the construction procedures to further assure composite action of the strap plate and concrete without any significant slip between the two elements.

The preload of the anchor bolts is not verified during intake structure surveillances. However, the strap plates are checked during each inspection to ensure all anchor bolts are functional (i.e., associated nuts are not loose). This is accomplished by checking the nuts by hand, inspecting for gaps between nut and washer, and checking for cracks in the coating over the nut and bolt. The Cycle 11 inspection did not reveal any loose nuts or bolts.

9. REQUEST

Determine if NDE methods are currently available or will be available for evaluating the condition of concrete at depth, and your plans for implementing the use of such NDE methods.

RESPONSE

Half-cell potential measurements is a nondestructive examination (NDE) method currently being used to evaluate the intake structure. This method has been used, along with visual surveys, for the three underwater surveillances (1986, 1988, and 1990). The half cell measurement data did not show any large potential differences which are characteristic of above-water half cell surveys. Therefore, this method has not proven to be a useful method for evaluating the intake structure. Visual inspections and sounding suspect areas have proven to be the most reliable and useful methods.

No new viable NDE methods to replace the half-cell surveys were found for evaluating the condition of reinforced concrete underwater. One NDE method, the Ultrasonic Pulse-Echo (UPE) system, has recently been developed by the U. S. Army Corps of Engineers to determine the quality and condition of surface and interior concrete up to one foot thick in dry or underwater environments. However, since UPE is currently limited to concrete thicknesses of one foot, it is not considered a useful method for the 2½ to 3 foot thick intake structure. However, efforts are underway by the U. S. Army Corps of Engineers to develop a similar system that will be useful on concrete tens of feet thick.

The principle of operation for the UPE system is to generate an ultrasonic (acoustic) wave by exciting a piezoelectric material with a high-amplitude, transient electric pulse from a high-voltage high-current pulser. The short burst of ultrasonic energy from the crystal is transmitted into the concrete and impinges upon the various interfaces within the concrete. The change in acoustic impedance at the various interfaces (e.g., air voids, water-filled voids, reinforcing bars, cracks, delaminations and other interfaces or inclusions within the concrete) causes a portion of the input energy to reflect (echo) back to the surface. The reflected energy is detected by a second piezoelectric element. A larger portion of the energy continues to travel forward and strike other interfaces and return an amount of energy based on: (1) the area of the reflecting surface, (2) the angle of the reflecting surface, and (3) the acoustic impedance of the reflecting material. The time for the echo to return is measured with the accurate time base of an oscilloscope. The time is then related to the ultrasonic pulse velocity, v , by the following equation:

$$v = 2L/t$$

where

L = concrete thickness
t = time of arrival of backwall echo.

Sound concrete will generally have a very narrow range of velocities, while localities where deterioration or microcracking has occurred will have a noticeably reduced velocity.

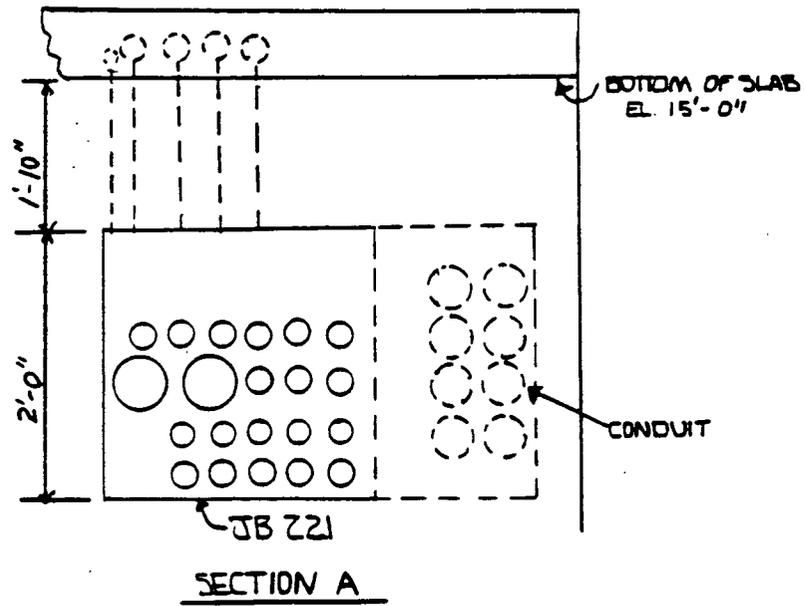
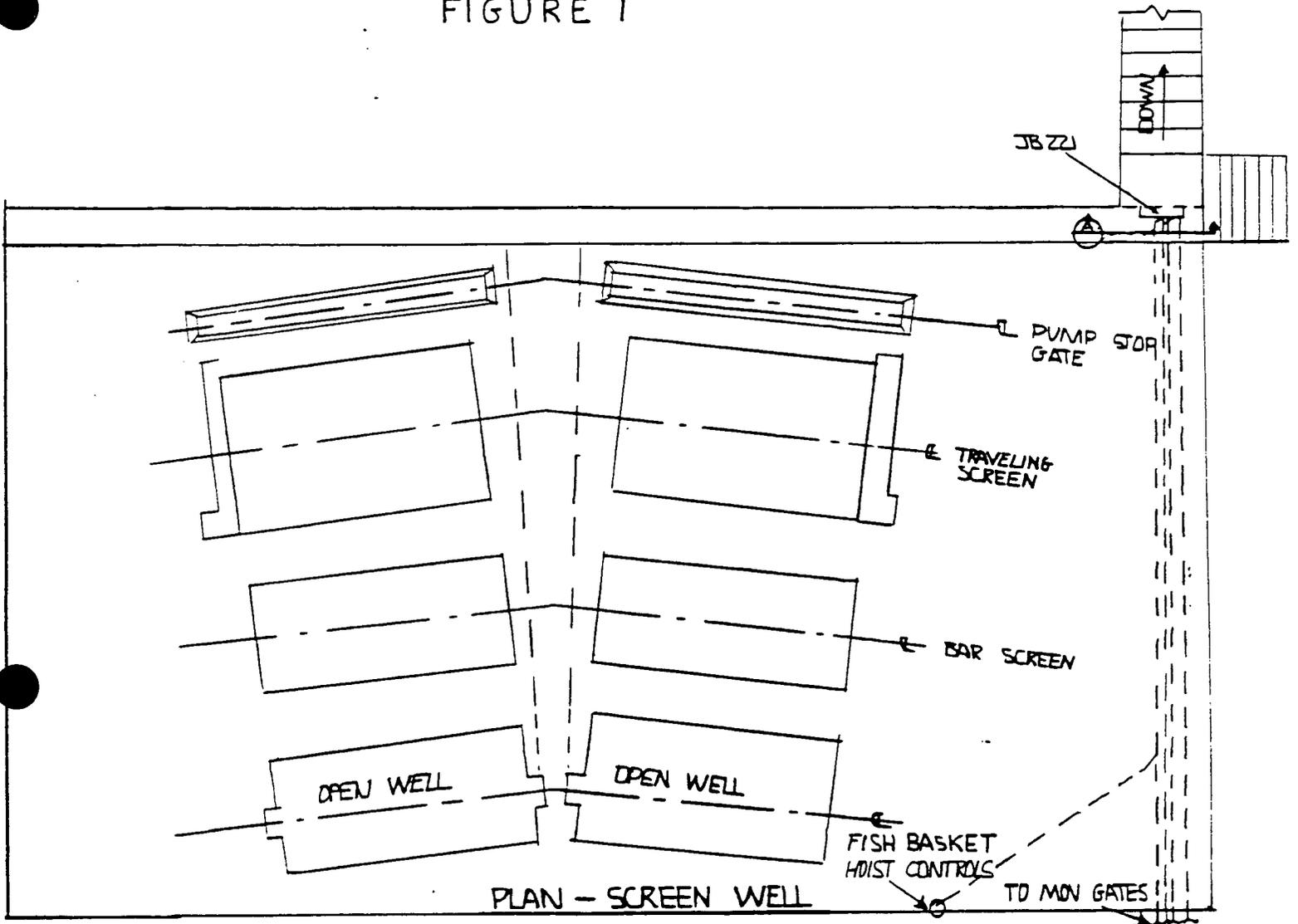
The following three NDE methods were also suggested by Wiss, Janney, Elstner (WJE) Associates, Inc. as possible underwater methods for determining the condition of the intake structure:

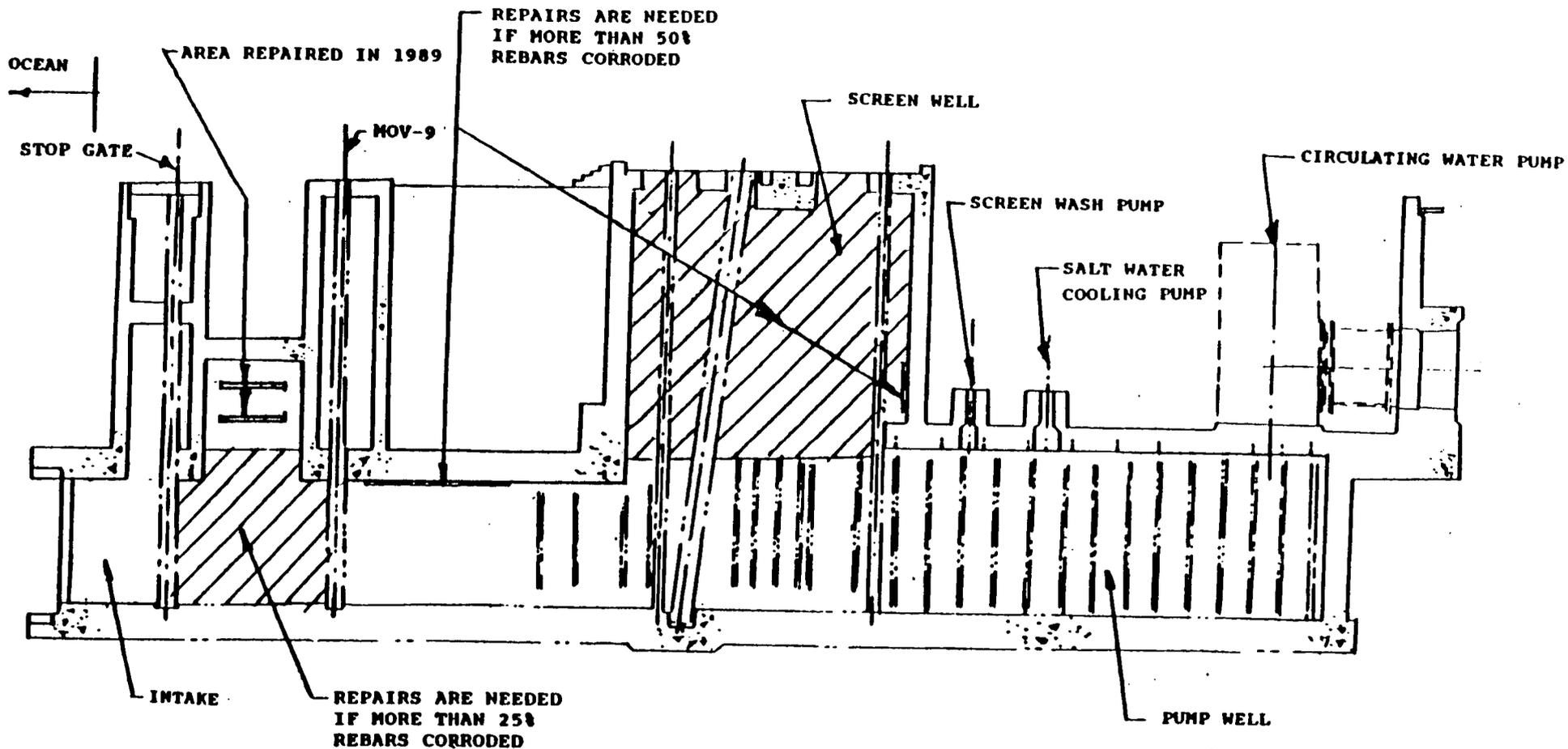
1. Direct Current Detection Method, developed by the navy, measures voltage differences between two reference electrodes to detect corrosion activity. However, this method is in the developmental phase and requires additional effort before further consideration of the technique can be made.
2. Impact Echo Method is a method that measures the energy (wave frequency) reflected from inside the slab when the surface of the concrete is impacted with a hammer. The frequency of the reflections is then measured with a spectrum analyzer to determine delamination planes. This method is also in the developmental stage.
3. Electrochemical Corrosion Detection Method, developed by TNO Institute for Building Materials and Structures located in the Netherlands, is based on relating the measurement of small electrical currents in the sea water due to the electrochemical corrosion process to corrosion rates. This method is potentially capable of detecting locations of high underwater corrosion current and the width and depth of underwater cracks in concrete.

Since Methods 1 and 2 remain in the developmental stage, neither are proven or viable underwater methods for determining the rate and/or extent of corrosion of the intake structure. Based on the limited information obtained from WJE on Method 3, a workable apparatus to assess present corrosion patterns may be available in Europe. This method is being further evaluated by SCE.

In summary, the existing UPE system and Methods 1 and 2 suggested by WJE are not considered viable for determining the condition of the intake structure. The current techniques of visual inspection and sounding suspect areas are proven, reliable methods for evaluating the intake structure. Future developments in NDE methods for underwater concrete structures will continue to be monitored and evaluated for inclusion into the SONGS 1 intake structure surveillance program.

FIGURE 1





ELEVATION. INTAKE STRUCTURE

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 - AREA THAT MAY NEED REPAIRS

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Figure 2

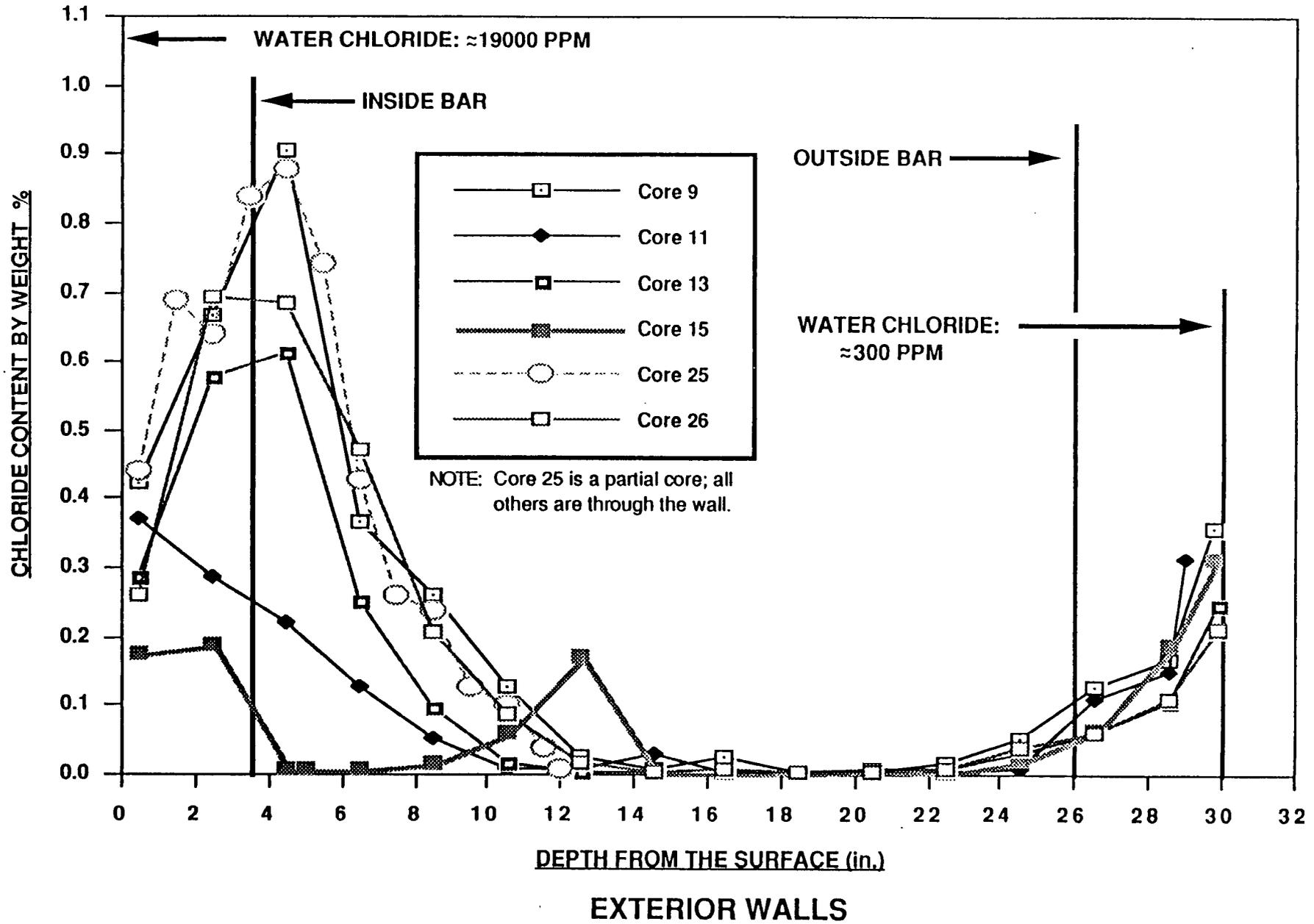


Fig. 3 - VARIATION OF CHLORIDE CONTENT WITH DEPTH

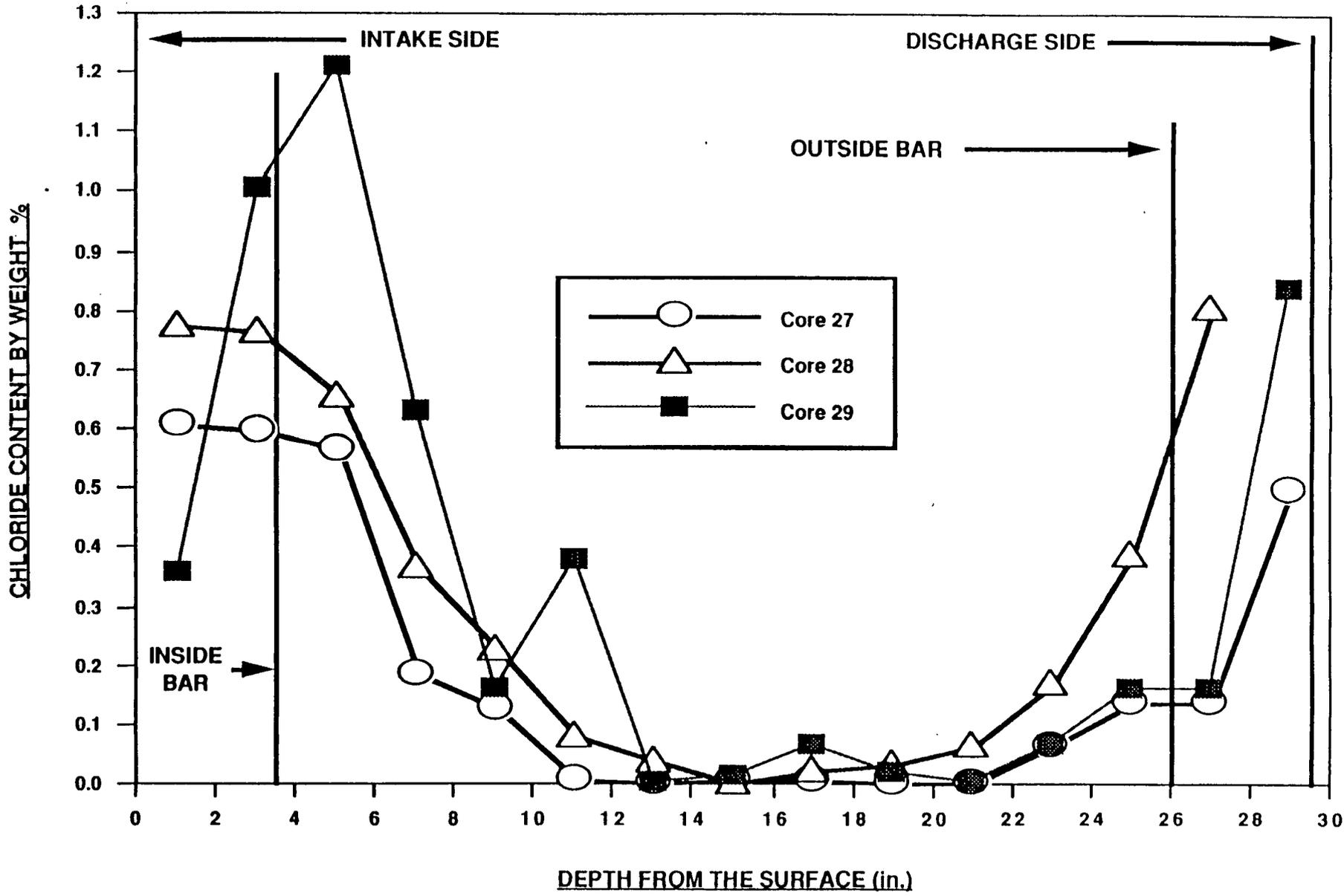


Fig. 4 - VARIATION OF CHLORIDE CONTENT WITH DEPTH

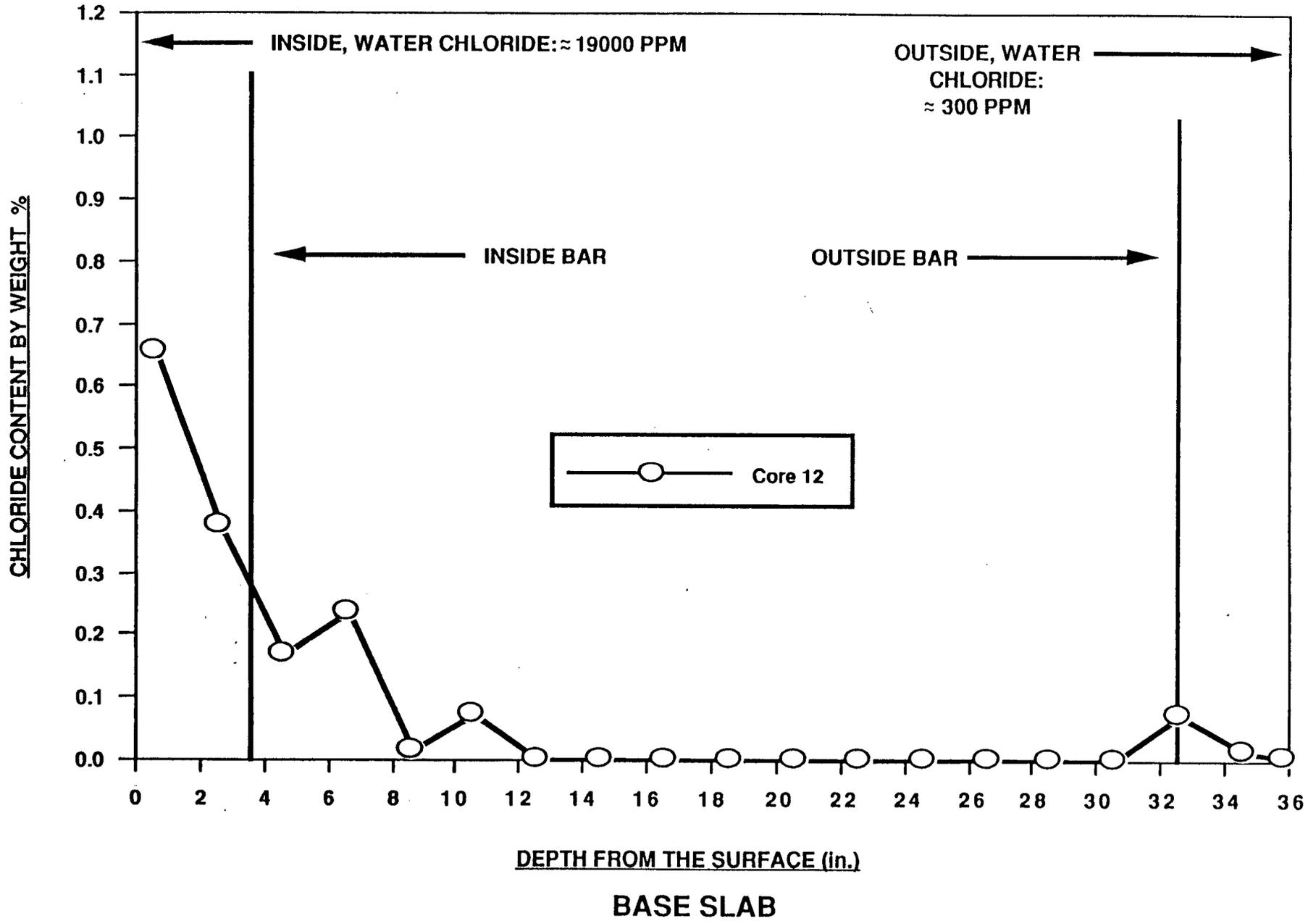


Fig. 5 - VARIATION OF CHLORIDE CONTENT WITH DEPTH

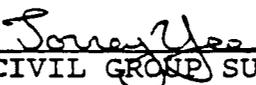
ATTACHMENT A

THIRD SURVEILLANCE REPORT
FOR
SONGS UNIT 1 INTAKE STRUCTURE
(CYCLE XI REFUELING OUTAGE)
OCTOBER 1990

APPROVED BY:


RESPONSIBLE ENGINEER

10-31-90
DATE


CIVIL GROUP SUPERVISOR

10-31-90
DATE


CIVIL DISC. MANAGER

11-6-90
DATE

EXECUTIVE SUMMARY

The Unit 1 Intake Structure must be inspected every refueling outage in accordance with the NRC approved surveillance program. As part of this surveillance program, the structure was inspected in 1986 and 1988. The intake structure was inspected in July 1990 for the third surveillance. The most recent inspection results indicate that the corrosion process is continuing, but differs in portions of the structure. Based on the inspection results and subsequent evaluation of structural margins, the intake structure meets its design basis requirement to withstand a 0.67g Modified Housner seismic event until at least the Cycle 12 surveillance.

