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## **1.0 Gate Observation**

### **1.1 General**

INCA mechanical and structural staff attended a site visit to observe the configuration of the spillway gate installation and the condition of the components. This was in support of the capacity analysis of the existing spillway gates and hoists.

Observers	Perry R. Cole, P.E. Vishal R. Gajera, E.I.T.
Date	19 December 2008
Weather	Clear Skies, 67° F

We began our observation with a general site orientation, followed by observation of the gates and hoists. There are four gates, starting on the right; Gate 1 is 10'-0" wide by 9'-6" high. Gates 2, 3, and 4 are 16'-0" wide by 9'-6" high. All gates are of similar construction.



Photo 1 - Upstream View of Spillway Gates (Gate 1 is off the right of the photograph.)



Photo 2 - Downstream View of Spillway Gates (Gate 1 is on the left.)

## **1.2 Gate Leaves**

The gate leaves are horizontally framed with seven girders. The girders are braced with vertically oriented channels; there are no vertical trusses. The end frames are comprised of two strut arms that are partially trussed in plane.



Photo 1 - Downstream Face of Gate Leaf





Photo 2 - Strut Arm



Photo 3 - Upstream End of Strut Arm



Photo 4 - Top of Gate



Photo 5 - Upper Strut Arm to Side Girder Connection





Photo 6 - Lower Strut Arm to Side Girder Connection



Photo 7 - Bottom of Gate

### **1.3 Gate Seals**

The gates have hollow J-bulb side and bottom seals bolted to the skin plate. There are two guide wheels on either side of the gate leaf, located roughly where the strut arms attach to the end girders. The guide wheels run on and the side seals seal against a steel embedment. The guide wheels are set to provide approximately one-inch of lateral play; during the site visit all gates had the guide wheels touching one pier and gapping the other.





Photo 8 - Top of Side Seal and Upper Guide Roller



Photo 9 - Side Seal Detail





Photo 10 - Lower Guide Roller

## **1.4 Trunnions**

The trunnions are mounted on external concrete corbels and have individual grease lines that are hard lined from the hoist bridge to the trunnion pins. There is relatively fresh grease on the zerk fittings indicating recent greasing. CMWD Staff reported that the gates had been serviced and exercised in November in preparation for the winter storm season. There is stain evidence of petroleum products on the far side (retainer plate side) of the trunnion pin. The stain appears to be grease and oil; there were no accumulations of extruded grease.