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1.0 INTRODUCTION

The Intake Structure is a reinforced concrete structure which provides the structural transition between the pipes that collect and discharge sea water for condenser cooling and the safety-related salt water cooling system. The Intake Structure also supports the safety-related salt water cooling pumps.

In June 1984, exposed reinforcing steel bars and local concrete spalls were found at the north stop gate slot. Subsequent dewatering and inspection of the intake structure showed that some of the reinforcing steel near the concrete surfaces in contact with sea water were corroded. In order to define the extent of corrosion and its effect on the structure, a coring and chipping program was undertaken. Additional tests and examinations included half-cell testing, petrographic examinations, and chemical testing for chloride content. The investigation concluded that a repair program was required.

The repair program involved bolting strap plates to designated areas of the screen and pump wells. The design of the plates was based on the conservative assumption that the inside reinforcement was non-existent in the repaired areas. The strap plates were protected against corrosion with a coal tar epoxy coating and sacrificial zinc anode for cathodic protection.

Intrusion of chloride ions was identified as the cause of the structural deterioration. Such intrusion had primarily occurred to the interior reinforcing steel in the screen well areas of the structure. Because of the nature of the reinforcement corrosion damage, the condition of the structure is monitored through a regular surveillance program. For details of the evaluation and repair, see Reference 1.

The first surveillance was performed during the Cycle 9 refueling outage according to guidelines approved by the NRC (References 5 and 6). The surveillance is documented in Reference 2. The repairs of 1984 were found to be in very good condition. However, the inspection of 1986 revealed that the corrosion process was continuing. The only new concentration of rust indications was found on the northeast section of the intake tunnel ceiling near the screen well. The quantity of corrosion products was not as extensive as observed in 1984 which indicated that the corrosion process was not progressing rapidly. The 1986 inspection also indicated a lack of systematic corrosion.

The Second Surveillance was performed during the Cycle 10 refueling outage. The results of that inspection were similar to those observed in 1986 (Reference 10). Small rust spots, shallow spalls, localized concrete surface discoloration and staining were observed. The only portion of the structure to exhibit signs of

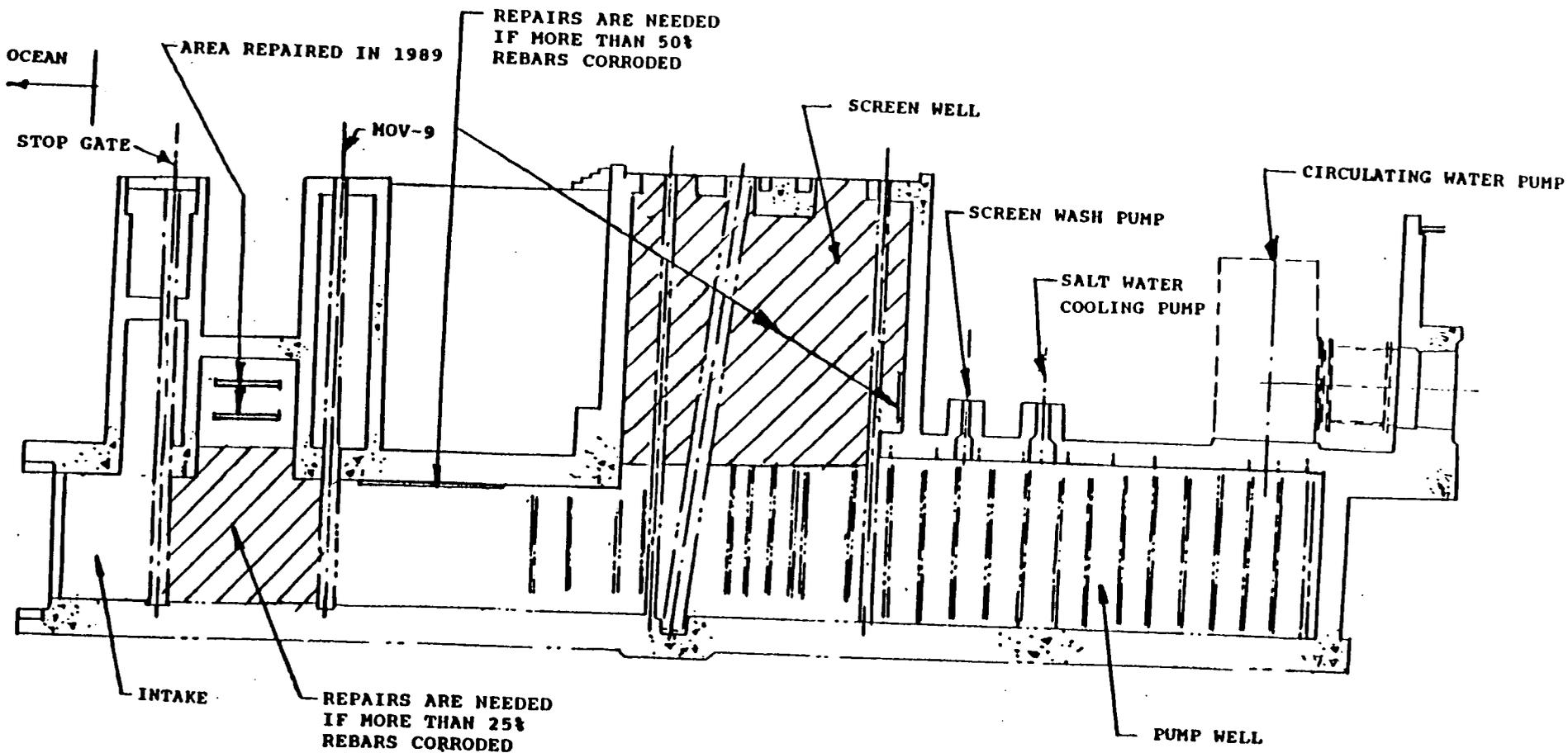
extensive corrosion was the upper section of the north wall crossover between the stop gate slot and the MOV-9 recirculation gate slot (above Elevation (-)11'). This area revealed heavy staining in combination with rust spots and two hollow sounding areas. This portion of the wall was analyzed to determine its structural capacity neglecting the presence of reinforcing steel (rebar). Since the moment capacity of the wall without rebar was determined to be less than the design moment, and the future possibility of rebar loss existed in the area, the wall was repaired with strap plates using a similar repair program as in the 1984 Return the Service effort.

1.1 PURPOSE

The purpose of this report is to document the results of the third intake structure surveillance that was performed in July 1990 during the Cycle 11 refueling outage.

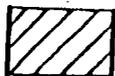
1.2 SCOPE

Prior to the second surveillance, the unrepaired concrete structural elements (those areas not repaired in 1984) of the intake structure were re-evaluated to determine reinforcement requirements to maintain the operability of the safety-related salt water cooling system during a Design Basis Earthquake (DBE). The areas evaluated were the north and south walls of the intake tunnel including the ceiling, screen well walls, concrete beams, MOV 9 and 11 gate structures and the transition segment. All other areas were either repaired in 1984 with strap plates, or classified as Quality Class Non-Safety Related, Seismic Category B since their failure would not affect the 4% minimum salt water flow to the salt water cooling pumps. The analysis identified the portions of walls and ceilings that would require repairs if the rebars were found to be corroded beyond acceptable limits. The analysis also identified the areas where the concrete strength is sufficient to withstand design loads without considering the inside face rebar (Calculation ISR-CC-01). The areas of potential repair (Figure 1) include the lower section of the north wall (below El. (-)14') between the stop gate slot and recirculation gate MOV 9 (the upper portion was repaired in 1988 during the Cycle 10 refueling outage), the ceiling between MOV 9 and the turning vanes, the lower portion of the east screen well walls, and the north and south walls of the upper screen well areas. The repairs for the above areas were designed based on the conservative assumption that the layer of rebars closest to salt water (inside face) was completely corroded and the concrete cover was delaminated. Repair details are shown in DCP 1-3440.1SC and DCP 3078.01BC.



ELEVATION. INTAKE STRUCTURE

Legend



— AREA THAT MAY NEED REPAIRS

Divers were used to visually inspect the intake structure and to complete silver-silver chloride half-cell measurements. The surveillance was conducted in accordance with station maintenance procedures (References 7 and 8). The surveillance activities concentrated on the areas of potential repair as well as wall-slab junctions and construction joints.

2.0 VISUAL OBSERVATIONS

Visual observations were recorded for the evident signs of corrosion in the Intake Structure. The locations of visual observations were documented on the Visual Inspection drawings in Appendix C. The numbered circles on the drawings correspond to the First Surveillance Visual Observations Field Notes with numbers 1 through 141, and the numbered squares correspond to the Second Surveillance Visual Observation Field Notes with numbers 142 through 280. Third Surveillance Visual Observation Field Notes are denoted on the drawings with triangles which are numbered from 1 through 149. The field notes are listed in Appendix A. Visual observations and sounding techniques (tapping surface with hammer to recognize potential delaminated areas) were used as the primary basis for determining the extent of material deterioration (concrete and reinforcing steel).

The visual inspection of the Intake Structure was conducted underwater by divers. The divers were directed by SCE and Bechtel engineering personnel via a remote video monitor. Various areas observed during the inspection were recorded on videotapes. The videotaped areas included the unrepaired areas where rebars are required and areas exhibiting increased corrosion activity.

The previously repaired areas and the areas which require no rebars for maintaining structural integrity were inspected for major deficiencies such as exposed rebar and deep concrete spalls. The strap plates were inspected for integrity of the coating, presence of corrosion products, condition of anodes and tightness of the strap plate retaining nuts.

The visual examination identified characteristics similar to those observed in previous surveillances, such as small scattered rust spots, small clusters of rust spots, shallow spalls, localized concrete surface discoloration and staining. There was no evidence of any increase in the size of rust spots that were identified in the previous inspections except in one instance which is discussed in the next paragraph. Corrosion indications are not uniform throughout the intake structure and varied from one area to another without any discernible pattern.

One area that had not been inspected since 1984, but was inspected during this outage as part of the emergency core cooling single failure analysis, displayed a noticeable change in surface

conditions. In the MOV 11 gate structure at approximately elevation 0'-6", spalling and rust spots were observed along a horizontal construction joint which extends all around the structure. This area was closely inspected and "sounded" to determine if the outside layer of horizontal rebar had more than the required area remaining. The immediate area around the joint "sounded" solid, meaning the rebar was probably acceptable. Due to the relative location, color and size of the spots, an evaluation was performed that conservatively assumed one horizontal rebar at this elevation to be deteriorated beyond acceptable limits (Reference Calc. ISR-CC-01, sheet 62A). The evaluation concluded that the gate structure would continue to withstand design loads until at least the Cycle 12 refueling outage and had an ample safety margin. Therefore, no repairs were required.

Additional inspections were performed on two gates, MOV 9 and 11, and their associated operators. The gates were inspected to validate their capability to withstand a 0.67g Modified Housner seismic event. The gates must remain open to supply sea water to the saltwater cooling pumps (MOV 9 during normal operating conditions and MOV 11 during recirculation) when the circulating water pumps are operating. During the inspection, the motor operators were removed and the gates lifted out of the structures by crane. Gate 11 was found to be in excellent condition with no visible cracks or spalls. Gate 9 had three cracks and a few randomly scattered hairline cracks. The upper south corner was found to be cracked, but the anchor bolt capacities are unaffected since the crack did not extend within the shear cones of the bolts. Two other cracks were observed on the north and south edges of the gate (see Figure 2). These cracks exhibited some rust staining and are approximately 2'-6" long. Since the cracks are located at the bottom of the gate, the anchor bolt strengths are not affected. The anchor bolts had no signs of corrosion or degradation. It was determined that both gates and their associated operators were in good condition and no repairs were required to ensure the gates would remain open during and after a seismic event.

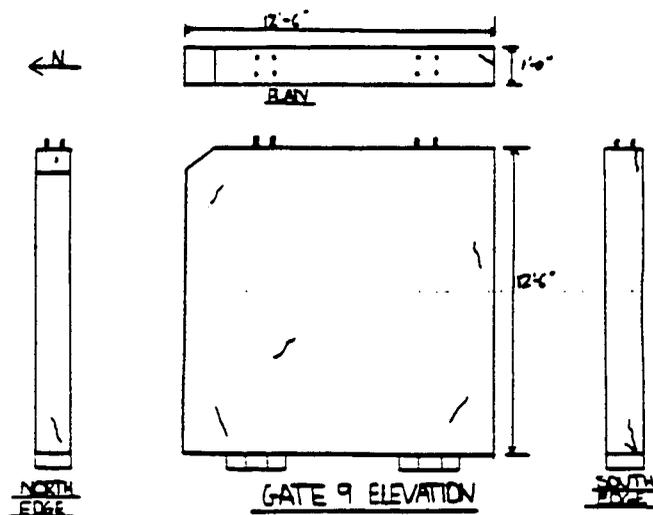


FIGURE 2

2.1 UNDERWATER VISUAL OBSERVATIONS

Underwater visual observations were made on the following areas of the Intake Structure:

1. North wall-west of Traveling Bar Screen (Notes 1-11)
2. South wall-west of Traveling Bar Screen (Notes 12-18)
3. Ceiling-west of screen well (No Notes)
4. Intermediate and south wall-
south screen well (Notes 19-20, 39-41 & 92-96)
5. Intermediate and north wall-
north screen well (Notes 21-23, 97-99 & 100)
6. Ceiling between bullnose and flow vanes (Notes 24-26)
7. Floor (Notes 27-29)
8. East wall-south screen well (Notes 30-38)
9. Intermediate wall of south pump bay (Notes 42-60)
10. East wall of south pump bay (Notes 61-64)
11. South wall of south pump bay (Notes 65-81)
12. Ceiling of south pump bay (Notes 82-91)
13. East wall of north screen well (No Notes)
14. North wall of discharge tunnel (Note 101)
15. Discharge tunnel side of Gate MOV 11 (Note 102)
16. North wall of north pump bay (Notes 103-115)
17. East wall of north pump bay (Notes 116-118)
18. Intermediate wall of north pump bay (Notes 119-133)
19. Ceiling of north pump bay (Notes 134-139)
20. MOV 11 gate and gate structure (Notes 140-146)
21. MOV 9 gate and gate structure (Notes 147-149)
22. All strap plates (Notes - Strap Plates)

The inspection notes are documented in Appendix A. A summary of the observations is given below.

North Screen Well

The north wall and the south wall (intermediate wall between the screen wells) were repaired with the strap plates in 1984. The strap plates extend up to Elevations (-)10' on the north wall and (-)4' on the south wall. In 1986 and 1988 numerous rust spots with discoloration of concrete were observed on the north wall and spread randomly over the surface of the wall. Most of the rust spots were observed in the lower portion within the previously repaired area. No signs of delamination were noticed. Two shallow spalled areas were found in the middle section of the wall that coincided with the areas chipped and repaired in 1984. The 1990 inspection revealed only one new rust spot and no signs of delamination. The intersection of the wall and floor was inspected by thoroughly cleaning small areas at random intervals and no rust staining was found.

On the intermediate wall three new randomly scattered rust spots

and one new cluster were discovered. Also, one new crack was noticed to extend from the floor to ceiling of the intake tunnel. Rust staining was found intermittently along the crack. However, the calculated moments are smaller than the unreinforced moment capacity of the intermediate wall. Therefore, its structural integrity is not compromised.

The east and west walls of the north screen well were inspected and no signs of corrosion were observed.

South Screen Well

The south wall and the north intermediate wall have strap plates extending to approximately Elevations (-)6' and (-)4', respectively. On the south wall only one new rust spot was discovered in an unrepaired area above the strap plates. The spot does not present a structural problem since no other signs of corrosion were observed in the area. The inspection of the joints at the intersection of the floor and wall revealed no rusting. Some previously repaired areas revealed continued degradation, but the corrosion is of no structural concern because the existing strap plate repairs do not rely on the internal layer of rebars and concrete cover.

On the intermediate wall a number of new rust spots and small clusters of rust spots were found. Most of the rust spots were concentrated along the abandoned pump stop gate slot, the traveling screen slot on the line of a concrete construction joint and in previously repaired areas. The calculated moments for the intermediate wall are smaller than the unreinforced moment capacity. Therefore, its structural integrity is not compromised.

The east wall above the ledge at El. (-)8'-0" revealed approximately eight rust spots scattered throughout the wall and ledge. This is an area where repairs are required if less than 50% of rebar is considered functional. It was determined from the scattered nature, size and color of the rust spots that the wall would continue to perform its safety-related function until at least the Cycle 12 refueling outage without any repairs at this time.

North and South Pump Bays

The walls and the ceiling of the pump bays were repaired with strap plates in 1984. The bays showed continued signs of corrosion with rust spots and rust clusters scattered throughout, but the structural integrity is not compromised due to the repairs already installed. The joint between the walls and floor slab showed no signs of degradation or rust staining.

Intake Tunnel between Tsunami Gate Slot and Screen Well

The north wall of the intake tunnel showed five new randomly located rust areas. The area on the north wall between the stop gate and MOV 9 below EL. (-)14' and the ceiling between MOV 9 and the screen wells were identified as tensile areas that would require strap plate repairs if extensive corrosion was detected. This section of the north wall revealed no new rust spots or signs of unacceptable corrosion levels. Therefore, no repairs were deemed necessary.

On the south wall the divers observed three areas of rusting, but all were in previously repaired areas. The temporary screen gate slot and MOV 11 slot showed some minor rusting and cracks that were of no major concern.

The ceiling of the intake tunnel was found to contain no new rust spots other than a crack with rust staining along its length. The crack runs from the north wall to the south wall (parallel to the span) with other smaller cracks along the length. The crack was determined to be in an area where no repairs are necessary due to the fact that the unreinforced moment capacity is larger than the calculated moments. Also, due to its relatively shallow depth no major spalling was deemed likely to occur along this crack. Since no new rust staining was found in an area requiring rebar, repairs on the ceiling were not deemed necessary at this time to ensure the structural integrity of Intake Structure until at least the Cycle 12 refueling outage.

Flow vanes and wall-to-floor joints were inspected and no major deficiencies were noticed by the divers.

North Wall of Discharge Tunnel

Two small rust spots and one minor crack discovered on the north wall. No other indications of corrosion were observed.

Transition Section

Approximately five scattered areas of rusting were found in the transition section. These areas do not show any signs of major degradation. The condition of the transition section is satisfactory.

MOV 11 Gate Structure

In the MOV 11 gate structure at about elevation 0'-6", spalling and rust spots were observed along a horizontal construction joint which extends all around the structure. This area was inspected and "sounded" to determine if the outside layer of horizontal rebar

may have deteriorated. The immediate location around the joint "sounded" solid meaning the rebar was probably acceptable. But to be conservative and due to the relative location, color and size of the spots, an evaluation was performed that assumed the one horizontal rebar at this elevation to be deteriorated beyond acceptable limits (Reference Calc. ISR-CC-01, sheet 62A). The evaluation result was that the structure would continue to withstand its design loads and maintain its structural integrity until at least the Cycle 12 refueling outage. Scattered rust spots and clusters were also noticed in the gate structure, but because of their randomness and size they were determined to be of no immediate concern.

MOV 9 Gate Structure

Approximately three areas of scattered rust staining were discovered in the structure. Intermittent rust spots were also observed up and down the length of the gate alignment slot. The scattered nature and color of the spots indicate that no extensive rebar deterioration is occurring. Therefore, no repairs are required to ensure the gate structure will withstand its design loads.

Strap Plates

None of the strap plates displayed corrosion or damage that would cause concern or affect structural integrity. A few plates had some coal tar epoxy coating loss on the plate itself and were recoated to help inhibit corrosion. The nuts attaching the strap plates to the anchor bolts were checked for hand tightness and their coating was inspected. All nuts were hand tight with a few having some degree of coating loss. Since the anchor bolts and nuts are made out of corrosion resistant Monel, the coating was provided only as extra protection to help inhibit corrosion. Therefore, the coating loss on the bolts is of no concern and recoating is not required. Anodes showed very little corrosion and were acceptable.

3.0 HALF-CELL MEASUREMENTS

3.1 GENERAL

Since the first surveillance performed in 1986, the half-cell measurement procedure was revised and the spacing between the grid points was increased (Reference 7). The spacing was increased with the provision that additional measurements would be taken in the areas where the readings differed by more than 0.1V.

The surveillance consisted of the divers using silver-silver chloride half-cells underwater with the Plant Cathodic Protection System shut off. Half-cell measurements are shown on drawings 5217776 to 5217781 in Appendix B.

3.2 HALF-CELL MEASUREMENTS

The half-cell readings obtained in 1990 were generally less negative, in milli-volts (mV), than those recorded in 1988, but closely correlate with 1986 readings taken when the cathodic protection system was shut off. The overall trend was similar to both of the previous inspections. The readings were more negative towards the transition and the east wall of the pump well, and less negative in the screen well. Also, the readings were more negative near the bottom of the structure. Although the reference half-cell was positioned in approximately the same location, the reference readings varied from day to day and are noted in Appendix B. Thus, the readings were biased by some external source. The half-cell readings were taken to determine the areas of highest potential for rebar corrosion and to establish a correlation between the half-cell readings and the rebar corrosion rate. A review of the data and the comparison with similar data obtained in 1986 and 1988 have failed to produce any trends of corrosion or to detect any localized areas of corrosion. The obtained data is inconclusive and was not used during the structural evaluation of the Intake Structure.

The half-cell readings at the Unit 1 Intake Structure are not a reliable tool for indicating areas with a higher probability for corrosion. The pattern of half-cell readings does not correlate with the areas where an increase in the number of corrosion indications was observed during the visual inspection. Since the readings do not provide any reliable data, the half-cell readings should be discontinued for future surveillances of the intake structure.

4.0 STRUCTURAL EVALUATION

4.1 INTRODUCTION

As part of the second surveillance the areas of the intake structure which were not repaired in 1984 during the Return to Service effort were evaluated for their moment capacities. The areas described in Section 1.2 were determined to require repairs if the rebars had corroded beyond their acceptable limits.

4.2 METHODS EMPLOYED

The Intake Structure was evaluated as a part of the Balance of Plant Re-evaluation program (Reference 1). The results of those analyses form the basis of the design loads in the structure.

The moment capacity of the structural concrete was calculated (Reference 9) assuming various rebar percentages, such as 100%, 75%, 50%, 25% and 0%. (A rebar is considered acceptable if less than 5% of the rebar cross-sectional area is corroded with no concrete delamination.) The reinforced concrete elements were

conservatively evaluated using one-way slab analysis. In addition, the moment capacities of the unreinforced concrete sections were calculated. These moment capacities were then compared with the design moments in their respective areas of the Intake Structure. For each of the areas, the maximum moment for the governing design condition from the Seismic Re-evaluation Program was used. These values formed the basis for determining the structure's integrity because they represent the most severe condition to which the structure will be subjected under operating or DBE conditions.

Figure 1 shows the areas that require steel reinforcement to withstand design loads. In addition, it shows the percentages of reinforcement area required.

The lower portion (between Elevations (-) 2'-3" and (-) 7'-9") of the east screen well wall was determined to require repairs if more than 50% of the rebars were corroded beyond acceptable limits.

The intake tunnel ceiling slab at Elevation (-) 11'-0" between the MOV 9 and the screen well was determined to require repairs if more than 50% of the rebars were corroded beyond acceptable limits.

The north wall portion below Elevation (-) 14'-0" between the tsunami gate slot wall and the MOV 9 gate slot wall was determined to require repairs if more than 25% of the rebars were corroded beyond acceptable limits.

The east wall of MOV 9 gate chamber and the north wall of MOV 11 gate chamber was determined to require repairs if more than 50% and 25% of the rebars, respectively, corrode beyond the acceptable limits.

4.3 RESULTS

Using the data and experiences gained in the 1984, 1986 and 1988 investigations, the 1990 surveillance data did not provide corrosion indications which were significant enough to require repairs or further investigation. The size and characteristics of the rust spots, the number of spots and their location were such that had similar observations been made in 1984, further investigation would not have been necessary and that portion of the structure would have been considered suitable for return to service. The observed rust spots were not concentrated, but were randomly spaced and did not display a distinct pattern as in 1984. The diameter of the rust spots and the concrete discoloration did not change measurably from the 1988 observations. Only minor concrete spalling was observed with no indication of concrete delamination. Specific structural evaluations of each area are described in Section 2.1. Therefore the observed change in the condition of the Intake Structure is insignificant, and it will continue to perform its safety related functions until at least the Cycle 12 refueling outage.

5.0 REPAIRS

No repairs were required during the Cycle 11 refueling outage to ensure the Intake Structure will continue to perform its safety related functions.

6.0 CONCLUSIONS

The Intake Structure was visually inspected and half-cell readings were taken as required per the referenced surveillance procedures. Since no significant changes in the condition of the structure were observed and safety margins were not adversely affected, it was concluded that the structure will continue to perform its safety related functions until at least the next surveillance for the Cycle 12 refueling outage.

Visual observations of the intake structure reveal that the structure has numerous rust spots with concrete surface discoloration and exuding rust products. However, there were no significant changes in the structure's condition since it was last inspected in 1988.

The half-cell readings were inconclusive and were not used for evaluation of the intake structure. No correlation between the readings and the rate of corrosion was established. The half-cell readings will be evaluated for exclusion from the scope of future surveillances.

The repairs which were performed in 1984 and 1988 showed no sign of distress or deficiencies. Some minor epoxy coating loss was discovered on a few plates. Although not required, these few locations on the plates were recoated with an underwater epoxy to help inhibit corrosion. Anodes were in good condition and no replacements were necessary.

7.0 REFERENCES

1. Letter to D. M. Crutchfield (NRC) from K. P. Baskin, dated December 8, 1981; Subject Docket No. 50-206 SEP Topic III-6 Seismic Design Consideration, and "Balance of Plant Structures Seismic Reevaluation Program"
2. Letter to G. J. Stawniczy from P. J. Speidel (BPC), dated June 11, 1986; Subject: Intake Structure Surveillance Report, and Report of First Surveillance for SONGS Unit 1 Intake Structure"
3. Letter to W. A. Paulson (NRC) from M. O. Medford dated October 18, 1984; Subject: Intake Structure Degradation Repair. Structural Evaluation and Repair of SONGS Unit 1 Intake Structure, BPC, Revision 1, October 2, 1984
4. Surveillance Guidelines for SONGS Unit 1 Intake Structure, BPC, January, 1986
5. Letter to J. A. Zwolinski (NRC) from M. O. Medford, dated October 4, 1985; Subject: Intake Structure Surveillance Guidelines for SONGS Unit 1 Intake Structure, BPC, October, 1985
6. Letter to K. P. Baskin from T. M. Novak (NRC), dated July 11, 1986; Subject: Long-Term Service (LTS) Seismic Reevaluation Program. Enclosure: Safety Evaluation Relating to the Long Term Service Seismic Reevaluation Program, Docket No. 50-206
7. Intake Structure - Diver Half Cell Potential Measurements and Surveillance Inspection, Maintenance Procedure S01-I-2.55, SCE
8. Intake Structure Core Sample Drilling, Inspection and Chloride Content Testing, Maintenance Procedure S01-I-2.56, SCE
9. Calculations CWIS-CC-01 "Circulating Water Intake Structure Repair", CWIS-CC-02 "Intake Structure Evaluation-North and South Wall of Screen Well", ISR-CC-01 with Supplement A "Intake Structure Repair for DCP 1-3440.0BC" and ISR-CC-01 Supplement B "Intake Structure Evaluation - Cycle XI".
10. Second Surveillance Report for SONGS Unit 1 Intake Structure (Cycle X Refueling Outage), 1989.

APPENDIX A

Visual Observation Field Notes

- o First Surveillance - 1986
- o Second Surveillance - 1988
- o Third Surveillance - 1990

VISUAL OBSERVATION FIELD NOTES

Taken During First (1986) and
Second (1988) Surveillances

APPENDIX A -- VISUAL OBSERVATION FIELD NOTES

TAKEN DURING FIRST SURVEILLANCE
(R136)

The following areas were selected during the underwater visual inspection process as points of interest on basis of visual signs of distress and are described below, in the video tapes, and on the drawings where they are identified by corresponding numbers. The reference at the end of each item is to indicate where the item is shown on the video tape and drawings. The areas are defined as follows:

1. The transition from circular pipe to square box (transition section), just west of the tsunami gate, has a large crack in the floor at the centerline varying in width from 6" to 2" which extends diagonally southeastward from the interface with the pipe for about 7 ft, can be probed to about 2 1/2" depth with a pointed rod of about 3/16" diameter. There is a triangular piece of concrete missing from the apex of this crack with item 2 (below) that is about 8 inches in length. No rust products are evident in this crack system and no concrete remains in the crack. Based on conversations with the diver, this crack and item 2 are evidently cracks that have been present for a period of years and were seen in previous (diving) inspections. (Ref. Tape No. 1 and Figure 8)
2. In the transition section a second crack starting at the pipe interface at floor centerline at the point of start of item 1 extends about 4 feet diagonally north east and is about 4" wide can be probed about 1 1/2" in depth. Has same characteristics as crack of item 1. (Ref. Tape No. 1 and Figure 8)
3. In the transition section ceiling a crack, 1/8 " wide 2 feet in length and probing to about 1" in depth is located 5 feet west of the tsunami gate 4 feet south of the centerline. There is no rust color or rust products associated with this crack. (Ref. Tape No. 1 and Figure 9)
4. In the floor of the tunnel immediately below the tsunami gate, there is a copper plate embedded. Immediately west of the plate the concrete is spalled away to a maximum of 8" and depth of about 1/2". The concrete is stained with black corrosion products and the plate is stained blue-green. (Ref. Tape No. 1 and Figure 8)
5. This item is the same as item 4 but occurs on the eastern boundary of the copper embedded plate and concrete floor. (Ref. Tape No. 1 and Figure 8)

6. The copper embedded guide in the north tsunami gate slot is hanging loose in the slot supported at only a few anchors. The edges of the embed are corroding. The condition of the gate is much the same as it appeared in previous inspections. The retaining anchors which were added in the past to correct the loose hanging conditions have corroded away. (Ref. Tape No. 1 and Figure 10)
7. On the north wall up in the tsunami gate cavity, there is a 5" by 2" area of spalled concrete which is 5" from the edge of the gate slot 6 feet above the tunnel ceiling. (Ref. Tape No. 1 and Figure 10)
8. In the tsunami gate cavity about 1 foot below the ledge that supported the gate operators, the walls have a 7" deep strip, around the perimeter, of unconsolidated concrete that appears to be a construction joint. The strip has heavy rust stains on the concrete which appear to come from steel that is corroding above this area. (Ref. Tape No. 1 and Figure 10)
9. The ledge which forms the ceiling of the tsunami gate cavity has a large area of delaminated concrete that has broken away from the first layer of reinforcing steel exposing 9 bars that run east and west. The bars are corroded through the entire diameter. The three inches of concrete cover over the bars has deteriorated and spalled off. Bars are about 1 ft apart. A steel plate that may have been used as the underside of the forms for this ledge and apparently left in place is corroded away. The severe corrosion and loss of concrete cover makes it reasonable to conclude that this deterioration has been occurring over the years but was not noted in the 1984 inspection because at that time the tsunami gate was in position and the structure was dewatered. This condition left no access to the cavity for visual inspection. (Ref. Tape No. 1 and Figures 9, 10)
10. The south gate slot for the tsunami gate contains an imbedded copper liner which is hanging loose, with its edges corroding and the anchors added in the past to correct the loss of support have corroded. In places, the plate is hanging about an inch away from the concrete. (Ref. Tape No. 1 and Figure 11)
11. The east side of the tsunami gate slot at the south wall there is an area of spalled concrete that extends from the floor to about 2 ft above the floor and is about 3 1/2" wide. The concrete is stained with red rust color and contains soft black rust products. (Ref. Tape No. 1 and Figure 11)

12. In the heat treat cross over area between MOV 9 and the tsunami gate in the east wall 5" above the ceiling of the tunnel there is a system of cracks that extend across the north south length of the wall. The cracks are discolored by rust products with red and orange stains at the surface with black rust products evident below the surface of the cracks. The concrete adjacent to the slot easily spalls to about 1/2" depth. (Ref. Tape No. 1 and Figure 10)
13. The south wall 5 ft east of east edge of MOV 11 there are 4 rust spots in a vertical line down the wall.
 - a) The first spot is 18" down from ceiling level, about 1 1/2" in diameter and protrudes 3/4" from the surface of orange rust color.
 - b) At 5 1/2 ft down from ceiling also 5' east of MOV 11 a rust spot of 1 1/2" diameter protrudes 1/2" from surface of orange rust color within a larger rust stain of 6" diameter.
 - c) At 5" above the floor and also 5' east of MOV 11 there is a third rust spot 3" diameter of dark reddish brown rust stain.
 - d) Also 5' above the floor but 6' east of MOV 11 there is a rust stain that is 6" long by 2" wide. Also see item 134. (Ref. Tape No. 1, Tape No. 5 and Figure 11)
14. North gate slot of MOV 9 at 4 ft below the ceiling west edge of the slot is spalled in an area of 4" x 3" and concrete is of normal color. Also a rust spot 2" diameter of orange and reddish rust color is in the north west corner of the slot. (Ref. Tape No. 2 and Figure 10)

Note: MOV 9 was removed at this time for installation of gate stops allowing access to the slot.
15. Also in the north gate slot of MOV 9 at 18" below the ceiling in the center of the slot there is an area of spalled concrete about 3/4" deep and 6" long by 3" high. (Ref. Tape No. 2 and Figure 10)
16. In the north gate slot of MOV 9 there is a 3" x 1/4" rust spot of dark red rust color 6" above the ceiling level. (Ref. Tape No. 2 and Figure 10)
17. In the north gate slot of MOV 9 there is a 2-ft long by 2" wide rust streak in the east corner just above ceiling level. (Ref. Tape No. 2 and Figure 10)

18. In the ceiling of the tunnel at MOV 9 the gate opening there is a 2" diameter spall of normal color 1" deep at 6" above ceiling level 18" south of the north wall on the west face of the opening. (Ref. Tape No. 2 and Figure 9)
19. Also in the ceiling opening for MOV 9 at 3 1/2" south of the north wall there is a 2 1/2" diameter dark red and light orange rust colored spot about 6" above ceiling level on the west face of opening. (Ref. Tape No. 2 and Figure 9)
20. MOV 9 ceiling opening on the west face on the corner with the ceiling there is a 1" diameter dark red rust colored spot at 18" north of the south wall. (Ref. Tape No. 2 and Figure 9)
21. The MOV 9 ceiling opening east face has a corner with 1" of concrete spalled away at 12" south of the north wall. (Ref. Tape No. 2 and Figure 9)
22. The MOV 9 ceiling opening east face at 2' south of north wall just above ceiling level there is a 5" long 2" wide dark and light red rust colored spot with some spalling of concrete. (Ref. Tape No. 2 and Figure 9)
23. MOV 9 ceiling opening east face about 5 ft south of north wall at 1 1/2 ft about ceiling level there is a 2" diameter rust spot of dark rust color protruding 1/4" from the surface of soft texture rust products. (Ref. Tape No. 2 and Figure 9)
24. MOV 9 ceiling opening east face at 7 ft south of north wall and 7" above ceiling level there is a 2" diameter rust spot and an S shaped spot about 2" long of spalled concrete with heavy rust stains in the spall. (Ref. Tape No. 2 and Figure 9)
25. MOV 9 ceiling opening east face at 4 ft north of the south wall at 7" above ceiling level there is a 3" diameter orange rust colored spot. (Ref. Tape No. 2 and Figure 9)
26. In the same area as item 25 there is a 3" diameter rust spot that protrudes 1/4" of soft textured orange rust products. (Ref. Tape No. 2 and Figure 9)
27. MOV 9 at 6" above ceiling level at the south slot in the east face there is a 1 1/2" diameter light orange rust spot with spalling concrete extending up the gate slot. (Ref. Tape No. 2 and Figure 9)
28. MOV 9 at 6" above ceiling 6" north of south wall there is a spalled area 3" long by 1 1/2" wide with dark brown and black rust stains. (Ref. Tape No. 2 and Figure 9)

29. MOV 9 south gate slot 4 ft above floor there is a 2 ft long crack in the silicon-bronze liner in the east corner of the slot. (Ref. Tape No. 2 and Figure 11)
30. MOV 9 south gate slot 4 ft from the floor level there is a 2 ft long 4" wide bright orange colored rust spot in the concrete at the corner of the slot. (Ref. Tape No. 2 and Figure 11)
31. MOV 9 south gate slot 12" above floor level there is a 12" long 1 1/2" wide orange rust colored spot in the east corner of the slot. (Ref. Tape No. 2 and Figure 11)
32. North wall of cross-over 2 ft east of the tsunami gate and 10 ft above the floor level there is a 12" long 1/2" wide rust spot with rust products deposited on the wall. (Ref. Tape No. 3 and Figure 10)
33. North wall of cross-over 6" east of the tsunami gate about 10 ft above floor level there is a 6" long 4" wide oblong rust spot of dark reddish rust color and a spot that extends from there to the ceiling. This is evidently the boundary between the first pour of concrete at the block out for the gate slot and the second pour which formed the gate slot. (Ref. Tape No. 3 and Figure 10)
34. South wall of cross-over 1 ft east of the tsunami gate and 2 ft above floor level there is a light orange and dark reddish rust colored spot that appears to be spalling of concrete that can be probed, at separation, to 1/2" depth with a visible separation of 3/4" that extends at a shallow angle into the depth of the wall. The crack is 7" long. (Ref. Tape No. 3 and Figure 11)
35. South wall of cross-over 5 ft east of tsunami gate there is spalling of concrete plus three rust spots of 3" diameter in an area of 3' diameter. The spots are of dark and light rust coloration. The area is about 3 ft above floor level. (Ref. Tape No. 3 and Figure 11)
36. South wall of cross-over 12 ft west of MOV 9 and 4 ft above floor level a rust spot of 3" diameter of dark red rust color also has a 2" diameter black spot within the larger spot of black rust coloration with spalling of concrete in the black spot. (Ref. Tape No. 3 and Figure 11)
37. South wall of cross-over 2 1/2 ft west of MOV 9 at 1 ft above floor level there is a T shaped rust spot that is 6" long by 3" wide of brown and reddish rust color. (Ref. Tape No. 3 and Figure 11)

38. South wall of cross-over 3 ft west of MOV 9 and 2" above floor level there is a 2" wide 5" long dark rust stain that can be easily gouged to 1/4" deep of dark rust products. Spalling of concrete is evident within this spot. (Ref. Tape No. 3 and Figure 11)
39. South wall 2" west of MOV 9 and 2 1/2 feet above floor level there is a protruding rust spot of light red rust color with the center protruding 1/8" beyond the concrete surface of dark rust color with black rust products beneath surface crust. (Ref. Tape No. 3 and Figure 11)
40. South wall is covered with barnacles which protrude individually about 1" from the surface. There is a 1/8" thick growth of algae which covers approximately 60% of the surface area. This is somewhat typical of the north wall and the rest of the interior of the intake structure. (Ref. Tape 3 and Figure 11)
41. Core Drill No. 15 and repaired area -- The color and appearance of these items give no sign of interaction or activity between the old concrete and reinforcing steel and the repaired area. (Ref. Tape No. 3 and Figure 10)
42. North wall 6" east of MOV 9 there is at 18" above floor level a 1 ft diameter rust spot with a 2" diameter center that protrudes 1/2" from the surface. There is a crack that can be probed to 1/2" depth that runs from this spot to MOV 9 gate slot. There is also a spalling crack that runs from the floor to the ceiling through this spot. The crack is probably the edge of a blackout that was later filled when the gate slot was formed. (Ref. Tape No. 3 and Figure 10)
43. North wall 15 ft east of MOV 9 there appears to be a spalling crack from floor to ceiling that can be probed to 1/2" depth. There is no discoloration associated with this crack. The crack appears to be either a construction joint or a form joint with only the edges of the joint spalling. (Ref. Tape No. 3 and Figure 10)
44. South wall 1" west of MOV 11 opening 5 ft above floor level there is a 5 ft long 1/8" wide crack that can be probed 1/4" with no discoloration. Also 5" east of MOV 9 at 1/4" above floor level there is a 1" long rust spot. (Ref. Tape No. 3 and Figure 11)
45. MOV 11 -- The gate itself has a crack pattern that exudes white material to highlight the cracks. The cracks are much as appeared in 1984 and are not considered to be significant. (Ref. Tape No. 3 and Figure 11)

46. North wall in tunnel approaching screen well -- There is a 1" diameter orange rust colored spot that protrudes rust about 1/4" beyond wall surface 6" above the floor and even with east nose of flow vane. (Ref. Tape No. 3 and Figure 10)
47. North wall 6" above floor level 1 ft east of east nose of flow vane there is a 1" diameter rust spot of dark red rust color. (Ref. Tape No. 3 and Figure 10)
48. North flow vane -- The north side of the north flow vane has no significant spots or cracks to report.

The west nose of the flow vane has a crack system (as seen in 1984) that runs the full height of the vane that varies in width from 1/8" to 2" and about 1/4" in depth by probing. Intermittent dark rust discolors the crack system.

The south side of the north flow vane has random minor pitting and spalling.

(Ref. Tape No. 3 and Figure 8)

49. On the north flow vane -- east nose, a crack pattern exists which runs the full height and varies to a maximum of 1" in width and allows probes to 1" depth along with intermittent rust stains and protruding rust along the cracks (appears much as it did in 1984). (Ref. Tape No. 3 and Figure 8)
50. Repair of chipped area R and R-1. There was no sign of interaction or distress between repaired area and old concrete. (Ref. Tape No. 3 and Figure 10)
51. North wall of north screen well -- There is a 6" to 8" wide reddish rust spot 10" east of gate slot that extends from 1 ft above floor level to 11 ft above floor level where it ends abruptly - 10 ft long rust spot. (Ref. Tape No. 3 and Figure 10)
52. North wall repaired gate slot. The new concrete looks good but old concrete east of the bar screen slot is heavily rust colored. There appears to be no adverse reaction between old and new concrete. The rust stains on this wall appear to be migrating from above and this as well as other spots on the north wall may be forming from the migrating rust. The ladder anchors above are contributing to much of the rust stains. (Ref. Tape No. 3 and Figure 10)
53. All strap plates in north screen well appear in good condition none of the nuts appear to have loosened. (Ref. Tape No. 3 and Figure 10)

54. North screen well south wall (intermediate wall) -- There is a 2" diameter orange rust colored spot which protrudes rust 1/4" from the surface 6 ft above floor level 8" west of stop gate slot. The discoloration easily breaks away and is of soft texture. (Ref. Tape No. 3 and Figure 13)
55. South wall of north screen well -- There is a 2" wide 4" long rust spot protruding 1/2" from surface of reddish rust color which is black rust products beneath surface that is located 10" west of stop gate slot 10 ft above floor level. The rust products are easily broken away to about 1/4" depth. (Ref. Tape No. 3 and Figure 13)
56. South wall of north screen well -- An expansion anchor bolt for a core drill remains in place in a rust spot that is 3 ft below the tunnel ceiling 1 ft west of the stop gate slot. (Ref. Tape No. 3 and Figure 13)
57. South wall of north screen well -- a rust spot in the gate slot 5 ft below the tunnel ceiling. Spot is 1" diameter of orange and black rust color. Rust is easily penetrated to 1/4" depth. (Ref. Tape No. 3 and Figure 13)
58. South wall of north screen well has a rust spot in the stop gate slot of 3" diameter, 8 ft above floor level that protrudes 1/2" of rust color. (Ref. Tape No. 3 and Figure 13)
59. South wall of north screen well -- The gate slot and the surface just west of slot has numerous intermittent protruding rust spots and cracks up and down the full height of the slot. Rust protrudes up to 1" beyond surface of concrete. (Ref. Tape No. 3 and Figure 13)
60. South wall of north screen well -- The strap plates look good with no rusting but black coating is peeling away in places. (Ref. Tape No. 3 and Figure 13)
61. North wall of north pump bay just east of strap plate No. 4 and 6 ft below the ceiling there is a rust spot of 6" diameter of light rust color which protrudes 1" beyond the concrete surface. Strap plates No. 1 through 4 look good. (Ref. Tape No. 3 and Figure 10)
62. North wall of north pump bay just east of strap plate No. 5 there is a 6" diameter rust spot 6 ft below the ceiling with light rust coloration and rust protruding 1 ft beyond concrete surface. Strap No. 5 looks good. (Ref. Tape No. 3 and Figure 10)
- 63A. North wall of north pump bay 1" east of strap No. 6 there is a 2" diameter reddish rust colored spot of rust protruding 1" beyond the concrete surface of soft black rust texture. (Ref. Tape No. 3 and Figure 10)

- 63B. Straps No. 6 through 13 look good. Strap No. 14 also looks good. Along the east wall of north pump bay straps No. 15 through 18 look good. (Ref. Tape No. 3 and Figures 10 and 12)
- 63C. The concrete surface in the ceiling beam west of the north circulating water pump looks good with no rust or discoloration evident, however visibility here is not good. (Ref. Tape No. 3, Figure 9)
- 63D. Strap No. 23 in the north intermediate wall looks good but there is a rust spot of 2" diameter 2 ft west of strap plate No. 23 of orange rust color 1 ft below the ceiling that protrudes rusts 1/2" beyond surface. (Ref. Tape No. 3 and Figure 13)
- 63E. Strap No. 24 looks good. (Ref. Tape No. 3 and Figure 13)
- 63F. Ceiling strap No. 31 looks good. A general inspection of the north pump bay, ceiling indicates a few random rust spots, however, this inspection was limited by poor visibility. (Ref. Tape No. 3 and Figure 9)
64. North wall of north screen well -- The bar screen slot has intermittent heavy rust spots up and down its height. (Ref. Tape No. 4 and Figure 10)
65. North wall of north screen well 1 1/2 ft east of bar screen slot that extends from 2 1/2 ft above floor level to 12 ft above floor level varies in width from 4 " to 12" and of light rust color. (Ref. Tape No. 4 and Figure 10)
66. North wall of north screen well light colored rust spot 4" to 12" wide 2 1/2 ft long broken and then 10' long starts 1 1/2 ft above floor level tapers towards east upward located about 3 1/2 ft east of bar screen slot. Spot tapers into strap plate. Strap plate is in good condition. (Ref. Tape No. 4 and Figure 10)
67. North wall of north screen well 5 ft east of bar screen slot there is a 1 1/2" diameter rust spot 4 ft above floor level. (Ref. Tape No. 4 and Figure 10)
68. North wall of north screen well rust stain starts at the bar screen slot about 3 ft above floor level goes upward west of slot extends to 2 ft below water surface and is about 2" wide. (Ref. Tape No. 4 and Figure 10)
69. North wall of north screen well -- There is a protruding rust spot 3 ft west of bar screen slot which protrudes about 1/2" of rust. (Ref. Tape No. 4 and Figure 10)

70. North wall of north screen well at 11 ft above floor level and 5 ft west of traveling screen there is a 5" long by 1" wide strip of rust discoloration on the concrete surface that appears to run under strap plate. Strap plate is not rusted or stained. (Ref. Tape No. 4 and Figure 10)
71. In the west corner of the north wall of north screen well 6 ft above tunnel ceiling level there is a 1/4" protrusion of rust product of light and dark rust color that is 1" high by 1" wide. The bar screen slot has intermittent rust spots in it up and down its full height. (Ref. Tape No. 4 and Figure 10)

Note: Items 71 through 83 are above the new concrete of the repaired area.

72. The stop gate slot in the north wall of the north screen well has a 1" x 3" rust spot of light and dark rust color with rust protruding 1/2" at 4 ft above the tunnel ceiling level. (Ref. Tape No. 4 and Figure 10)
73. The stop gate slot in north wall of north screen well has rust spots and spalling with rust protruding 1/2". Spall is 1/4" deep in a 3 1/2" diameter. Rust spot of 3 ft length of light and dark rust color varies in width from 1/2" to 3" and begins at 4 ft above tunnel ceiling level and extends upward for its 3 ft length. (Ref. Tape No. 4 and Figure 10)
74. Strap No. 68 in the north wall is rust stained for the top 10" of length. This stain, however, is coming from rust spot on concrete above the strap plate. Concrete above is stained in a 6" strip that runs upward to 3 ft above the strap plate. There are protruding rust spots within the stained strip that protrude from 1/2" to 1" beyond concrete surface. Strap No. 68 is in good condition. (Ref. Tape No. 4 and Figure 10)

Note: The rust spots and rust stains for items 74 and 75 are evidently migrating from above where anchors for the ladder and the ladder itself is corroding.

75. North wall of north screen well at 1 ft east of stop gate slot there is a dark and light rust colored strip that is about 6 ft long and 6" to 8" in width. Within this strip there is a protrusion of rust products that is 8" high by 2" wide with 1/2" of protrusion. The rust strip begins at 3 ft below top of strap plate and extends to 3 ft above top of strap plate. (Ref. Tape No. 4 and Figure 10)
76. North wall north screen well at 3 ft east of bar screen slot and 6 ft above tunnel ceiling there are two protruding rust spots each one ft long with protrusions of 1/4". (Ref. Tape No. 4 and Figure 10)

77. North wall of north screen well at 3 ft west of traveling screen and 5 ft above tunnel ceiling there is a 1" x 1" light and dark rust colored spot that protrudes 1/8". (Ref. Tape No. 4 and Figure 10)
78. North wall of north screen well at 1 ft east of bar screen slot there are three light and dark rust colored spots with rust protruding 1/4" to 1/2". One spot is 6 ft above ceiling level of 3" width by 4" length. Another spot is 6 1/2 ft above ceiling level is 6 to 8" wide and 2 ft long. A third spot is 12 ft above ceiling level of 6" by 1" size. (Ref. Tape No. 4 and Figure 10)
79. North wall north screen well at the bar screen slot 12 ft above tunnel ceiling level there is a 2 ft by 3 ft rust spot with protruded areas inside the rust spot. One protrusion of 1/4" is 6" wide by 4" high and another protrudes 1/8" is 2" x 1". Light and dark rust coloration. (Ref. Tape No. 4 and Figure 10)
80. North wall of north screen well at 6" east of stop gate slot and 12 ft above tunnel ceiling level there is a light and dark rust colored spot that is 1 ft long and 3" wide with areas of rust protruding 1/4" from the surface of the concrete. (Ref. Tape No. 4 and Figure 10)
81. North wall of north screen well. Rust spot 1 ft long and 6" wide narrows to 1" wide where 1/2" diameter of rust products protrudes 1/2" located 1 ft west of stop gate slot 12 ft above ceiling level. Rust also surrounds pipe support bracket in this location. (Ref. Tape No. 4 and Figure 10)
82. North wall of north screen well has a 8" x 4" light and dark rust colored area of spalled and pitted concrete surface behind plastic pipe 13 ft above tunnel ceiling level. (Ref. Tape No. 4 and Figure 10)
83. North wall of north screen well 6" west of stop gate slot 14' above tunnel ceiling level a rust spot 6" long by 1 to 3" wide protrudes 1/4" of rust. (Ref. Tape No. 4 and Figure 10)
84. Ceiling of tunnel in approach to screen well contains several rust spots in an area 18" x 8" of light and dark rust coloration that protrudes 1/4" to 4" from the concrete surface. This area is located 3 ft south of the north wall and 4 ft west of east edge of the ceiling. (Ref. Tape No. 4 and Figure 9)
85. Ceiling of tunnel in approach to screen well a rust protrusion of 1/2" x 1/2" area protrudes 1/2" from concrete surface located 15" south from north wall 4 ft west of east edge of ceiling. (Ref. Tape No. 4 and Figure 9)

86. Ceiling of tunnel in approach to screen well contains a 5" x 2" light and dark rust colored spot that protrudes 1 1/2" from the surface located 4 ft south of north wall and 5 ft west of the east edge of the ceiling. (Ref. Tape No. 4 and Figure 9)
87. South wall of south screen well at 6" east of the west corner and 3 ft above the tunnel ceiling there is an oblong 6" by 8" protruding rust spot that protrudes light and dark rust colored corrosion 4" beyond concrete surface. Just next to this spot is a 1/2" x 1/2" rust spot that protrudes 1/2" from the concrete surface. (Ref. Tape No. 4 and Figure 11)
88. The stop gate slot in the south wall exudes rust products, contains cracks also exuding rust, and shows signs of concrete spalling intermittently all up and down its height. (Ref. Tape No. 4 and Figure 11)
89. In the south wall of the south screen well there are an additional 12 rust spots of up to 2" diameter each located randomly in the wall from floor level to about 6 ft above the floor level. The steel strap plates are in good condition in this wall. The bar screen slot has exuding rust spots throughout its height. (Ref. Tape No. 4 and Figure 11)
90. The north wall (intermediate wall) of the south screen well in the area between the stop gate slot and the traveling screen contains no significant rust discoloration or signs of distress. Just west of the stop gate slot at 2 1/2 ft above floor level there is a pipe support bracket with completely corroded anchor bolts and a rust spot protruding from 1" to 3" beyond the concrete surface. The concrete surface behind the vertical pipe run has excessive corrosion products discoloring the concrete from floor to ceiling. Just east of the nose of the intermediate wall there is a 6 ft long vertical crack, discolored with rust products, extending from 6 ft above floor level to 12 ft above floor level. This crack appears to be the interface between repairs done in 1984 and the original concrete. The steel strap plates in the wall are in good condition. Brackets for the vertical run of pipe in this area are corroded away at 15 ft above floor level. (Ref. Tape No. 4 and Figure 12)
91. The nose of the intermediate wall contains several rust spots. There is a 3/4" diameter rust spot 4 ft above floor level. There are 3 rust spots within 6" above floor level with a 1 ft long vertical crack, starting at these spots, protruding 1/2" of rust products of light and dark rust color which easily breaks away. All these spots and cracks are in the nose of the intermediate wall. (Ref. Tape No. 4 and Figure 12)

92. South wall (intermediate wall) of the north screen well at 1 ft west of the gate slot a vertical crack starts at floor level, runs 8 ft up the wall, has a 18" break then begins again and continues to 6 ft above the tunnel ceiling level. Width of the crack allows a knife blade to be inserted. Heavy rust products protrude from 1/8" to 3" from the crack. (Ref. Tape No. 4 and Figure 13)
93. South wall of the north screen well there is a protruding rust stain 2 1/2" x 2" which protrudes 1/2" of light and dark colored rust located 1 1/2" ft east of the gate slot at the tunnel ceiling level. At 3 ft above ceiling level just east of the gate slot there are 2 more rust spots that are 10" long by 5" wide of dark and light rust coloration and protrudes rust products 1/2" beyond the concrete surface. (Ref. Tape No. 4 and Figure 13)

At 8 ft above ceiling level and just east of the gate slot there is a 16" x 7" rust colored area that protrudes rust 1/2" from the concrete surface. (Ref. Tape No. 4 and Figure 13)

There are protruding rust spots that protrude 1/4 to 3/4" intermittently up and down the length of the gate slot. (Ref. Tape No. 4 and Figure 13)

Brackets from the supports for the vertical plastic pipe are missing (corroded away). (Ref. Tape No. 4 and Figure 13)

The bar screen slot has intermittent protruding rust spots up and down the full height. (Ref. Tape No. 4 and Figure 13)

94. South wall of the north screen well at 6 ft east of bar screen slot and 8" above floor level there is a 2 1/2" x 2" spot of protruding rust, protrudes 1/2" from the concrete surface. (Ref. Tape No. 4 and Figure 13)

2 1/2 ft above the floor at this location there is a 8" x 4" dark rust spot that protrudes rust 1" from the concrete surface. A third spot at 3 ft above floor level of 3" x 2" also protrudes rust. (Ref. Tape No. 4 and Figure 13)

95. Ceiling of tunnel east of MOV 9 in area of flow vanes at 8" west of the east edges there is a 4" x 6" rust spot that protrudes 1" of rust of light and dark rust color located at 6 ft south of the centerline. (Ref. Tape No. 4 and Figure 9)
96. Ceiling of tunnel at 6 ft west of the east edge of ceiling and 4 ft south of the north wall there is a 6" x 3" light and dark rust colored spot that protrudes rust 2". (Ref. Tape No. 4 and Figure 9)

97. The cross-over area between the tsunami gate and MOV 9 the ceiling was scanned with nothing of significance found. Ceiling looks good. (Ref. Tape No. 4 and Figure 9)
98. The cross-over area north wall - visibility was poor. One rust area of 3" x 2" was found but overall the wall appears in good condition. (Ref. Tape No. 4 and Figure 10)
99. South pump bay south wall at 8" east of strap plate 83 at 18" above floor level there is a 4" diameter light and dark rust colored spot that protrudes 1/2" from the concrete surface. (Ref. Tape No. 5 and Figure 11)
100. South pump bay south wall at 8" east of strap plate 83 and 7 ft above floor level there is a 1/2" diameter rust spot. (Ref. Tape No. 5 and Figure 11)
101. South wall of south screen well at 8" east of strap plate 83 and 24 ft above floor level there is a 2" diameter rust spot. Strap plate 83 is in good condition. (Ref. Tape No. 5 and Figure 11)
102. South wall of south pump bay at 4" west of strap plate 59 and 5 ft below ceiling level there is a 1/2" diameter black and red rust spot. (Ref. Tape No. 5 and Figure 11)
103. South wall of south pump bay at 1/2" east of strap plate 59 there is a 3" by 1" orange, yellow and black rust spot that protrudes 1/4" located 7 ft below ceiling level. (Ref. Tape No. 5 and Figure 11)
104. South wall of south pump bay between strap plates 58 and 59 there is at 10 ft below the ceiling a 2" diameter rust spot that protrudes 1/2" with a 1/8" diameter hole through the center which penetrates into the concrete. Strap 59 is in good condition. (Ref. Tape No. 5 and Figure 11)
105. South wall the south pump stop gate slot has intermittent rust spots up and down its height. The slots are just east of the traveling screens and were abandoned for use as stop gate slots. (Ref. Tape No. 5 and Figure 11)
106. South wall in south pump bay at 18" below the top edge of strap 58 there is a 12" diameter area containing 4 rust spots of 2" diameter each which protrude from 1/2 to 1" of orange red rust. Strap plate 58 is in good condition. (Ref. Tape No. 5 and Figure 11)
107. South wall of south pump bay at 5 ft above floor level a rust spot extends from beneath strap plate 57 to 2" west of the strap and is about 2" wide of red rust color that can be penetrated to a black interior of 1/8" depth into concrete. Strap plate 57 is in good condition. (Ref. Tape No. 5 and Figure 11)

108. South wall of south pump bay at 6" east of strap 57 at 5 ft above floor level there is a 6" dark red rust spot with a 3" diameter hole into the concrete and a 1/2" diameter light orange spot with a 1/4" diameter hole that penetrates 1/4" into concrete. Straps No. 55 and 56 are in good condition with no discolored concrete adjacent to strap 56. (Ref. Tape No. 5 and Figure 11)
109. In the south wall at 3" below the ceiling and 2" east of strap 55 there is a 1" diameter bright orange rust spot that protrudes 1/4" of yellow and black rust products about 1/8" deep. (Ref. Tape No. 5 and Figure 11)
110. In the south wall at 5 ft above floor level and 6" east of strap 55 there is a bright orange and yellow rust spot of 6" Ø which protrudes, in spots, from 1/4" to 1/2". (Ref. Tape No. 5 and Figure 11)
111. In the south wall at 5 ft from floor level and 6" west of strap 55 there is an 18" long and 4" high strip of yellow and red rust color with spots within this strip of 2" diameter and 6" diameter rust protruding 1/8" from surface. (Ref. Tape No. 5 and Figure 11)
112. In the south wall of the south pump bay at 5 ft above floor level and 6" west of strap No. 54 there is a 6" diameter bright red rust spot. (Ref. Tape No. 5 and Figure 11)
113. In the south wall of the south pump bay 8" east of strap No. 54 and 5 ft above floor level there is a 5" by 2" wide strip of yellow and bright orange rust that protrudes 1" from the concrete surface. (Ref. Tape No. 5 and Figure 11)
114. Running from under strap No. 54 there is a 4" diameter protruding rust spot at 15 ft above floor level with a 4" protrusion of bright orange and red rust. Strap 54, however, is in good condition. (Ref. Tape No. 5 and Figure 11)
115. Also 20" east of strap No. 54 at 2 ft below ceiling level there is a 2" orange rust spot that protrudes 1/2" from the surface. (Ref. Tape No. 5 and Figure 11)
116. On the south wall of the south pump bay at 5 ft above floor level and 3" east of strap No. 53 there is a 4" diameter bright red and orange rust spot that protrudes 4". There is a reddish rust stain on the anode at this location. Straps No. 52 and 53 are in good condition. (Ref. Tape No. 5 and Figure 11)
117. South wall of south pump bay at 3" west of strap No. 51 and 12" below ceiling level a 1" diameter rust spot protrudes 1/4" of bright red rust. Strap No. 51 is in good condition. (Ref. Tape No. 5 and Figure 11)

118. South wall of south pump bay at 18" east of strap No. 50 and 12 ft above floor level there is a 2" diameter rust spot that protrudes 1/8" from the surface. Straps No. 45 through 50 are in good condition. (Ref. Tape No. 5 and Figure 11)
119. East wall of south pump bay 18" south of strap 45 and 18" below the ceiling a 1/2" diameter rust spot protrudes 1/4" of bright orange red rust. Straps No. 42 through 45 are in good condition. Visibility too poor to inspect concealed beam in ceiling east of south circulating water pump. (Ref. Tape No. 5 and Figure 12)

And in the north wall of the south pump bay straps No. 35 through 38 and strap No. 66 are in good condition. (Ref. Tape No. 5 and Figure 12)
120. In the north wall of the south pump bay at 18" west of strap No. 35 and 5 ft above floor level there are 2 rust spots, a 6" diameter and a 3" diameter that protrude 1/2" to 1" of bright red and orange rust. (Ref. Tape No. 5 and Figure 12)
121. In the north wall of south pump bay 18" east of strap No. 35 and 15 ft above floor level in an area about 2 ft high there are 5 rust spots of bright orange red rust color of 3" to 4" diameter that protrude 1" to 1 1/2" of rust from the surface. (Ref. Tape No. 5 and Figure 12)
122. North wall of south pump bay 4" east of strap No. 34 and 5 ft above floor level there is a 1 1/2" diameter bright red orange rust spot that protrudes 1/2" from the concrete surface. (Ref. Tape No. 5 and Figure 12)
123. North pump stop gate slot for the south pump bay has intermittent rust spots that protrude up to 3" up and down the height of the slot. The slot is immediately east of the traveling screen and have been abandoned for use as pump stop gate slots. (Ref. Tape No. 5 and Figure 12)
124. North wall of south pump bay 6" east of strap No. 82 and 10 ft above floor level there is an 8" long by 4" wide rust spot that protrudes 2" of bright orange red rust. (Ref. Tape No. 5 and Figure 12)
125. At 6" east of strap No. 82 at 4 ft above ceiling level there is a 4" diameter bright orange rust spot that protrudes 1/4" from the concrete surface. Strap No. 82 is in good condition. (Ref. Tape No. 5 and Figure 12)
126. At 8" east of strap No. 82 and 9 ft above ceiling level there is a 1 1/2" diameter bright orange rust spot that protrudes 1/4" from the surface. (Ref. Tape No. 5 and Figure 12)

In accordance with section 6.2 of Maintenance Procedure S01-I-2.55, the following items are recorded:

127. Paragraph 6.2.4.4 -- Video indicates panning of stop gate slot in north screen well. Rust previously noted on strap plate No. 68 is from rust stain on concrete above. Strap plate and coating is intact and in good condition. (Ref. Tape No. 6 and Figure 10)
128. Paragraph 6.2.4.3 -- Concealed beam in the north wall of the north screen well is shown in the video tape. (Ref. Tape No. 6 and Figure 10)
129. Paragraph 6.2.4.2 -- Repaired area in the north wall of north screen well. Area around the repair appears rust colored and stained with protruding rust. (Ref. Tape No. 6 and Figure 10)
130. Video tape of top portion of strap plate No. 68. (Ref. Tape No. 6 and Figure 10)
131. Ceiling of tunnel approaching screen well. Cluster of exuding rust spots. (Ref. Tape No. 6 and Figure 9)
132. Paragraph 6.2.4.1 -- Ceiling of tunnel at approach to the intermediate wall of screen well. (Ref. Tape No. 6 and Figure 9)
133. Paragraph 6.2.1 -- Crossover north wall between the tsunami gate and MOV 9. (Ref. Tape No. 6 and Figure 10)
134. (Also see item #13) South wall 4 ft east of MOV 11 shows four rust spots:
 - a) At 18" below tunnel ceiling.
 - b) A 1 1/2" diameter orange rust spot protruding 1/4" in a 6" diameter rust stain at 4 ft below ceiling level.
 - c) A 3" diameter dark reddish rust spot at 5 " above floor level.
 - d) A 6" long 2" wide rust spot that is 6 ft east of MOV 11 and 3" above floor level.(Ref. Tape No. 6 and Figure 11)

135. Paragraphs 6.2.2 and 6.2.4.5 -- Concealed beam in ceiling of north pump bay indicating the following:

- o A 1/2" diameter hole in concrete that is rust stained at 3 ft south of north wall.
- o A 1/2" diameter rust stained hole in the concrete at 4 ft south of the north wall and a 1/4" diameter hole.
- o Rust spot 2 1/2" diameter east of strap No. 33 2 1/2" ft north of the south wall and another rust spot just east of this spot.
- o Rust spots (2) of 1" diameter protruding 1/4" of dark rust 6" north of south wall.

(Ref. Tape No. 6, Figure 9 and Items 63C and 63F)

136. Paragraph 6.2.4.3 -- North wall of north pump bay area between strap plates No. 8 and 9. At 5 ft below ceiling:

- o 3" diameter dark reddish rust spot that protrudes 1/2" from the surface.
- o 1" diameter rust spot.
- o 2 protruding rust spots of 3" diameter that protrudes 1 1/2" of rust from the surface.
- o Large rust stain of 18" by 9" of reddish orange rust color with protrusions of rust of 1" from the concrete surface.

(Ref. Tape No. 6, Figure 10 and Items 63A and 63B)

137. Paragraph 6.2.4.3 -- Pump stop gate slot for the north pump bay scanning from bottom to top. (Ref. Tape No. 6 and Figure 10)

The following observations were made while the upper portion of the south screen well was dewatered:

- 138. On the north wall of the south screen well at 1 ft above the top of the strap plates in elevation and 4 ft east of the stop gate slot there is a 2" diameter rust spot which is exuding rust products to the surface of the concrete.
- 139. North wall of south screen well at 6 ft east of the stop gate slot and 10 ft above the top of the strap plates there is a 3" diameter rust stain on the concrete surface.
- 140. North wall of the south screen well there is a 1 1/2" diameter rust stain on the concrete located at 2 ft west of the traveling screen at 10 1/2 ft above the top of strap plate level.

141. North wall of the south screen well at 5 ft east of the stop gate slot and 8 ft below the level of the top of strap plates there is an exuding rust spot 4" long by 2" wide which protrudes 1" of rust products from the surface of the concrete.

NORTH WALL

142. Crack at construction joint. extending across the wall at ceiling level. (El.-14) from east wall to west wall in the north wall of the crossover section. (Visual only). Has numerous rust spots above and below the joint with hollow sounding across the joint. Joint is generally covered with rust stains.
143. Crack that extends diagonally down 4 ft. from the construction joint in the north wall at elevation-14 then runs horizontal for 2 feet and then diagonally upward to rejoin the construction joint at the east wall of elevation-14. Crack can be penetrated to 3/16 inch depth.
144. Crack, 2 ft. long horizontal at center of wall 6 ft. above ceiling of tunnel below pitting and rust spots of dark orange and red. Hollow sounding from 6 inches to 15 inches wide along the crack.
145. Rust spot, 2 inches dia. of orange and red rust 5 ft. above ceiling level at center of wall rust exuding holes around this area, hole dia. 1/2 inch. In the north wall of crossover area.
146. Hollow sounding area, light orange stained 6 ft. west of east wall 5 ft. above ceiling of tunnel below, area of 4' diameter in the north wall of the crossover section.
147. Area of dark orange rust exuding holes, hollow sounding, in north wall of upper crossover area located 4 ft. west of the east wall and 3 ft. below the uppermost ceiling.
148. Discolored hollow sounding area 2 ft. vertical height by 5 ft. horizontal length, heavily orange rust discolored starts at the west wall of the uppermost north wall of the crossover area and extends 5 feet to the east centered 5' above construction joint at tunnel roof.
149. Spalled concrete from north gate slot of gate #9 at 9 ft. above the floor west side of slot. Spall is 2 by 3' in size and approximately 1/8 inch deep. Seen also in 1986.
150. Rust spot in lower north wall of crossover area 3 ft. below the tunnel ceiling and 6 ft. west of gate #9.
151. Vertical crack and spall area 6 wide by 10 high located 8 ft east of tsunami gate and 3 ft. above the floor of the north wall of the crossover area. Area is rust stained and has soft concrete surface. A small area in the center of spot, about 6 inch diameter sounds hollow.

- Rust spot, 8 ft. east of Tsunami gate runs 3 ft. vertically and 1-1/2 ft. wide starts three ft. above the floor on the north wall of the crossover area. Sounds hollow at center area of 6 inch diameter.
152. Soft spot of concrete to depth of 3/4 inch with no discoloration of 6 inch diameter located 9 ft. east of tsunami gate 7 ft. above the floor on the north wall in the crossover area.
153. Crack runs diagonally for 3 ft. length located 6 inches below the tunnel ceiling and 4 inches west of gate 9 slot, in the north wall of crossover section. Sounds hollow along the crack.
154. Rust spot of 1-1/2" diameter located at the tunnel ceiling 3 ft east of west wall in the north wall of the crossover area.
155. Rust spot of 1-1/2 inch diameter red surface black rust at depth located in the north wall of crossover area 3 inches above tunnel roof and 3-1/2 ft. east of west wall.

NORTH WALL OF NORTH SCREEN WELL

156. Rust spot corresponds to item 71 of previous surveillance, 1/2 diameter black rust.
157. Rust spot, 1-1/2 inch diameter of dark red with orange perimeter protrudes 1/2 inch of rust from wall surface located on the north wall of north screen well 11 inches west of west gate slot 8 ft. above the floor. Previous No. 81.
158. Rust spot, 5 inches long and 1-1/2 inches wide of dark orange rust with small area of hollow sound located on the north wall of north screen well 1-1/2 ft. east of west gate slot 3 ft. above top of steel plate. See No. 75 of previous surveillance.
159. Rust spot, 2 inch diameter; also a strip 2 inches wide and 8 inches vertical length of dark red rust with penetration of 1 inch into concrete located in the north wall of the north screen well 4-1/2 ft. above the top of steel plate and 6 inches east of west gate slot.
160. Rust spot of 2 inch diameter 6 ft. above steel plate. See previous #79.
161. Rust spot in north wall of north screen well located 8 ft. above steel plate and 4 inches east of west gate slot size of 1-1/2 inch diameter protruding 5/8 inch out from surface of bright orange rust. See No. 80 of previous survey.
162. Red spot 1 inch diameter of red rust on the north wall of north screen well 10 ft. above top of steel plate and 5 inches east of west gate slot.

163. Rust spot, 2" diameter heavy orange rust surface stain located in the north wall of north screen well 7 ft. above the floor and 1 ft. east of the traveling bar screen. See previous No. 65.
164. Soft concrete surface, 3 ft. diameter located on north wall of north screen well starting 3 ft. above the floor extending to 6 ft. above the floor and 1 ft. east of the traveling bar screen. Spot is rust stained on surface but clear within and solid.
165. Rust spot located 7 ft. above floor between strap plates 70 and 71.
166. Rust stains over wide area with 5" diameter hollow area within; located in the north wall of north screen well 12 ft. above the floor between strap plates 72 and 73.
167. Rust stains - orange rust on surface in area of north wall of north screen well 15 ft. above floor between strap plates 69 and 70.
168. Rust stains orange rust on surface over an area of north wall of north screen well 15 ft. above the floor between strap plates 70 and 71.
169. Extensive surface rust stains between strap plates 69 and 70.
170. Spalled concrete area, 5 ft. x 3 ft. red and orange surface rust color with black rust color immediately below surface. Spall appears to be 1/8" deep and surface breaks away easily with white chalky color below surface sounds hollow in a 6 inch diameter area within total area. May be from previous chipped area #Y which was patched with different material than original. Located 3 ft. east of west bar screen 4 ft. above strap plate in north wall of north screen well.
171. Spall area, 2-1/2 ft. by 3 ft. length to depth of 1/8 inch orange rust surface color located in north wall of north screen well 12 ft. above strap plates and 6 ft. west of east traveling screen. Sounds solid. Does not appear significant.
172. Orange stains widespread - light 15 ft. above strap plates - no other irregularity. North wall of north screen well.

NORTH WALL - NORTH SCREEN WELL - BETWEEN TRAVELING SCREEN
AND EAST SCREEN WELL WALL.

173. Heavy rust spot, 2 inch diameter protruding 1-1/2" above surface located 14 inches above ledge which is at elevation 7 ft. and 13 inches west of east wall in north wall of north screen well.
- Heavy red rust spot, 6" triangular shape at ledge at elevation-7 and 7 inches west of east wall on north wall of north screen well.

Rust spot, 1" diameter of red and black rust 14 inches above ledge at elevation-7 and 2-1/2 inches east of gate slot on north wall of north screen wall.

174. Red rust spot, 1-1/2 inch diameter located 5 ft. above ledge at elevation-7 and 5 inches west of east wall on north wall of north screen wall.

Rust spot, red and black rust 1-1/2 inches in diameter protrudes rust 3/4 inches from surface 2 inches east of east gate slot and 5 ft. above ledge at elevation-7 on north wall of north screen wall.

175. Rebar exposed and heavily rusted located west side of strap plate #34: One bar at 36 inches below ceiling and other 20 inches below ceiling. Must be steel transported from elsewhere.

SOUTH PUMP BAY

176. Orange to red rust spot located 5 ft. above the floor 1-1/2 ft. west of strap plate #35. Spot runs 6 inches vertically by 3 inches high and protrudes rust at about 2 inches from surface. This corresponds to previous survey note No. 120 in the north wall of south pump bay.
177. 2 ft. x 5 inch x 3 inch concrete piece was removed from the floor of south pump bay. Piece came from the center piece of double slot of traveling screen.
178. Rust spot, 2-1/2 ft. long vertically by up to 5 inches wide of dark red and black rust color located in the north wall of the south pump bay at 3 inches west of strap plate #36 and 8 ft. above the floor.
179. Rust spot, 3-1/2 inches diameter protruded 1-1/2 inches from surface 1 inch east of strap plate #48 and 3-1/2 ft. above floor on south wall of south pump bay.
180. Rust spot, 3 inches diameter 3 inches below the ceiling 20 inches west of strap plate #50 on south wall of south pump bay.
181. Rust stains and rust deposits in and around the grout at the top of strap plate #51 on south wall of south pump bay.
182. Rust spot of 1-1/2 inch diameter 1 ft. below ceiling and 1 inch west of strap plate #51 on south wall of south pump bay corresponding to previous survey note #117.
183. Rust spot running 8 inches vertically by 5 inches wide 15 inches east of strap plate #54, 2 ft. below the ceiling corresponding to previous survey note #114 on south wall of south pump bay.
184. Rust spot, 2" diameter just east of strap plate #55 at 8 ft. below the ceiling on south wall of south pump bay.

- 185. Rust spot - 1 inch diameter at the top of strap plate #57 on south wall of south pump bay.
- 186. Rust spot, 3 inch diameter located 10 inches above the floor just east of strap plate #59 on south wall of south pump bay.

EAST WALL OF SCREEN WELLS

- 187. Rust spots up to 3 inches in diameter and several cracks in the west face of ledge all along the west face of ledge that is between elevation-7 and -11 ft. at east wall of south screen well.
- 188. White chalky deposit running up from the ledge at elevation-7 ft. extending upward 6 ft. at the south corner on the east wall of the south screen well.
- 189. Rust spot, 1-1/2 inches diameter 4 ft. above the ledge at elevation-7 and 6 ft. north of south wall on the east wall of the south screen well.
- 190. Rust spot, 4 inches diameter of red and brown rust 5-1/2 ft. above ledge at elevation-7 and 6 ft. south of north wall on the east wall of the south screen well.
- 191. Strip of reddish brown rust 1 ft. long and 1-1/2 inches wide 6-1/2 ft. above ledge of elevation-7 and 7 ft. south of north wall on east wall of south screen well.
- 192. Two rust spots of 1-1/2 inches diameter each 9 ft. above ledge at elevation-7 and 6 ft. north of south wall on the east wall of the south screen well.
- 193. Rust spots and cracks along the west face of the ledge at elevation-7 on the east wall of the north screen well.
- 194. Rust spot, 1 inch diameter at corner with ledge 9 inches north of south wall on the east wall of the north screen well.
- 195. Crack diagonally down and to the south from 3-1/2 ft. above the ledge and 2 ft. from the north wall on the east wall of the north screen well. Crack is clean of rust and sounds solid.

SOUTH WALL OF NORTH SCREEN WELL

- 196. Two rust spots - 1 inch diameter each and of dark reddish rust located 2 ft. west of east gate slot and 11 ft. above the ledge at elevation -7 on the south wall of the North screen well.

- 197. Rust spot, 5 inches vertically by 3 inches wide located 10 inches west of east gate slot at 11 ft. above the ledge at elevation-7 on the south wall of the north screen wall.
- 198. Rust spot in corner 1 inch wide by 4 inches long runs vertically up corner from 16 inches above ledge at elevation-7 ft. on north wall of south screen well in corner with east wall.

SOUTH SCREEN WELL

- 199. Rust strip, 3/4 inch width by 2-1/2 inches long located 2-1/2 ft above ledge at elevation-7 4-1/2 inches from east wall on the north wall of the south screen well.
- 200. Crack with dark red to black rust stains 4 inches long runs to east wall from 3-1/2 inches east of gate slot located 3-1/2 ft. above ledge at elevation-7 ft. on north wall of south screen well.
- 201. Rust spot at east gate slot 3 inches vertically by 2-1/2 inches width located 5-1/2 ft. above the elevation-7 ft. ledge.
- 202. Rust spot, 3 inch diameter 2 inches east of east gate slot and 8-1/2 ft. above the elevation-7 ft. ledge.
- 203. Rust spot, 3 inches wide by 6 inches long located 1 ft. west of traveling screen slot and 5-1/2 above elevation-7 ft. ledge on the north wall of south screen well.
- 204. Rust spot, 3 inches wide by 7 inches long located 10 inches west of screen slot 4 ft. above the elevation-7 ft. ledge 10 inches west of east gate slot on the north wall of the south screen well.
- 205. Rust spot, 4 inches wide, 6 inches long located 10 inches west from traveling screen slot and 5-1/2 ft. above elevation-7 ft. ledge on the north wall of the south screen well.
- 206. Rust spot - hollow sounding 1-1/2 ft. wide by 2" high located 15 inches above strap plates 1-1/2 ft. east of bar screen on north wall of south screen well.
- 207. Rust spot, 2 inches diameter located 18 inches west of traveling screen slot and 9-1/2 ft. above elevation-7 ft. ledge on the north wall of south screen well.
- 208. Rust spot, 2 inches diameter 20 inches east of traveling screen double slot and 8 ft. above elevation-7 ft. ledge on north wall of south screen well.

- 209. Rust spot, 2 inches diameter located 4 ft. east of traveling screen double slot and 10 ft. above elevation-7 ft. ledge on north wall of south screen well.
- 210. Rust strip, 20 inches high and varies in width from 2 inches to 4 inches located 8-1/2 ft. above elevation-7 ft. ledge and 2-1/2 ft. west of east gate slot in the north wall of south screen well. Hollow sound along the strip.
- 211. Two rust spots - one of 2-1/2 inch diameter, one 12 inches wide by 6 inches high located 6 inches west of east gate slot 8 ft. above elevation-7 ft. ledge on north wall of south screen well. Hollow sound.
- 212. Rust spot, 8 inches high by 3-1/2 inches wide located 3 inches west of east gate slot 8 inches below elevation-11 ft. (bottom of ledge) on south wall of south screen well. Some hollow sounding.
- 213. Rust spot - same as previous survey note #101.
- 214. Rust spot, 3 inches diameter located 2 ft. east of west wall and 2 ft. above strap plates in north wall of south screen well.
- 215. Crack, 3-1/2 inches long, orange rust color located 5 ft. above strap plates 2-1/2 inches east of west gate slot on north wall of south screen well.

SOUTH WALL OF NORTH SCREEN WELL

- 216. Rust spot, 2 inches diameter located 1 ft. above strap plates just east of west gate slot in south wall of north screen well.
- 217. Rust spot, 2-1/2 inch diameter located 3 ft. above strap plates, 18 inches east of west wall on the south wall of north screen well.
- 218. Rust spot, 1-1/2 inch diameter located 2-1/2 ft. above the floor 5 inches east of traveling bar screen on the south wall of north screen well.
- 219. Rust spot, 3 inches diameter of bright orange with yellow rust exuding located 2-1/2 ft. above floor and 3 ft. east of strap plate No. 77 on south wall of north screen well.
- 220. Rust spot, 3 inches diameter orange and exuding yellow rust located 5 ft. above the floor and 1-1/2 ft. east of strap plate No. 77. Light orange stains throughout this area of wall on south wall of north screen well.

- 221. Rust spot, 1/2 inch diameter, exuding bright orange rust located 3-1/2 ft. west of east screen, 25 ft. above floor on south wall of north screen well.
- 222. Three rust spots 3 inch diameter each and dark rust stains over area located 3 ft. east of west bar screen and 1 - ft. above strap plates. Sounds solid on south wall of north screen well.
- 223. Rust spot, 2 inch diameter, located 5 ft. east of west bar screen, 10 ft. above strap plates on south wall of north screen well.

CEILING OF CROSSOVER

- 224. Rust spot, 2-1/2 inch diameter upper ceiling of crossover section 12 ft. south of north wall in corner with west wall located in upper ceiling of crossover.
- 225. Hairline crack, upper ceiling of crossover 12 ft. south of north wall and 5 ft. east of west wall.

NORTH WALL OF NORTH PUMP WELL

- 226. Rust spot of bright orange with bright yellow rust exuding from the center; 3 inch diameter and 1-1/2 inches protruding from the surface located 4 inches east of strap plate no. 2 at 4 feet above the floor on the north wall of the north pump well.
- 227. Rust spot of bright orange; 3 inch diameter located at the east edge of strap plate no. 3 and 10 feet above the floor on the north wall of the north pump well.
- 228. Rust spot of orange color; 1 foot vertical length and 6 inches wide and projecting 1 inch from the wall surface located 2 feet east of strap plate no. 3 and 10 feet above the floor on the north wall of the north pump well.
- 229. Crack in the concrete, 6-1/2 inches horizontal length and up to 1/4 inch wide located 8 inches east of strap plate no. 3 and 9 feet above the floor on the north wall of the north pump well.
- 230. Rust spot, 1 inch in diameter located at the west edge of strap plate no. 4 and 10-feet above the floor on the north wall of the north pump well.
- 231. Rust spot, 3 inches diameter located at the west edge of strap plate No. 4 and 9-1/2 feet above the floor on the north wall of the north pump well.

232. Rust spot of orange with yellow center; of 2-1/2 inches diameter and projecting 2 inches from wall surface located 2 inches east of strap plate No. 5 and 11 feet above the floor on the north wall of the north pump well.
233. Rust spot, 2 inches diameter, located 14 inches east of strap plate No. 5 and 11 feet above the floor on the north wall of the north pump well.
234. Rust spot, 1-1/2 inches diameter of orange color projecting 1 inch from the wall surface located 4 inches east of strap plate no. 6 and 5 feet below the ceiling on the north wall of the north pump well.
235. Rust stains of 6 inches in diameter; when surface is chipped concrete is clean underneath; located 3 inches east of strap plate No. 6 and 10 feet above the floor on the north wall of the north pump well (see previous 63A).
236. Rust spot of 3 inches by 2 inches projecting 1-1/2 inches from wall surface located 4 inches west of strap plate No. 7 and 11 feet above the floor on the north wall of north pump well.
237. Rust spot of 4-1/2 inches diameter projecting 1 inch from wall surface located 10 inches west of strap plate No. 7 and 2 feet above the floor on the north wall of the north pump well.
238. Rust spot of orange color; 3-3/4 inches diameter projecting 1 inch from wall surface located 9 inches east of strap plate No. 7 and 11 feet above the floor on the north wall of north pump well.
239. Rust spot along form line of 3 inches diameter and 1-1/2 inch projection from wall surface located 21 inches east of strap plate No. 7 and 10 feet above the floor on the north wall of north pump well.
240. Rust spot, 4 inches by 2-1/2 inches and projecting 2 inches from wall surface located 13 inches east of strap plate No. 8 and 5 feet below the ceiling on the north wall of the north pump well.
241. Rust spot and spall - 2-1/2 inch by 1 inch with hole in center of 1 inch depth of orange rust; opened hole to 3 inches diameter with black rust deposit in hole with bubbles escaping from hole; located 17 inches east of strap plate No. 8 and 10 feet above the floor. Sounded solid.
242. Rust stain, orange, and heavy rust spot of 11 inches long by 6 inches wide projecting 1-3/4 inches from wall surface located 18 inches west of strap plate No. 9 and 5 feet above the floor on the north wall of north pump well.

243. Rust spot, 3 inches by 1-1/2 inches, orange with yellow center and yellow at depth, located 19 inches east of strap plate No. 10 and 6 inches above the floor on the north wall of the north pump well.

EAST WALL OF NORTH PUMP WELL

244. Rust spot, 6 inches by 5 inches and projecting 3 inches from wall surface of bright orange and brownish yellow located 2 feet south of strap plate No. 15 and 10 feet above the floor on the east wall of the north pump well.
245. Rust spot, 1 inch diameter and projecting 1/2 inch from wall surface located 1 inch south of strap plate No. 16 and 3 feet above the floor on the east wall of the north pump well.

SOUTH WALL OF NORTH PUMP WELL

246. Rust spot, 2 inch diameter and projecting 1/2 inch from wall surface, orange rust, located 6 inches east of strap plate No. 26 and 4 feet above the floor on the south wall of the north pump well.
247. Rust spot, 3-1/2 inches by 2-1/2 inches projecting 1 inch from wall surface, orange with yellow center located 3 inches west of strap plate No. 26 and 5 feet above the floor on the south wall of north pump well.
248. Rust spot, 3-1/2 inches by 2-1/2 inches projecting 1/4 inch from wall surface located 2 inches west of strap plate No. 26 and 10 feet above the floor on the south wall of the north pump well.
249. Rust spots - (4) in a horizontal line, all 8 feet above the floor as follows:
- o 3 inch diameter and projecting 1-1/2 inches from wall surface
 - o 3 inch diameter and projecting 1 inch from wall surface
 - o 2-1/2 inch diameter and projecting 1/4 inch from wall surface
 - o 7-1/2 inches by 4-1/2 inches projecting 2 inches from wall surface
- located in a horizontal line from 1/2 inches west of strap plate no. 25 to 21 inches west of strap plate no. 25 and all 8 feet above the floor on the south wall of the north pump well.
250. Rust spot, 2 inches diameter and projecting 1/2 inch from wall surface, located 12 inches east of strap plate no. 25 and 9 feet above the floor on the south wall of the north pump well.

251. Rust spot, 2 inch diameter and 1/2 inch projecting from wall surface located 3 feet east of strap plate No. 25 and 2-1/2 feet above the floor on the south wall of the north pump well.
252. Rust spot, 1-1/2 inch diameter and projecting 3/4 inch from wall surface located 3 feet east of strap plate No. 25 and 5 inches above the floor on the south wall of north pump well.
253. Rust spot, 2 inches diameter projecting 1 inch from wall surface located 5 feet east of strap plate No. 25, 2-1/2 feet above the floor on the south wall of north pump well.
254. Rust spot, orange, 2 inch diameter projecting 1/2 inch from wall surface located 2 feet west of strap plate No. 24 and 4 feet above the floor on the south wall of north pump well.
255. Rust spot, orange 2-1/4 inch diameter and projecting 1 inch from wall surface located 1-1/2 feet west of strap plate No. 24 and 10 feet above the floor on the south wall of north pump well.
256. Rust spot, orange, 1 inch diameter projecting 3/4 inch from wall surface located 2 feet west of strap plate No. 24 and 1-1/2 foot below the ceiling on the south wall of the north pump well.
257. Rust spot, 6 inches by 3 inches and projecting 2 inches from wall surface located 1-1/2 feet east of strap plate No. 24 and 1 foot below the ceiling on the south wall of the north pump well (see previous 63D).
258. Rust spot, bright orange, 2 inch diameter projecting 1 inch from wall surface located 2-1/2 feet east of strap plate No. 23 and 8-1/2 feet above floor on south wall of north pump well.
259. Rust stain over the surface of the wall in an area east of strap plate No. 23 on the south wall of north pump well.
260. Rust spot, orange, 4 inches by 3 inches and projecting 1-1/2 inches from wall surface located 2 inches west of strap plate No. 22 and 10 feet above floor on south wall of north pump well.
261. Rust spot, 6-1/2 inches by 6 inches projecting 1-1/2 inches from wall surface located at the east edge of strap plate No. 22 and 10 feet above the floor on the south wall of north pump well.
262. Rust spot, bright orange, 6-1/2 inches diameter projecting 2 inches from wall surface located 1-1/2 feet east of strap plate No. 22 and 11 feet above the floor on south wall of north pump well.
263. Rust spot, 7 inches by 5 inches projecting 2 inches from wall surface located 1-3/4 feet east of strap plate No. 22 and 11 feet above the floor (adjacent to no. 262 above) on the south wall of north pump well.

264. Rust spot, orange rust, 3 inches diameter projecting 1-1/4 inches from wall surface located 1-1/2 feet east of strap plate No. 22 and 1 foot below the ceiling on south wall of north pump well.
265. Rust spot, orange, 2 inch diameter and projecting 1 inch from wall surface located 2 feet east of strap plate No. 21 and 8 feet above the floor on south wall of north pump well.
266. Rust spot, 4 inches by 6 inches projecting 1 inch from wall surface located 3 feet east of strap plate No. 21 and 8 feet above the floor on the south wall of north pump well.
267. Rust spot, 2 inches diameter located 5 inches east of strap plate No. 21 and 4 feet above the floor on the south wall of north pump well.
268. Rust spot of orange rust, 6 inches by 2-1/2 inches projecting 1-1/2 inches from wall surface located 9 inches west of strap plate No. 21 and 3 feet above the floor on the south wall of the north pump well.
269. Rust spot, 2 inches diameter projecting 1 inch from wall surface located 5 inches east of strap plate No. 21 and 9 inches above the floor on the south wall of the north pump well.
270. Rust spot, orange rust, 2 inches diameter projecting 2 inches from wall surface located 1 foot east of strap plate No. 20 and 8 inches above the floor on the south wall of north pump well.
271. Rust spot, 6 inches diameter projecting 1-1/2 inches from wall surface, located 15 inches west of strap plate No. 20 and 6 feet above the floor on the south wall of the north pump well.
272. Rust spot, 3 inches by 1 inch projecting 1/2 inch from wall surface located 3 inches east of strap plate No. 19 and 5 feet below the ceiling on the south wall of north pump well.
273. Rust spot, orange rust, 5 inches by 2 inches projecting 1-1/2 inches from wall surface located 3 inches east of strap plate No. 19 and 7 feet above the floor on the south wall of the north pump well.

EAST WALL OF NORTH PUMP WELL

274. Rust spot, bright orange rust, 3 inches diameter projecting 1-1/2 inches from the wall surface located 2 feet north of strap plate No. 18, 10 feet above the floor on the east wall of the north pump well.
275. Rust spot, orange rust, 1-1/2 inches diameter projecting 1/2 inch from wall surface located 2 inches north of strap plate No. 17 and 12 feet above the floor on the east wall of the north pump well.

276. Rust stain over the surface of the east wall directly behind the circulating waterpump in the north pump well.

NORTH WALL

277. Bright orange rust spot, 4" dia., 3-1/2 ft. above floor, 3 ft. west of gate No. 9 slot in North wall at crossover. (Visual only).
278. Bright red rust spot, 4" dia., 3 ft. above floor, 4 ft. west of gate No. 9 slot in North wall at crossover. (Visual only).
279. Rust spot, 18" O, 10 ft. west of Gate No. 9 slot 2' above floor; area of previous core drill No. 15. (Visual only).
280. Crack from floor extends vertically up for 2 ft. on west side of Gate No. 9 slot in the North wall.

VISUAL OBSERVATION FIELD NOTES

Taken During Third
Surveillance (1990)

SONGS UNIT 1

JULY 1990 - INTAKE STRUCTURE SURVEILLANCE

An inspection of the intake structure was conducted during the time period from July 20, 1990 through July 27, 1990. The inspection was conducted with the intake structure water levels at sea level by divers directed from the surface.

The inspection consisted of the description of rust spots and their location, inspection of strap plates for damage or corrosion, half cell potential measurements and any other feature that might be encountered.

Portions of the inspection were videotaped. Some of the areas were "sounded" to provide additional data. Sounding consisted of tapping with a hammer at the affected area and marking the boundary where the tapping sound changed from solid to soft. The enclosed area of the soft sounding was then evaluated. The soft sound could mean an indication of delamination or of deterioration of the concrete near the surface. Near can mean up to 4 inches. The locations of the observations are shown on drawings 5212379 to 5212384 and 5217775 of Appendix C. The results of the inspection program follows:

VISUAL OBSERVATION FIELD NOTES
THIRD SURVEILLANCE, JULY 1990

NORTH WALL-WEST OF TRAVELING BAR SCREEN

1. Rust spot, 9 ft. above floor 15 inches west of bar screen, 2 inch diameter protrudes $\frac{1}{2}$ inch from wall, red at surface and black under surface after scraping surface. Sounds soft only on rust spot -- surrounding area sounds solid. This spot is 1 inch from the edge of Plate #68. North wall.
2. Intermittent rust spots and stains down the north wall gate slot west of bar screen from elevation 0.00 to floor.
3. Rust spot, 5 ft. above ceiling of intake tunnel 18 inches west of bar screen, $2\frac{1}{2}$ inch diameter of red rust, after scraping surface spot is 3 inches horizontal by 1 inch vertical; sounds soft in a 9 inch diameter area around the rust spot.
4. Construction joint between floor and north wall, 4 inches east of flow vanes, dark brown spot on floor, no rust, sounds solid -- determined to be residue from construction activities, no distress evident.
5. Joint line, 4 inches below ceiling of intake tunnel, 4 ft. 6 inches west of the ceiling edge at screen well, no rust, no distress evident.
6. Several rust spots and stains in a 2 ft. diameter area, 2 ft. below the second plate down from the upper ceiling and 4 ft. east of west wall on the north wall in the upper section of the crossover. Spots are red to dark red in color. Area sounded solid.
7. Pit in the concrete corresponds to 9 in earlier inspection. 3 inches by 2 inches and $\frac{3}{8}$ inches deep. No rust, no distress.
8. Drill hole of $\frac{5}{8}$ inches diameter, in transition at 5 o'clock looking west and 1 foot east of pipe joint 1 inch deep; no rust, no distress.
9. Rust spot, in transition at 4:30 o'clock looking west. $4\frac{1}{2}$ inches east of pipe joint; 2 inches diameter; red rust and black on surface and grey underneath. Sounds soft in a 4 inch diameter area; appears to be a drill hole with rust exuding.
10. 2 rust spots $5\frac{1}{2}$ inches apart at 10:00 o'clock looking west at $1\frac{1}{2}$ ft. east of pipe joint; largest spot is 2 inches vertical by $1\frac{1}{2}$ inches; red surface, black underneath in the transition.
11. Rust spot in transition at 8:30 o'clock looking west, $1\frac{1}{2}$ ft. east of pipe joint; 3 inches long horizontal by 2 inches wide vertically; black rust products. Sounds solid except directly at spot.

SOUTH WALL-WEST OF TRAVELING BAR SCREEN

12. Crack in south wall adjacent to MOV-11 located west of gate opening just 3 inches to 3/4 inches west of edge goes from 2 ft. above floor to 3 ft. below ceiling can be penetrated up to 2 inches. Smaller crack starts at this crack 2 ft. above the floor and rejoins 3½ ft. above floor.
13. Crack similar to 12 on east side of MOV-11 starts at floor and ends 2 ft. below ceiling.
14. Rust spot; 2½ ft. above floor, 1 ft. east of Plate # 93, spot is 1½ inch diameter and protrudes from the surface ½ inch. Yellowish brown to dark brown turning to black underneath. Sound solid except at spot.
15. Rust spot at edge of Plate #93, 8 inches above floor. Spot is 1 inch diameter red surface, black underneath. Sounds solid except at spot.
16. Cluster of rust spots. 5 spots between Plates #93 and #94, 3 ft. above floor in area 6 in. in height and 2 ft. wide. 2 holes have been grouted, two have metal studs in them and 1 hole is black of 3/4 inch diameter with ½ inch of rust protruding. Color of holes is reddish brown. Sounds solid.
17. Temporary screen gate slot has intermittent rust spots and stains along the entire wall.
18. Rust spots 5 ft. above floor 9 inches east of temporary screen gate slot in south wall 2 inches east of Plate #88 of 1½ inches diameter protruding ½ inch, reddish brown surface and black underneath. Second spot 1 ft. above first spot of rust discoloration.

INTERMEDIATE WALL-SOUTH SCREEN WELL

19. Cluster of 5 rust spots in a vertical line of 2 ft. length 10 inches east of temporary screen slot 1 ft. 4 inches below top of Plate #79. Spots are 1 inch in diameter with 1/4 inch rust protrusion. Color is dark red and brown.
20. Rust spot 8 inches above floor, 1 ft. west of bar screen, of 1½ inch diameter with 1/4 inch protrusion from surface. Red rust color on surface and black underneath.

INTERMEDIATE WALL-NORTH SCREEN WELL

21. Crack in concrete, 1 ft. west of bar screen runs from floor to ceiling of intake tunnel, rust color intermittent from floor to ceiling but heavier rust at lower portion. Bracket holes at top of crack. Bullnose has soft sounding.
22. Rust spot 8 inches above floor 9 inches west of bar screen, spot is 1½ inches diameter and is reddish brown at surface and black underneath.

23. Rust spot 2 ft. west of bar screen 1 ft. above top of Plate #78. Spot is 6 inches vertical by 2 inches wide and color is dark brown. Sounds solid except at spot.

CEILING BETWEEN BULLNOSE AND FLOW VANES

24. Crack in ceiling runs more or less from north wall to south wall with other smaller cracks along length. Crack varies in distance from east edge of ceiling from 7 inches to 1 ft. Crack is rust colored with one large rust spot of 5 inches diameter located 6 ft. north of south wall. There is a soft sounding area that varies from 3 inches to 7 inches in width and straddles the crack.
25. Cluster of 6 rust spots in area of 3 ft. diameter located $1\frac{1}{2}$ ft. south of north wall, $3\frac{1}{2}$ ft. west of ceiling edge at screen well. Largest spot is $3\frac{1}{2}$ inches by 2 inches with 1 inch protrusion of orange and brown with black underneath. Smallest is 1 inch diameter with $\frac{1}{2}$ inch protrusion. Sounds soft in a 3 ft. diameter area of cluster. See items 84 and 85 of previous inspection (1986).
26. Rust spot 6 ft. south of north wall $3\frac{1}{2}$ ft. west of ceiling edge at screen well. Spot is 5 inches by $2\frac{1}{2}$ inches of orange and brown surface and black underneath. Sounds soft only on rust spot. See item 96 of previous inspection (1986).

FLOOR

27. Spalled concrete in two places at temporary screen slot. 2 ft. north of south wall. One spall is 5 inches diameter with no rust. The other smaller spall is 4 ft. north of south wall. No rust.
28. Patch in concrete 6 ft. east of MOV 9 5 ft south of south wall 5 ft. long east and west by 2 ft. wide north and south. Shows no distress.
29. Corresponds to 48 of previous inspection (1986). North flow vane at floor. Spalling and rust stain.

Floor of south pump bay had more than a foot of shells and debris over surface and visibility was poor. An area of 10 ft. length from traveling screen east was cleaned and inspected with no sign of rust or of distress.

Floor of north pump bay had about 2 inch deep shells and debris covering but visibility was sufficient. No sign of distress over floor area.

EAST WALL-SOUTH SCREEN WELL

30. Rust spot 3 ft. south of north wall 4 inches west of east wall on the ledge. Spot is $\frac{1}{2}$ inches diameter of orange and brown color.
31. Rust spots and stain 1 ft. above ledge in northeast corner on intermediate wall 5 inches long with $\frac{3}{4}$ inch protrusion with 12 inch long rust stain

- running to ledge. Also at 18 inches above ledge an additional spot of $1\frac{1}{2}$ inch diameter.
32. Rust spot 2 ft. above ledge $5\frac{1}{2}$ ft. north of south wall of $\frac{1}{2}$ inch diameter and $1/16$ inch protrusion.
 33. Rust spot $2\frac{1}{2}$ ft. north of south wall $1\frac{1}{2}$ ft. above ledge of $\frac{1}{2}$ inch diameter and $\frac{1}{4}$ inch protrusion of orange and brown rust.
 34. Rust spot east wall at vertical centerline 5 ft. above ledge. 1 inch diameter 1 inch protrusion orange and brown. Sounds solid.
 35. Rust spot east wall centerline 7 ft. above ledge 2 inches long, 1 inch wide, $\frac{1}{4}$ inch protrusion. Light orange to dark brown in color.
 36. Rust spot, 5 ft. north of south wall 8 ft. above ledge small stain of dark brown.
 37. Rust spot, 6 ft. above ledge $5\frac{1}{2}$ ft. south of north wall, 6 inches long, 4 inches wide with $\frac{1}{4}$ inch ϕ hole in center. Center 1 inch ϕ sounds soft. Orange and dark brown.
 38. Rust spots, several along top of ledge but silt and stains causes difficulty with visibility.

INTERMEDIATE WALL-SOUTH SCREEN WELL

39. Gate slot has intermittent rust spots throughout.
40. Rust spots along a strip vertically 1 inch west of east wall; largest spot is 3 inches diameter protruding 1 inch; dark brown to orange in color. Sounds solid. Total of 11 rust spots in this line.
41. Rust spots along a vertical line; 12 spots west of gate slot. Largest spot is 4 inches diameter with $\frac{1}{4}$ inch protrusion. Dark brown to orange.

INTERMEDIATE WALL-SOUTH PUMP BAY

42. Rust spots in vertical line between Plate #82 and gate slot; total of 5 spots with indications of a crack joining the spots. Largest spot is 7 inches by 4 inches with $\frac{1}{4}$ inch protrusion. Orange to brown in color. Sounds solid.
43. Rust spots; 3 spots corresponding to 175 of previous inspections located about 2 ft. below ceiling at west edge of Plate #34. 3 inch diameter with $\frac{1}{2}$ inch protrusion of orange color.
44. Rust spots; 2 spots; one is 6 ft. below ceiling 3 inches east of Plate #34; $1\frac{1}{2}$ inches diameter $\frac{1}{2}$ inch protrusion of orange and brown color. Second spot is 7 ft. below ceiling and 8 inches east of Plate #34.

59. Cluster of 3 rust spots in a 3 ft. diameter area; 3 ft. above floor and 1 ft. east of Plate #40; spots are 2 inches in diameter and 3/8 inch protrusion of orange color.
60. Rust spot; 6½ ft. above floor 4 inches east of Plate #41; 1½ inches diameter, ¼ inch protrusion of orange color.

EAST WALL-SOUTH PUMP BAY

61. Rust spot 5 ft. below ceiling at north edge of Plate #43; 1½ inches diameter and ¼ inches protrusion of orange color.
62. Rust spot; 9 ft. above floor 6 inches south of Plate #44; 1½ inches diameter and ¼ inch protrusion; orange and black in color.
63. Rust spot; 6 ft. above floor at corner on east wall at south wall of 2 inch diameter and ½ inch protrusion of orange and black color.
64. 4 Rust spots (2 large and 2 small) in a 2 ft. area 3 ft. below ceiling 1 ft. north of south wall; larger spots are 2 inches in diameter, ½ inch protrusion of orange and black color. See 119 of previous inspection (1986).

SOUTH WALL-SOUTH PUMP BAY

65. 2 rust spots 6 inches apart; 1½ ft. below ceiling, 1 ft. west of east wall; 1 3/4 inch diameter, 3/8 inch protrusion of orange and black.
66. Rust spot; 3 ft. above floor and 5½ inches west of Plate #47; 1½ inches diameter and 1/4 inch protrusion of orange color.
67. Rust spot; 7½ ft. above floor, 4½ inches west of Plate #47; 2 inch diameter and 1 inch protrusion of orange and black color.
68. Rust spot; 1½ ft. below ceiling, 4½ inches east of Plate #47; 3 inches diameter and ½ inches protrusion of orange color.
69. Rust spot; 1 ft. below ceiling, 1 inch east of Plate #48; 1½ inch diameter and ¼ inch protrusion of orange color.
70. Rust spot; 5½ ft. below ceiling, 5½ inches west of Plate #48; 22½ inch diameter, ½ inch protrusion of orange color.
71. Rust spot; 3½ ft. above floor, 1 inch east of Plate #48. Spot is 5½ inches by 3½ inches with 1½ inch protrusion of orange color. See item 179 of previous inspection.
72. Line of 4 rust spots in a horizontal line of 5 ft. by 2 ft.; 1 ft below ceiling at west edge of Plate #51 and extending westward; largest spot is 4 inches by 2 inches high with 3/4 inch protrusion of orange color. See

- items 180, 181, 182 and 117 of previous inspections (1986 & 1988).
73. Rust spot; 10 ft. above floor, 9 inches east of Plate #50; $1\frac{1}{2}$ inches diameter, $\frac{1}{2}$ inch protrusion of orange color.
 74. Cluster of 3 rust spots; in an area of 3 ft. by 1 ft.; located $3\frac{1}{2}$ ft. above floor, 5 inches east of Plate #53; largest spot is 12 inches by 4 inches with $\frac{3}{4}$ inch protrusion of orange and black color. Sounds solid except on spots. See item 116 of previous inspection (1986).
 75. 2 rust spots; $8\frac{1}{2}$ ft. above floor and 1 ft. east of Plate #53; larger spot is 3 inches by 2 inches and 1 inch protrusion of orange and black color.
 76. 2 rust spots in 3 ft. by 6 inch area; $2\frac{1}{2}$ ft. below ceiling 8 inches east of Plate #54; size of $4\frac{1}{2}$ inches by $3\frac{1}{2}$ inches with $2\frac{1}{2}$ inch protrusion of orange and black color. See items 114, 115 and 183 of previous inspections (1986 & 1988).
 77. Cluster of 10 rust spots in a horizontal line; 5 ft. above the floor between Plates #54 and #55; largest spot is 5 inches by 3 inches and $\frac{3}{4}$ inch protrusion of orange color. Sounds solid. See items 110, 111, 112 and 113 of previous inspection (1986).
 78. Rust spot; 2 inches below ceiling at edge of Plate #55; 2 inches by 1 inch and $\frac{3}{8}$ inch protrusion of orange color. See item 109 of previous inspection (1986).
 79. 2 rust spots; 5 ft. above the floor, one on each edge of Plate #57; 4 inches by $1\frac{3}{4}$ inch with $\frac{1}{2}$ inch protrusion of orange and black color. See items 108 and 107 of previous inspection (1986).
 80. 2 rust spots; 1 inch below ceiling, 1 ft. east of Plate #57; $1\frac{1}{2}$ inch diameter and $\frac{3}{8}$ inch protrusion, spots are 2 ft. apart; of orange color.
 81. 2 rust spots; 6 ft. above floor, one at east edge of Plate #59, other 3 ft. west; $2\frac{1}{2}$ inches by 1 inch with $\frac{3}{4}$ inch protrusion of orange color.

CEILING OF SOUTH PUMP BAY

82. Rust spot; $4\frac{1}{2}$ ft. north of south wall $3\frac{1}{2}$ ft. east of Plate #66; spot of $3\frac{1}{2}$ inches by $1\frac{1}{2}$ inches with $\frac{3}{8}$ inch protrusion of orange color.
83. 2 rust spots 1 ft. apart; 6 ft. north of south wall, 8 ft. west of pump centerline, in concealed beam; 3 inch diameter with 1 inch protrusion of orange color.
84. 2 rust spots; one 2 ft. north of south wall, 3 ft. east of Plate #66; 6 inches by 4 inches with 2 inches protrusion of orange color; the other is 17 inches north of south wall, 6 inches east of Plate #66 of $2\frac{1}{2}$ inch diameter, 2 inch protrusion of orange color.

45. Rust spot; 4 ft. above floor; 2 inches east of Plate # 34; 2 inches diameter with $\frac{1}{4}$ inch protrusion of orange and brown.
46. Rust spot; 6 ft. below ceiling, 6 ft. east of Plate # 34; $3\frac{1}{2}$ inches in diameter of orange and brown color.
47. Rust spot; 7 ft. above floor, $5\frac{1}{2}$ ft. east of Plate #34; 5 inches diameter with $\frac{1}{4}$ inch protrusion of orange and brown.
48. Rust spot; 8 ft. above floor, 1 ft. west of Plate #35. Spot is 3 inches long by $1\frac{1}{2}$ inches wide ranging from light brown to dark brown.
49. Cluster of 3 rust spots; in an area 1 ft. 8 inches long by 5 inches wide; located $5\frac{1}{2}$ ft. above the floor and $1\frac{1}{2}$ ft. west of Plate #35; largest spot is 3 inches long by $2\frac{1}{2}$ inches wide projecting $\frac{1}{4}$ inch out from the surface; color ranges from orange to light brown. Corresponds to item 120 and 176 of previous inspections (1986 & 1988).
50. Rust spot; $3\frac{1}{2}$ ft. east of Plate #35 and $7\frac{1}{2}$ ft. above the floor; 3 inches in diameter 1 inch protrusion; color ranges from orange to light brown.
51. Cluster of 14 rust spots in an area of 4 ft. diameter 11 ft. above the floor and 1 ft. east of Plate #35; range in size from 3 inch diameter to 1 inch diameter with up to 2 inches protrusion. Color ranges from orange to light brown. Sounds soft in 5 ft. diameter area over the cluster.
52. Rust spot; 4 ft. above the floor 1 inch west of Plate #36; spot is 2 inches by 1 inch of orange color.
53. Rust spot; 8 ft. above floor 2 inches west of Plate #36; spot is $4\frac{1}{2}$ inches by $3\frac{1}{2}$ inches with 2 inches protrusion; color ranges from orange to red with black under surface. See 178 of previous inspection (1988).
54. Rust spot; 4 ft. below ceiling, 13 inches west of Plate #36; spot size is $1\frac{1}{2}$ inches diameter and $\frac{3}{4}$ inch protrusion of orange color.
55. Rust spots, 2 in number; 4 ft. and 6 ft. below ceiling $6\frac{1}{2}$ inch west of Plate #37 and $\frac{1}{2}$ inch west of Plate #37 respectively; first spot is $1\frac{1}{2}$ inches by 1 inch and $\frac{1}{2}$ inch protrusion; second spot is 1 inch diameter with $\frac{3}{4}$ inch protrusion. Colors are orange to dark brown.
56. Cluster of 5 spots of rust in an area of 5 ft. by 2 ft; $7\frac{1}{2}$ ft. above the floor and $3\frac{1}{2}$ ft. east of Plate #39; average size of $1\frac{1}{2}$ inch diameter with $\frac{3}{8}$ inch protrusion.
57. Rust spot; $7\frac{1}{2}$ inches above the floor at west edge of Plate #40; size of 2 inches by 1 inch with $\frac{1}{8}$ inch protrusion of orange color.
58. Cluster of 3 rust spots; 10 ft. above the floor and $2\frac{1}{2}$ ft. east of Plate #40; sizes of 1 inch diameter and $\frac{1}{2}$ inch protrusion of orange color in an area of 3 ft. diameter.

85. Rust spot; 5 ft. south of north wall, 9 ft. west of east wall; 2 inches in diameter with 2 inch protrusion of orange color.
86. Rust spot; 4 ft. north of south wall 7 inches west of Plate #65; 3 inches diameter and $1\frac{1}{2}$ inch protrusion of orange color.
87. Rust spot; on centerline 2 inches west of Plate #64; 2 inches diameter and $1\frac{3}{4}$ inch protrusion of orange color.
88. Rust spot; 3 inches south of pump centerline 18 inches west of Plate #62; 5 inches by 3 inches with $1\frac{1}{2}$ inch protrusion of orange color.
89. Rust spot; 4 ft. south of north wall 8 inches east of Plate #61; $2\frac{1}{2}$ inches diameter 1 inch protrusion of orange color.
90. Cluster of 9 rust spots in a 40 inch diameter area; 36 inches north of south wall between Plates #61 and #60, up to 3 inches in diameter and 2 inches protrusion of orange and brown color. 3 ft. diameter area of spots; sounds soft.
91. Cluster of 3 rust spots; 8 inches south of north wall $1\frac{1}{2}$ inches west of Plate #60; spots are 1 inch diameter with $\frac{1}{2}$ inch protrusion of orange and brown color.

SOUTH WALL-SOUTH SCREEN WELL

92. 4 rust spots and cracks joining them in $1\frac{1}{2}$ ft. diameter area; located 6 ft. above the floor, 7 inches west of Plate #85. Largest spot is 6 inches by 13 inches with 1 inch protrusion of orange and black color. Soft sounding area of 4 inches by 10 inches in the cluster. A $6\frac{1}{2}$ inch by 2 inch piece of concrete fell away during sounding. See item #89 of previous inspection (1986).
93. 4 cracks in corner of south wall; 6 ft. above the floor, 4 inches from Plate #86. No rust. See item 89 of previous inspection (1986).
94. Rust spot; 2 ft. 7 inches above and 10 inches west of Plate #84; size is 2 inches diameter with $\frac{1}{2}$ inch protrusion of orange and black color.

INTERMEDIATE WALL-SOUTH SCREEN WELL

95. Rust spot; 11 ft. above floor, 3 inches west of Plate #81, 4 inches by $2\frac{1}{2}$ inches, orange and brown in color $\frac{7}{8}$ inches protrusion from surface.
96. Rust spot; 7 ft. below top of Plate #81, $17\frac{1}{2}$ inches west of Plate #81; $1\frac{1}{2}$ inches diameter, $\frac{1}{2}$ inch protrusion of orange color.

INTERMEDIATE WALL-NORTH SCREEN WELL

97. Rust spot; 2 ft. 4 inches above floor 4 inches east of bar screen; 1 inch diameter, 1 inch protrusion of orange and black color.
98. Rust spot; 2 ft. 4 inches below top of Plate #77, 2 ft. east of Plate #77; 2½ inches diameter, 1 inch protrusion of orange and brown color.
99. 3 rust spots in vertical line; centered 2 ft. 3 inches above floor, 19 inches west of Plate #76, line is 2 ft. long; 2½ inches in diameter, 1½ inch protrusion of orange, black and grey color. See item 219 of previous inspection (1988).

NORTH WALL-NORTH SCREEN WELL

100. Rust spot; 5 inches above top of Plate #74 on centerline of plate; 1 3/4 inch diameter, 1½ inch protrusion of orange and brown color.

NORTH WALL OF DISCHARGE TUNNEL

101. 2 rust spots; 9 ft. below upper ceiling, 3 ft. west of east wall in upper section of crossover; one spot 3 inches diameter, other spot is 2 inches diameter with 1 inch protrusion of orange, brown and black color. Spots are 1 ft. apart vertically and are directly above bottom of floor incline. All else on wall, from sea wall to east end of intake structure, looks good with no sign of distress.
102. Crack in concrete wall at west side of gate opening (Gate MOV 11 - Discharge Structure Side) in north wall of discharge structure. Crack starts on north wall 1 inch west of corner of opening and 26 inches above the floor and extends to 3 ft. below ceiling and there angles into corner upward on the west face of opening on into gate slot. The crack ends at 1 ft. below ceiling in the west gate slot.

South wall of discharge structure, from sea wall to east end of intake structure, looks to be in excellent condition with no sign of distress apparent.

NORTH WALL-NORTH PUMP BAY

103. 2 rust spots; 15 inches above the ledge 14 inches east of gate slot; 2½ inches in diameter, 2 inch protrusion of orange and brown color.
104. Rust spot; 3 ft. above ledge, 2 inches east of gate slot; 5½ inches long by 2 inches wide with 3/8 inch protrusion of orange and brown color.
105. Rust spot; 9 ft. above floor, 3½ inches west of Plate #2; 1½ inches diameter, ½ inch protrusion of orange and brown color.
106. Rust spot; 5½ ft. above floor, 3 inches east of Plate #3; 3 inch diameter with 1 inch protrusion of orange and black color.

107. Rust spot; 2 ft. 3 inches above floor; 8 inches west of Plate #3; 3 inches by $\frac{1}{2}$ inch with $\frac{1}{4}$ inch protrusion of orange and black color.
108. Cluster of 5 rust spots within a $3\frac{1}{2}$ ft. diameter area; $9\frac{1}{2}$ ft. above floor at east edge of Plate #4; largest spot is 5 inches by $3\frac{1}{2}$ inches, $\frac{1}{4}$ inch protrusion of orange and black color. Sounds solid except directly at rust spots. See item 61 of previous inspection (1986).
109. Cluster of 3 rust spots in a 2 ft. diameter area; 7 ft. below ceiling, 8 inches west of Plate #5. Largest spot is 5 inches by 2 inches with $1\frac{7}{8}$ protrusion of orange and brown color.
110. Cluster of 4 rust spots in a horizontal line of 4 ft. length; 7 ft. below the ceiling at east edge of Plate #6. Largest spot is $6\frac{1}{2}$ inches by 4 inches with $\frac{1}{4}$ inch protrusion of orange and brown color.
111. Cluster of 3 rust spots in a 3 ft. long line; centered 6 ft. below ceiling. 2 inches east of Plate #8; largest spot is 3 inches in diameter of orange and brown color. See items 239 and 241 of previous inspection (1988).
112. Cluster of 5 rust spots in a 2 ft. diameter area; centered 6 ft. above floor, 17 inches east of Plate #9; spots are up to 3 inches in diameter with $\frac{1}{4}$ inch protrusion of orange and brown color.
113. 2 rust spots 1 inch apart; $5\frac{1}{2}$ ft. above the floor, 11 inches east of Plate #9; largest is 7 inches by $1\frac{1}{2}$ inches with 1 inch protrusion of orange and black color.
114. Rust spot; 5 inches above floor 1 ft. west of Plate #11; 3 inches by 1 inch with $\frac{3}{4}$ inch protrusion of orange and black color. See item 243 of previous inspection (1988).
115. Rust spot at corner between floor and wall; 8 inches west of Plate #14; $5\frac{1}{2}$ inches by 2 inches with 1 inch protrusion of orange and black color.

EAST WALL-NORTH PUMP BAY

116. Cluster of 3 rust spots in a 2 ft. diameter area; 7 ft. below ceiling, 3 ft. south of Plate #15; largest spot is 8 inches by 5 inches with 3 inch protrusion of orange and black color.
117. Cluster of 4 rust spots in a $4\frac{1}{2}$ ft. long horizontal line; centered 7 ft. below ceiling 2 ft. south of Plate #17; $2\frac{1}{2}$ ft. diameter with $\frac{1}{4}$ inch protrusion of orange color.
118. 2 rust spots 2 ft. apart in southeast corner; $7\frac{1}{2}$ ft. above floor; size of largest is $4\frac{1}{2}$ inches by 1 inch with $\frac{3}{4}$ inch protrusion of orange color.

East wall above ledge in screen well has no apparent sign of distress. Gate slots in screen well have intermittent rust spots and stains throughout.

INTERMEDIATE WALL-NORTH PUMP BAY

119. Rust spot; 7½ ft. above the floor 3 inches east of Plate #19; 3½ inches by 1 inch with 1½ inch protrusion of orange and black color.
120. Rust spot; 6½ ft. above floor, 7 inches east of Plate #20; 2 inches diameter with ¾ inch protrusion of orange color.
121. Cluster of 4 rust spots in a 2½ ft. diameter area; centered 3½ ft. above the floor at west edge of Plate #21; size of 2 inch diameter with 1½ inch protrusion of orange and brown color. See items 267 and 268 of previous inspection (1988).
122. 2 rust spots; 9 inches above the floor, 23 inches west of Plate #21; 6½ inches by 4½ inches with 2½ inch protrusion of orange and brown color.
123. Rust spot; 14 inches below ceiling, 2 ft. west of Plate #21; 2½ inches diameter with 1½ inch protrusion of orange and brown color.
124. Cluster of 4 rust spots in a 3 ft. diameter area; centered 8½ ft. below the ceiling, 1 ft. west of Plate #22. Largest spot is 5½ inches by 2 inches with 3½ inches protrusion of orange color.
125. Rust spot; 7 ft. above the floor, 8½ inches west of Plate #23; 4 inches by 2 inches with 1 inch protrusion orange and brown color.
126. Rust spot; 9½ inches below ceiling, 18 inches east of Plate #24; 4 inches by 2½ inches with 1½ inch protrusion of orange and brown color. See item 257 of previous inspection (1988).
127. Rust spot; 8 ft. above the floor, 20 inches west of Plate #24; 2 inch diameter with ¾ inch protrusion of orange and brown color.
128. Rust spot; 5½ inches above the floor, 2 ft 10 inches east of Plate #25; 3 inch diameter with ¼ protrusion of orange and black color. See item 252 of previous inspection (1988).
129. 7 Rust spots in a horizontal line 3½ ft. long centered 8 ft. above the floor, 2 inches west of Plate #25. Largest is 5 inches by 4 inches with 1½ inches protrusion of orange, brown and black color. A 6 inch strip centered on the line sounds soft. See item 249 of previous inspection (1988).
130. Rust spot; 1½ ft. below ceiling at west edge of Plate #26; 3½ inches by 2 inches with ¾ inch protrusion of orange and brown color.
131. Rust spot; 6 ft. below the ceiling, 1½ inches west of Plate #26; 3 inches diameter with ¼ inch protrusion of orange and brown color. See item 248 of previous inspection (1988).
132. 2 rust spots in a 3½ inch diameter area; 5 ft. above the floor 2½ ft. west

of Plate #26; 1½ inch diameter with ¾ inch protrusion of orange and black color.

133. Crack in concrete; extends from 4 ft. above the floor to the top of the ledge; bottom 4 ft. of crack is rust colored. See item 92 of previous inspection (1986).

Intermediate wall above ledge in screen well has no apparent sign of distress.

CEILING OF NORTH PUMP BAY

134. 5 rust spots in a north south line of 6 ft. length; 6 ft. north of south wall 6 inches east of Plate #28; spots are 2½ inch diameter with 2 inch protrusion of orange color.
135. Rust spot; 4 inches south of north wall, 16 inches west of Plate #31; 3 inches by 1½ inches with 1½ inches of protrusion of orange and brown color.
136. Rust spot; 7 ft. north of south wall, 6 ft. east of Plate #33; 2 inches in diameter with 1½ inch protrusion of orange and brown color.
137. Rust spot; 1 ft. north of pump centerline 18 inches west of west edge of pump opening (circ. pump); 2½ inches in diameter with 1 inch protrusion of orange and brown color.
138. 3 rust spots in a 6 ft. long line parallel to north wall; 8 inches south of north wall and 3 ft. west of eastern most wall. Largest is 5 inches by 3 inches with 4 inch protrusion of orange and brown color.
139. Rust spot; 10 ft. south of north wall, 13 inches west of eastern-most wall; 3 inches in diameter with 1 ¾ inch protrusion of brown color.

MOV 11 GATE STRUCTURE

140. Construction joint 11 ft. above ledge concrete with spalling on south wall. 7 rust spots along horizontal joint in south wall of 2 to 3 inch diameter with 1½ inch protrusion of orange and brown color with rust stains all along construction joint. Rust spot on east wall and rust stained at construction joint. Rust spot is 4 inches by 2 inches with 1½ inch protrusion of orange color 4 inches north of south corner. 4 rust spots in north wall similar to spots and rust stains of south wall. Rust spot on west wall 4 inches north of gate slot spot is 4 inches in diameter with 2½ inches protrusion of orange color. All the above are located along the construction joint around the perimeter of the gate structure 11 ft. above the ledge. Sounds solid.
141. 2 rust spots 18 inches apart horizontally; 10 ft. above the ledge in the south wall 2 ft. west of east wall. Spots are 2 inches in diameter with 2 inch protrusion of orange color.
142. 2 rust spots in east corner of west wall 6 inches south of gate slot, spots

- are 2 inches in diameter with 3/4 inches protrusion of orange brown and black color.
143. East slot has intermittent rust spots and stains from the ledge to 11 ft. above the edge.
 144. Rust spot in south wall 10 ft. above the ledge 5 ft. east of west wall 10 ft. above the ledge; 1 inch diameter with $\frac{1}{2}$ inch protrusion of orange color.
 145. 2 rust spots in west wall, 14 ft. above ledge 2 ft. north of slot. One spot is 5 inches in diameter with $2\frac{1}{2}$ inches protrusion of dark orange color. Second spot is 2 inches in diameter with 2 inch protrusion of orange color.
 146. Rust spot in west wall; 10 ft. above ledge 18 inches north of south wall; 3 inch diameter with 1 inch protrusion of orange color.

MOV 9 GATE STRUCTURE

147. At 11 ft. above the ledge there are studs protruding from holes that are rusted. The holes are about $1\frac{1}{2}$ inches deep and appear to have contained the studs as construction aids. No serious distress has resulted.
148. Rust stain in southwest corner of gate structure 11 ft. above ledge.
149. Cluster of 3 rust spots in horizontal line 1 ft. long located 11 ft. above the ledge. Construction joint in east wall. Largest spot is 4 inches by $\frac{1}{2}$ inch with 1/8 inch protrusion of light and dark orange color.

Each gate structure has intermittent rust spots up and down the length of the alignment slot from ledge to 11 ft. above ledge.

STRAP PLATES

All strap plates that could be inspected were examined for coating loss, tightness of bolt by checking to see if bolts were hand tight or better, corrosion, looseness of anodes and size of anode. The plates attached beside traveling bar screens and traveling screens could not be reached and were not inspected. All plates were in satisfactory condition except as listed below.

Plates that had loose anodes are as follows: 78, 79, 88, 92 and 94. ✓

Plates that had coating loss on one or more attaching bolts were as follows: 26, 28, 34, 35, 36, 68, 76, 77, 78, 79, 81, 84, 85, 86 and 92.

Plates that had some coating loss on plate itself are as follows: 28, 34, 35, 36, 78 and 79.

None of the above plates display any significant corrosion or damage that would cause immediate concern or affect structural integrity.

APPENDIX B

Silver-Silver Chloride Half-Cell
Measurements Drawings

REFERENCE HALF-CELL READINGS, THIRD SURVEILLANCE

DATE OF MEASUREMENTS	LOCATION OF HALF-CELL MEASUREMENTS	REFERENCE HALF-CELL READING
7/23/90	Base Slab, Intake Tunnel	-0.2906
7/23/90	Base Slab, South Pump Bay	-0.2900
7/26/90	Base Slab, North Pump Bay	-0.2968
7/20/90	Roof Slab, Intake Tunnel	-0.3630
7/23/90	Roof Slab, South Pump Bay	-0.2907
7/26/90	Roof Slab, North Pump Bay	-0.2968
7/20/90	North Wall, Intake Tunnel up to Screen Well	-0.3725
7/25/90	North Wall, North Screen Well	-0.3100
7/26/90	North Wall, North Pump Bay	-0.2968
7/20/90	South Wall, Intake Tunnel up to Screen Well	-0.3702
7/23/90	South Wall, South Pump Bay	-0.2895

REFERENCE HALF-CELL READINGS, THIRD SURVEILLANCE (CONT.)

DATE OF MEASUREMENTS	LOCATION OF HALF-CELL MEASUREMENTS	REFERENCE HALF-CELL READING
7/25/90	South Wall, South Screen Well	-0.3103
7/20/90	Intermediate Wall - North Face, West End of Pump Well	-0.3651
7/23/90	Intermediate Wall - North Face, South Pump Bay	-0.2981
7/23/90	East Wall, South Pump Bay	-0.2892
7/25/90	Intermediate Wall - North Face, Pump Well Between Screens	-0.3121
7/20/90	Intermediate Wall - South Face, West End of Pump Well	-0.3630
7/25/90	Intermediate Wall - South Face, Pump Well Between Screens	-0.3106
7/26/90	Intermediate Wall - South Face, North Pump Bay	-0.2968
7/26/90	East Wall, North Pump Bay	-0.2968

APPENDIX C

Visual Inspection Drawings

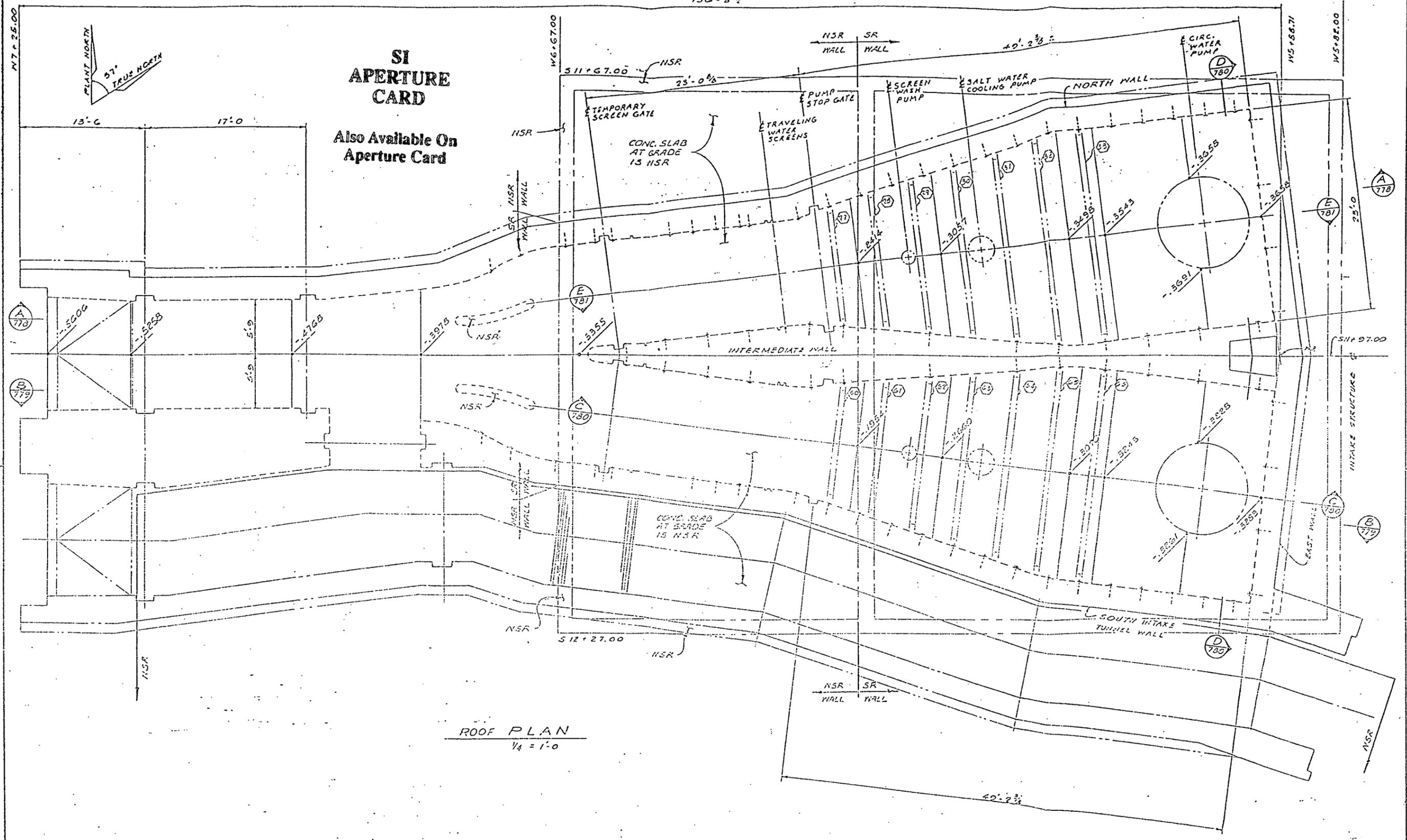
ATTACHMENT B

Section B-II

SAN MATEO SANDSTONE ANALYSIS

	<u>Sample 1</u>	<u>Sample 2</u>
Electrical Conductivity ($EC \times 10^5 @ 25^\circ C$)	50.0 mmho/cm.	360.0 mmho/cm.
Carbonates	None Detected	None Detected
Bi-Carbonates	24.40 ppm.	61.0 ppm.
Sulfates	5.36 ppm.	2.51 ppm.
Chlorides	7.09 ppm.	47.85 ppm.
Nitrates	2.56 ppm.	3.51 ppm.
Flourides	1.15 ppm.	1.50 ppm.
Calcium	0.50 ppm.	3.00 ppm.
Magnesium	0.27 ppm.	0.81 ppm.
Sodium	16.50 ppm.	47.50 ppm.
Potassium	1.30 ppm.	1.70 ppm.
Iron	0.21 ppm.	2.35 ppm.
Boron	0.03 ppm.	0.40 ppm.
Copper	0.08 ppm.	0.13 ppm.
Manganese	< 0.01 ppm.	0.07 ppm.
Silica (SiO_2)	6.50 ppm.	7.10 ppm.
Chromium	< 0.01 ppm.	< 0.01 ppm.
Nickel	< 0.01 ppm.	< 0.01 ppm.
Mercury	0.03 ppm.	< 0.02 ppm.
Total Alkalinity ($CaCO_3$)	2.00 ppm.	50.00 ppm.
Total Dissolved Solids	28.00 ppm.	213.00 ppm.

13C'-8 1/2



SI APERTURE CARD

Also Available On Aperture Card

ROOF PLAN
1/4" = 1'-0"

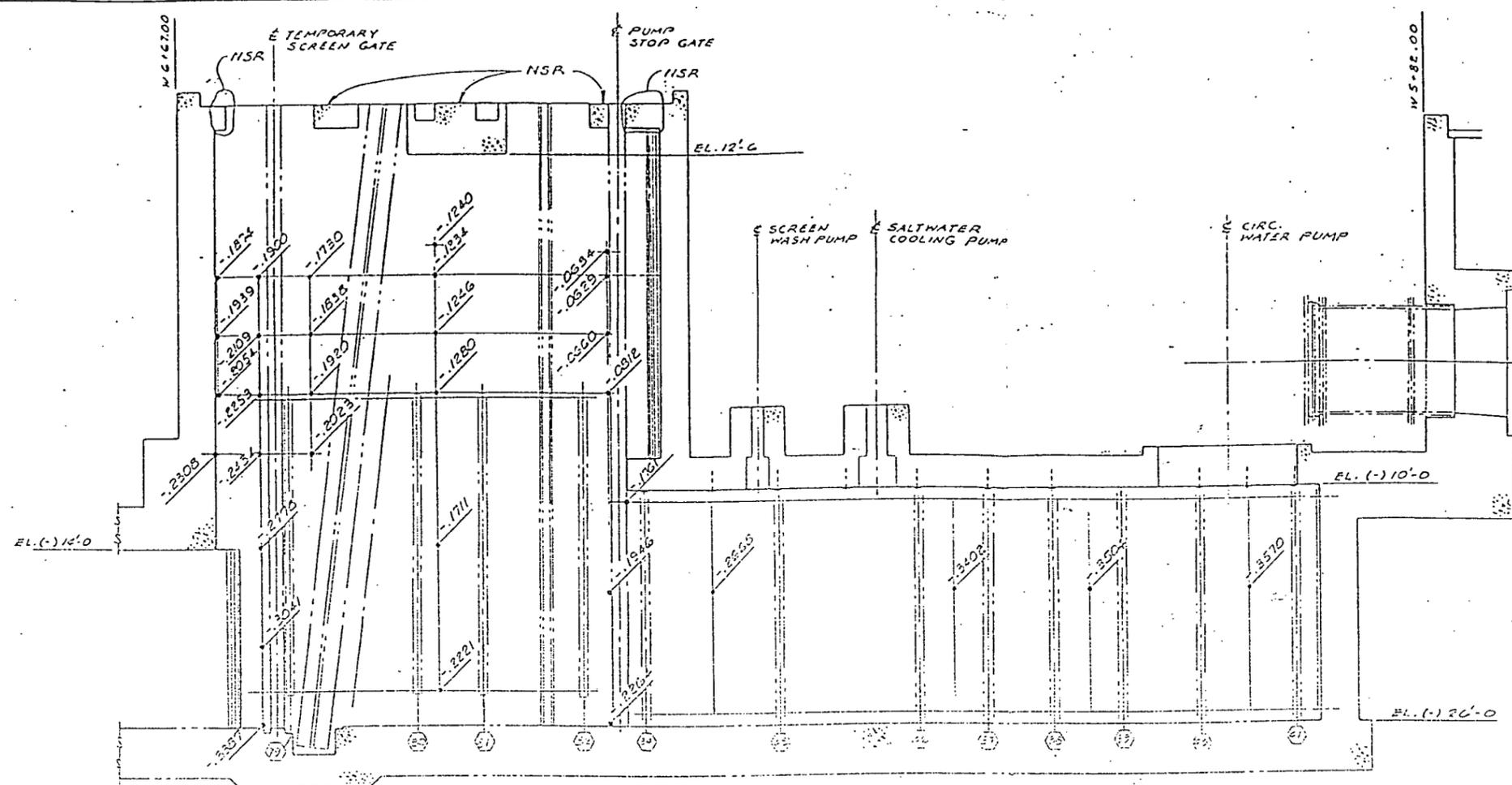
NOTE: ALL SURVEILLANCE DATA SHOWN ON THIS DRAWING IS QUALITY CLASS: NON-SAFETY RELATED (NSR).

SAFETY RELATED (EXCEPT AS NOTED)
READINGS TAKEN WITH CATHODIC PROTECTION OFF

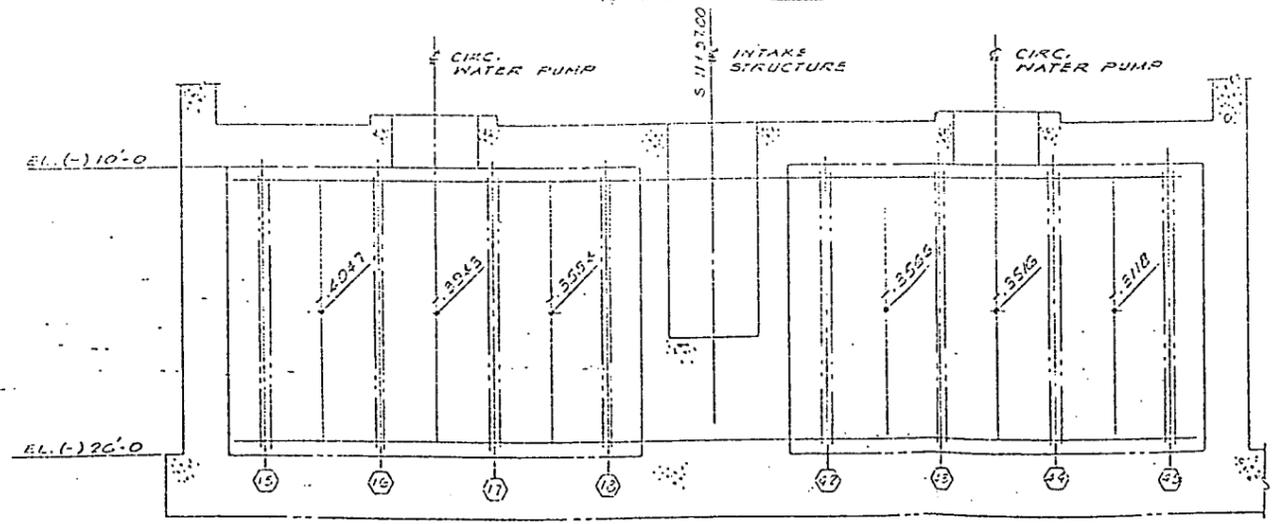
NO.	DATE	P.E.	D.A.E.	APPV.	APPROVED	CHAP.	CR'D.	MADE	ED. NO.	NO.	REVISIONS
521772											
TO											
521773											

LOCATION	SAN ONOFRE NUCLEAR GENERATING STATION	UNIT	I	DWGT. NO.	
HALF-CELL READINGS			CEILING		
			(1990)		
SCS EDISON					

9101160244-02 5217777-0



SECTION C
SOUTH INTERMEDIATE WALL
1/4" = 1'-0"



SECTION D
EAST WALL
1/4" = 1'-0"

SI
APERTURE
CARD

Also Available On
Aperture Card

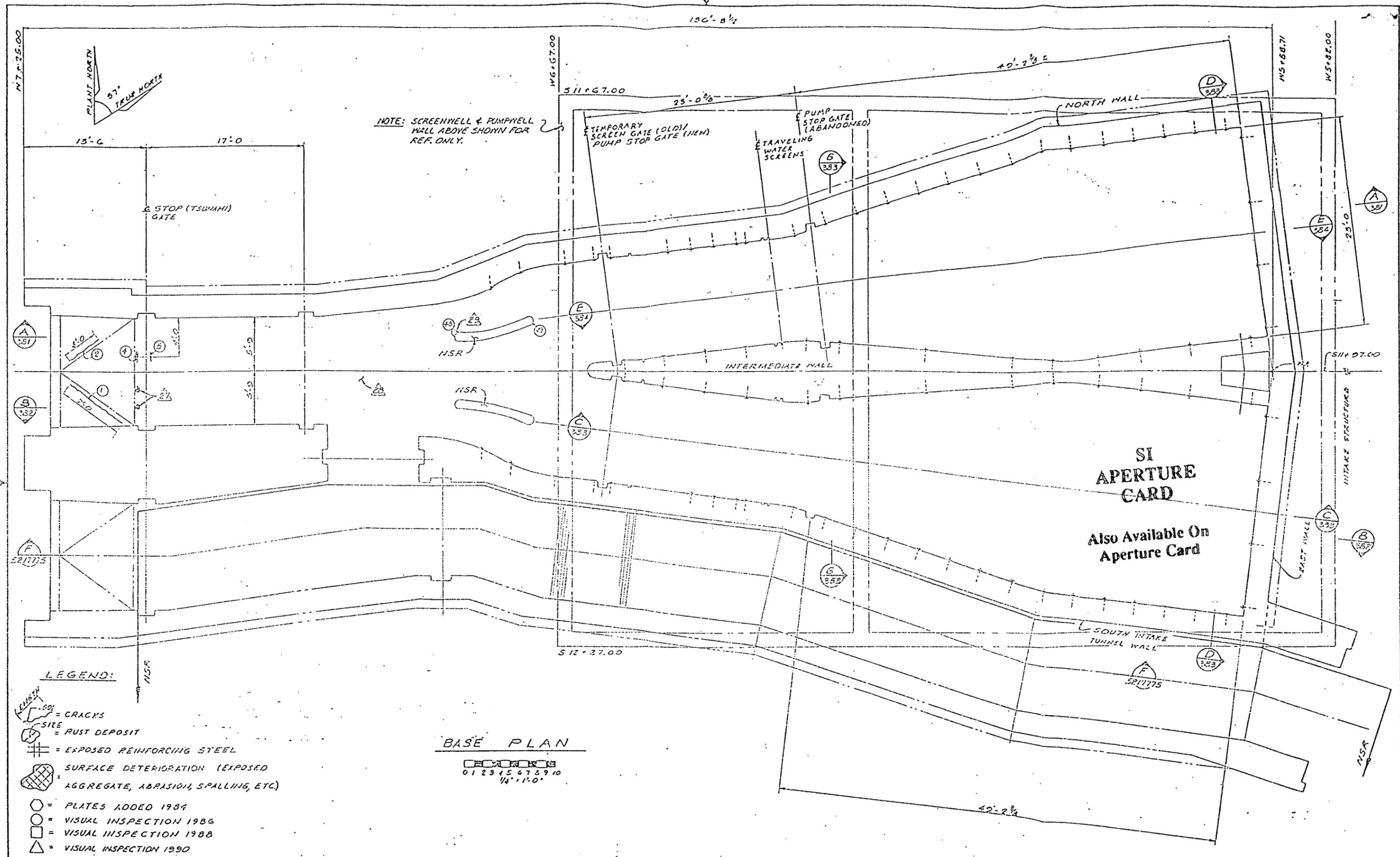
NOTE: ALL SURVEILLANCE DATA SHOWN ON THIS DRAWING IS QUALITY CLASS: NON-SAFETY RELATED (NSR). SAFETY RELATED (EXCEPT AS NOTED)

READINGS TAKEN WITH CATHODIC PROTECTION OFF

NO.	DATE	P.E.	D.A.E.	APP. NO.	APPROVED	ENCL.	CD'S	MARK	JO. NO.	NO.	REVISIONS	M	DATE	P.E.	D.A.E.	APP. NO.	APPROVED	ENCL.	CD'S	MARK	JO. NO.	NO.	REVISIONS	
521776	1990																							
521775																								

SAN Geronimo NUCLEAR GENERATING STATION UNIT 1
 HALF-CELL READINGS SOUTH INTERMEDIATE AND EAST WALL (1990)
 SCE EDISON

9101160244-05 5217780-0



NOTE: SCREENWELL & PUMPWELL WALL ABOVE SHOWN FOR REF. ONLY.

SI APERTURE CARD

Also Available On Aperture Card

LEGEND:

- = CRACKS
- = RUST DEPOSIT
- = EXPOSED REINFORCING STEEL
- = SURFACE DETERIORATION (EXPOSED AGGREGATE, ABRASION, SPALLING, ETC.)
- = PLATES ADDED 1984
- = VISUAL INSPECTION 1986
- = VISUAL INSPECTION 1988
- = VISUAL INSPECTION 1990

BASE PLAN

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

NOTE: ALL SURVEILLANCE DATA SHOWN ON THIS DRAWING IS QUALITY CLASS: NON-SAFETY RELATED (NSR).

SAFETY RELATED (EXCEPT AS NOTED)

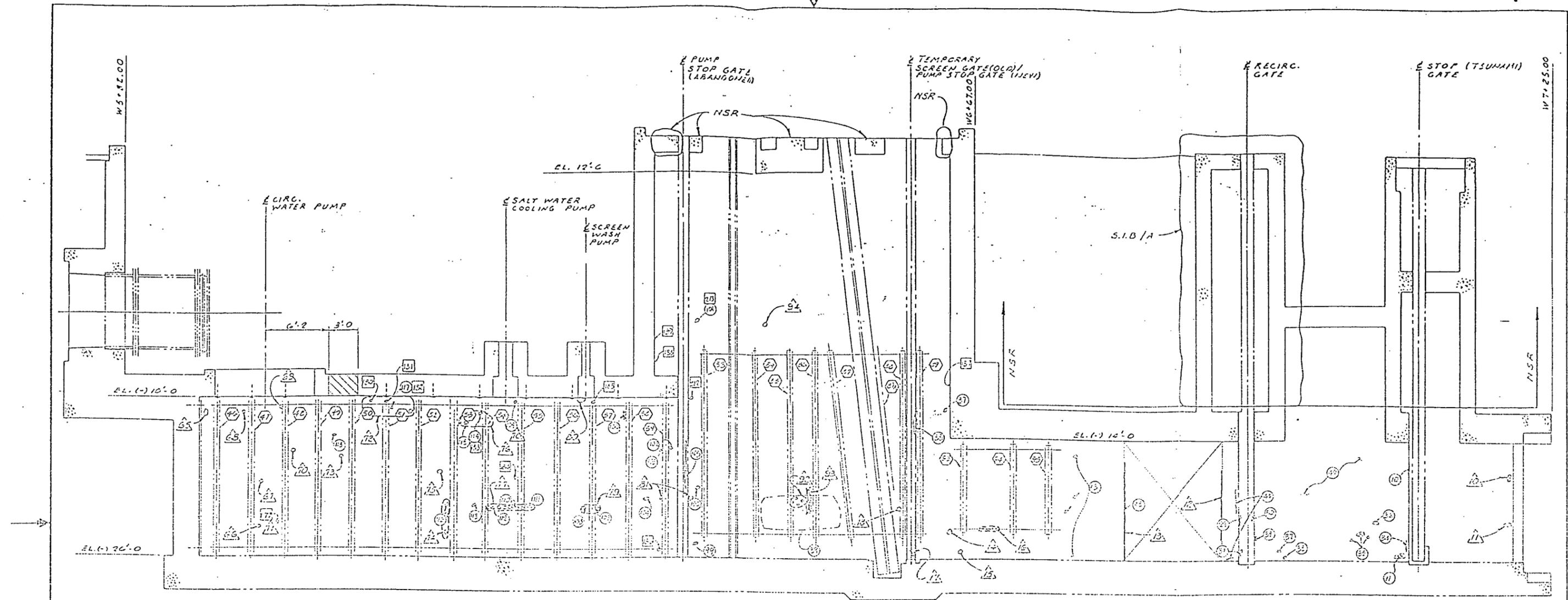
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5212379	BASEMAT																		SAN ONOFRE NUCLEAR GENERATING STATION - UNIT 1	
5212380	COLLING																			
5212381	NORTH WALL																			
5212382	SOUTH WALL																			
5212383	SO. INTERM. & EAST WALL																			
5212384	NO. INTERMEDIATE WALL																			

LOCATION: SAN ONOFRE NUCLEAR GENERATING STATION - UNIT 1

VISUAL INSPECTION BASEMAT

EDISON

9101160244-07 5212379-1



SECTION B
 SOUTH WALL
 01 2 3 4 5 6 7 8 9 10
 14'-11.0"

SI APERTURE CARD

Also Available On Aperture Card

LEGEND:
 FOR LEGEND SEE DWG. 5212379.

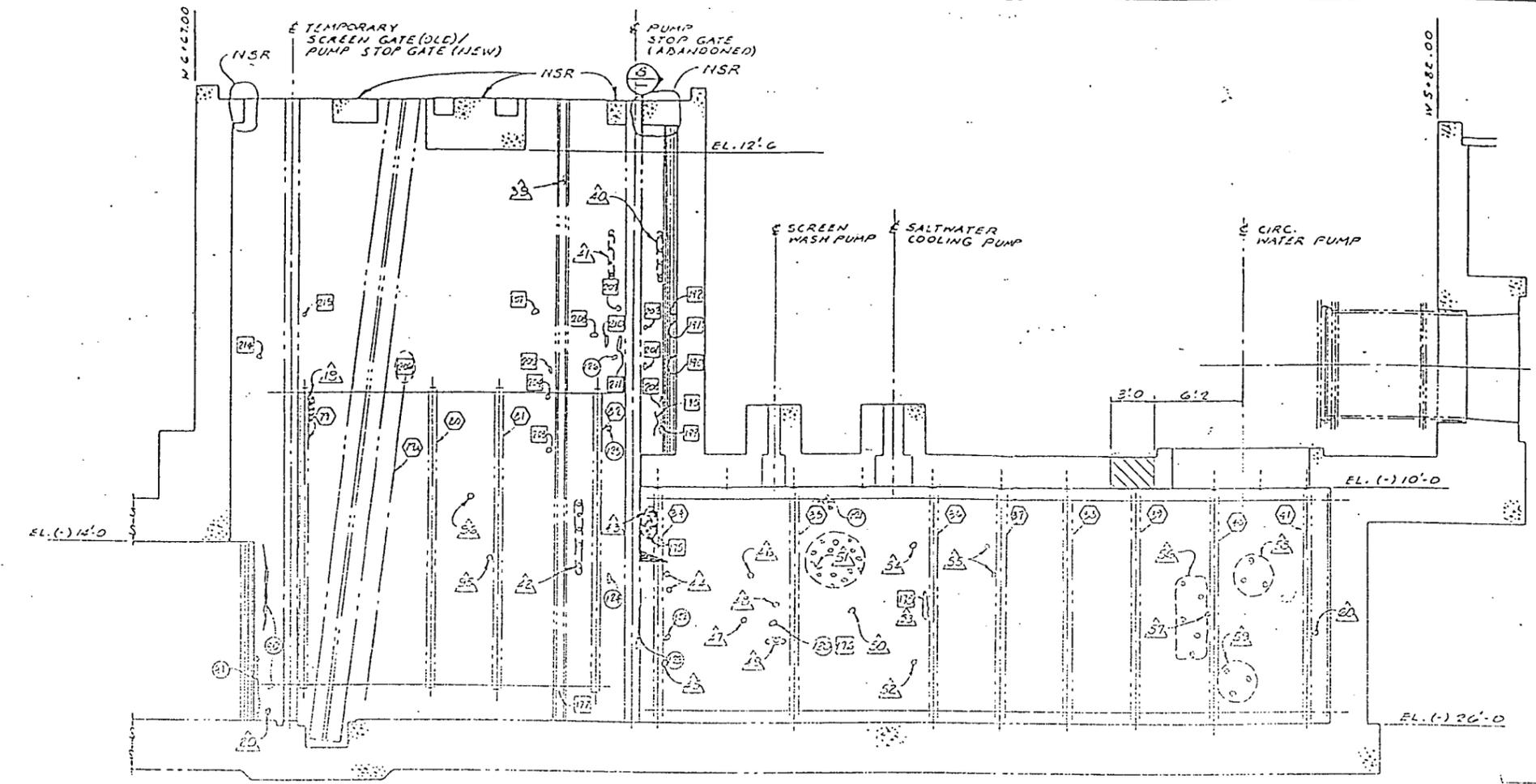
NOTE: ALL SURVEILLANCE DATA SHOWN ON THIS DRAWING IS QUALITY CLASS: NON-SAFETY RELATED (NSR).

SAFETY RELATED (EXCEPT AS NOTED)

REFERENCE DRAWING	REFERENCE DRAWING NO.	REVISIONS	M	DATE	P.E.	D.A.E.	SUPV.	APPROVED	ENGR.	CH'D	DATE	NO.	REVISIONS	M	DATE	P.E.	D.A.E.	SUPV.	APPROVED	ENGR.	CH'D	DATE	NO.	LOCATION	SHEET NO.
																								SAN ONOFRE NUCLEAR GENERATING STATION UNIT 1	
																								VISUAL INSPECTION SOUTH WALL	
																								SC EDISON	

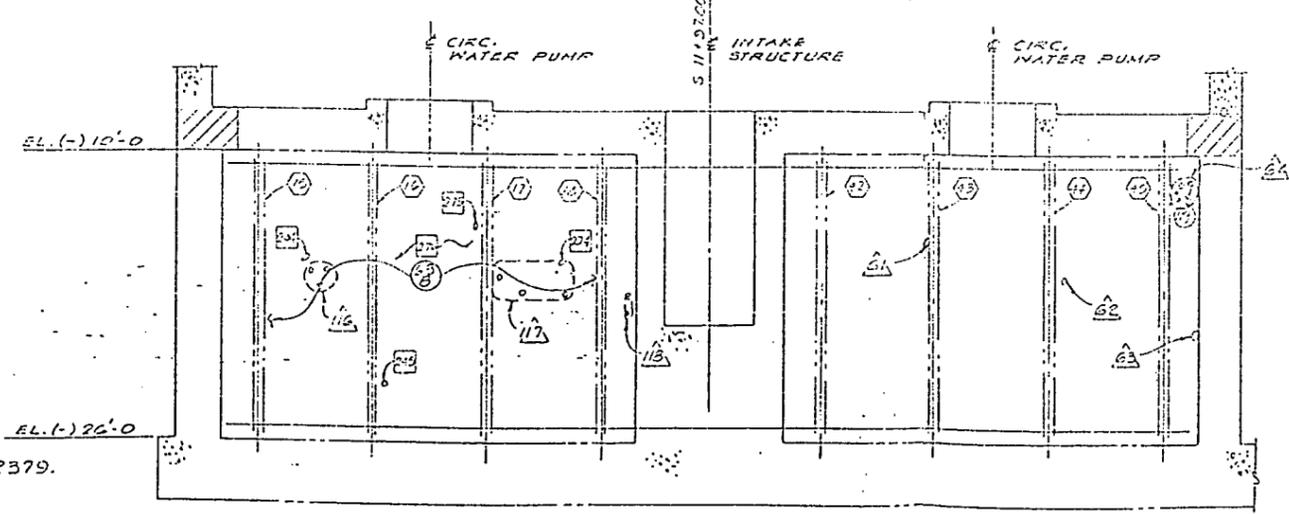
9101160244-10

5212382-1



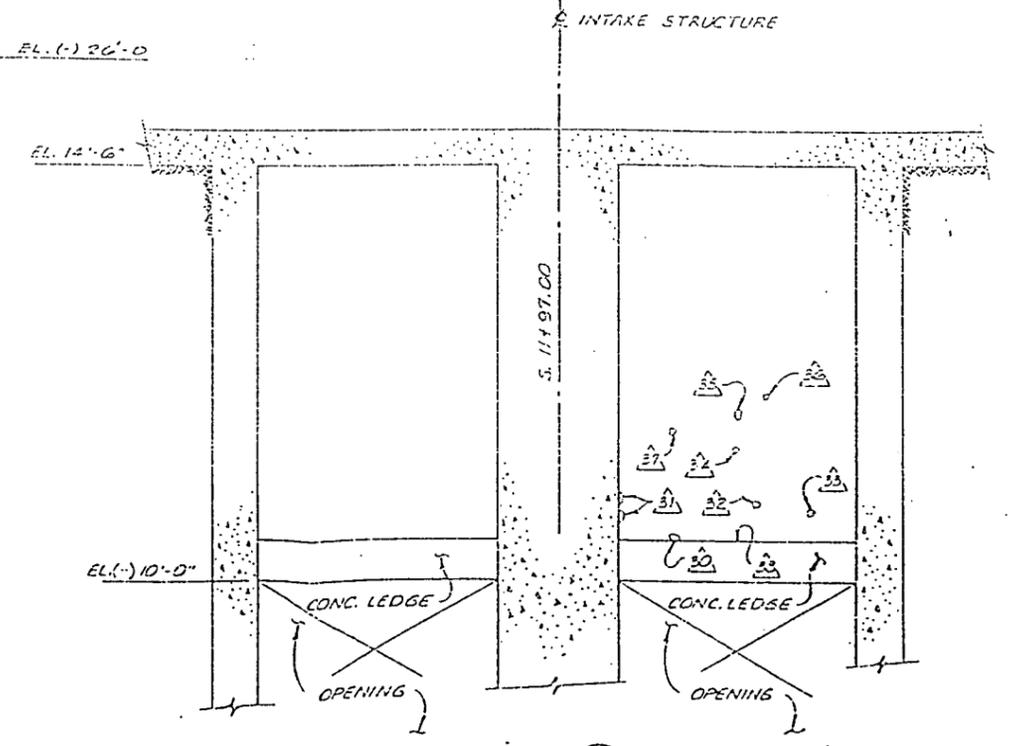
SI APERTURE CARD
 Also Available On Aperture Card

SECTION C
 SOUTH WALL (INTERMEDIATE)
 1/4" = 1'-0"



LEGEND:
 FOR LEGEND SEE DWG 5212379.

SECTION D
 EAST WALL
 1/4" = 1'-0"



SECTION G
 1/4" = 1'-0"

NOTE: ALL SURVEILLANCE DATA SHOWN ON THIS DRAWING IS QUALITY CLASS: NON-SAFETY RELATED (NSR).
 SAFETY RELATED (EXCEPT AS NOTED)

NO.	REVISIONS	M	DATE	P.E.	D.A.E.	SUPV.	APPROVED	NSR	CR'D.	MAK	JO. NO.	NO.	REVISIONS	M	DATE	P.E.	D.A.E.	SUPV.	APPROVED	NSR	CR'D.	MAK	JO. NO.	NO.

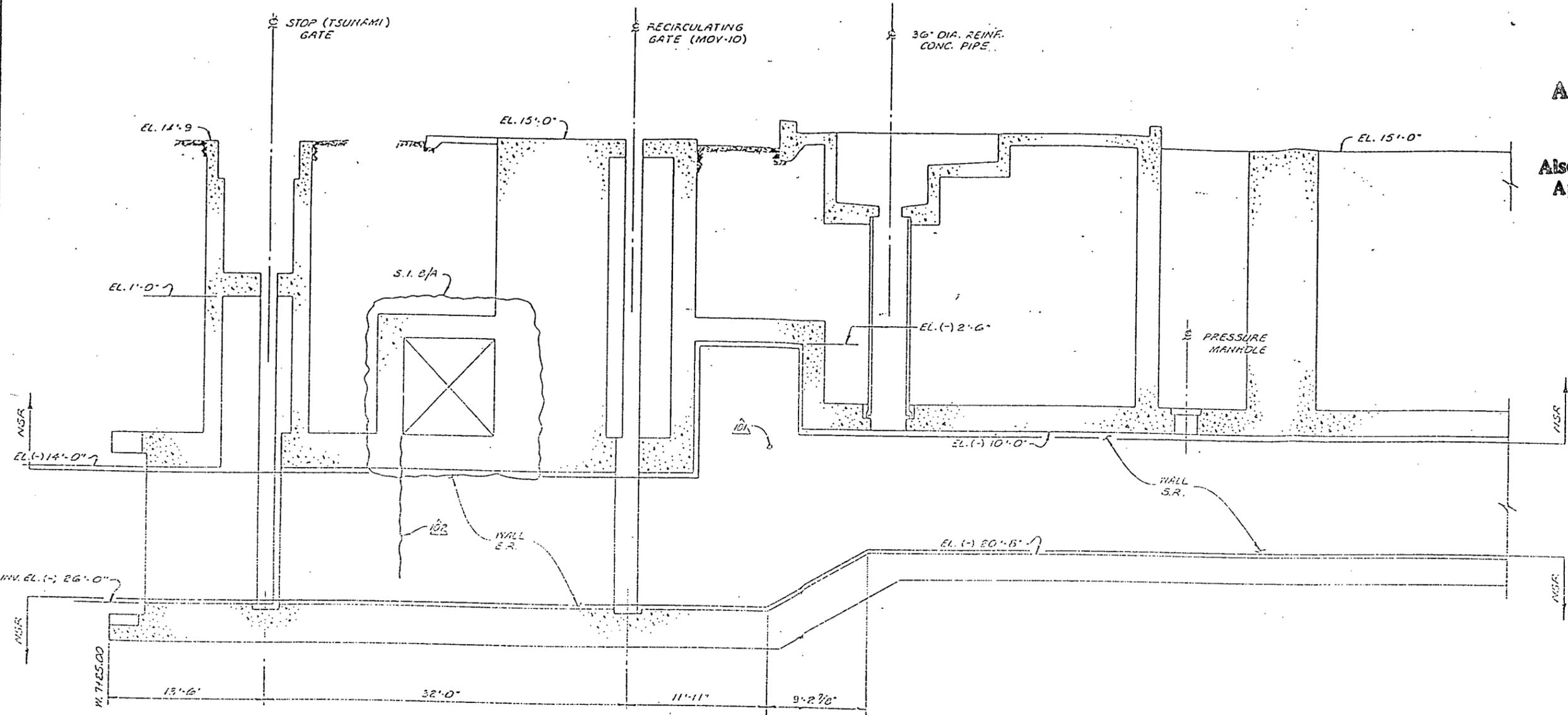
LOCATION: SAN ONOFRE NUCLEAR GENERATING STATION UNIT 1
 VISUAL INSPECTION SOUTH INTERMEDIATE AND EAST WALL
SC EDISON
 SHEET NO. _____

9101160244-11

5212383-1

**SI
APERTURE
CARD**

Also Available On
Aperture Card



SECTION **F**
5212379
NORTH WALL - DISCHARGE TUNNEL

LEGEND:
FOR LEGEND SEE DWG. 5212379.

NOTE: ALL SURVEILLANCE DATA SHOWN ON THIS
DRAWING IS QUALITY CLASS:
NON-SAFETY RELATED (NSR).

SAFETY RELATED (EXCEPT AS NOTED)

										LOCATION: SAN ONOFRE NUCLEAR GENERATING STATION UNIT-1		SHEET NO.	
										VISUAL INSPECTION NORTH WALL - DISCHARGE TUNNEL			
REFERENCE DRAWINGS	NO.	REVISIONS	DATE	P.E.	O.A.E.	APPROVED	EMGR	CA'D	MADE	LD NO	NO	Southern California Edison Company	

9101160244-13

5217775-0