Photo 11 - Trunnion on Corbel

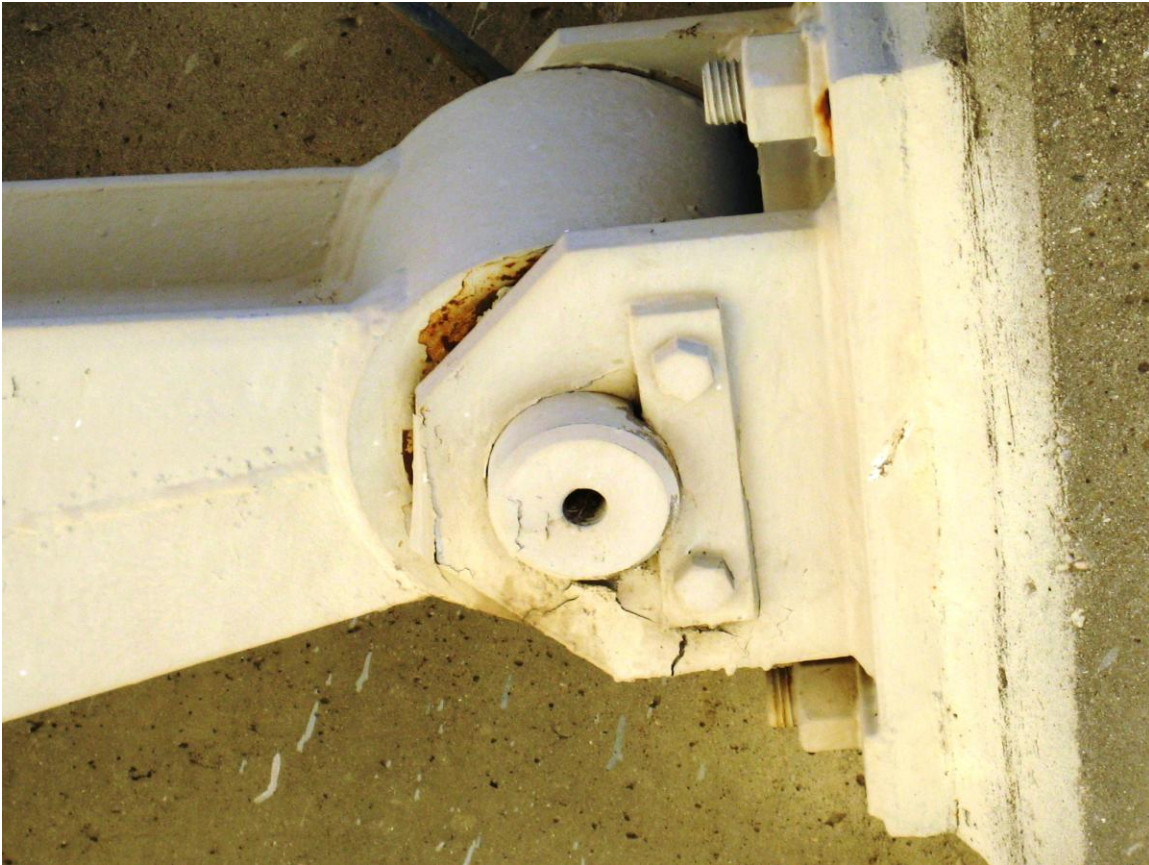


Photo 12 - Inboard View of Trunnion with Keeper Plate



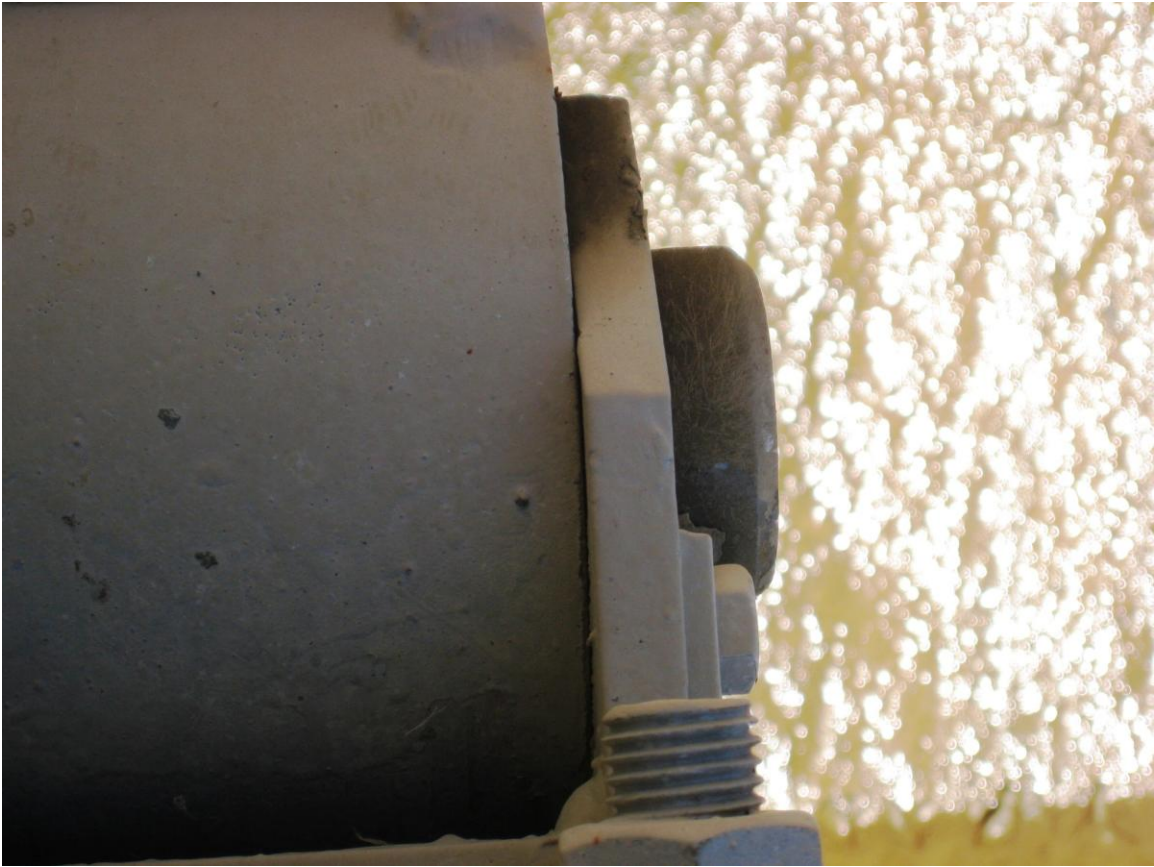


Photo 13 - Detail of Inboard Side of Trunnion Pin





Photo 14 - Detail of Outboard Side of Trunnion Pin

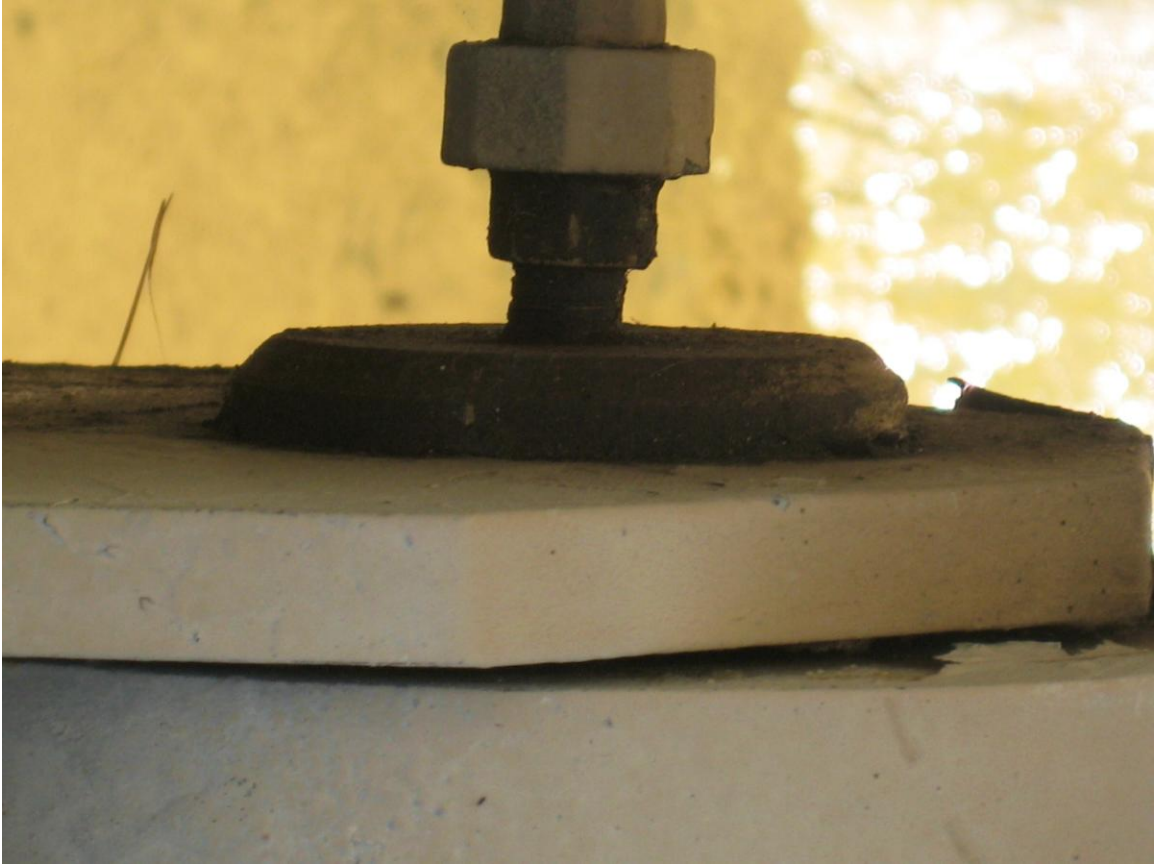


Photo 15 - Detail of Trunnion Pin Lubrication Piping

## **1.5 Operators**

The gates are operated with a hoist comprised of a centrally located single drive motor and enclosed gear speed reducer driving right and left shafts to the hoist drums. The drums are grooved for the wire ropes, which are connected to the gate skin plate.



Photo 16 - Hoist Motor, Gear Reducer, Drive Shafts, and Hoist Drums





Photo 17 - Hoist Motor and Brake





Photo 18 - Hoist Motor Nameplate



Photo 19 - Gear Reducer (Hoist 4)



Photo 20 - Drive Shaft



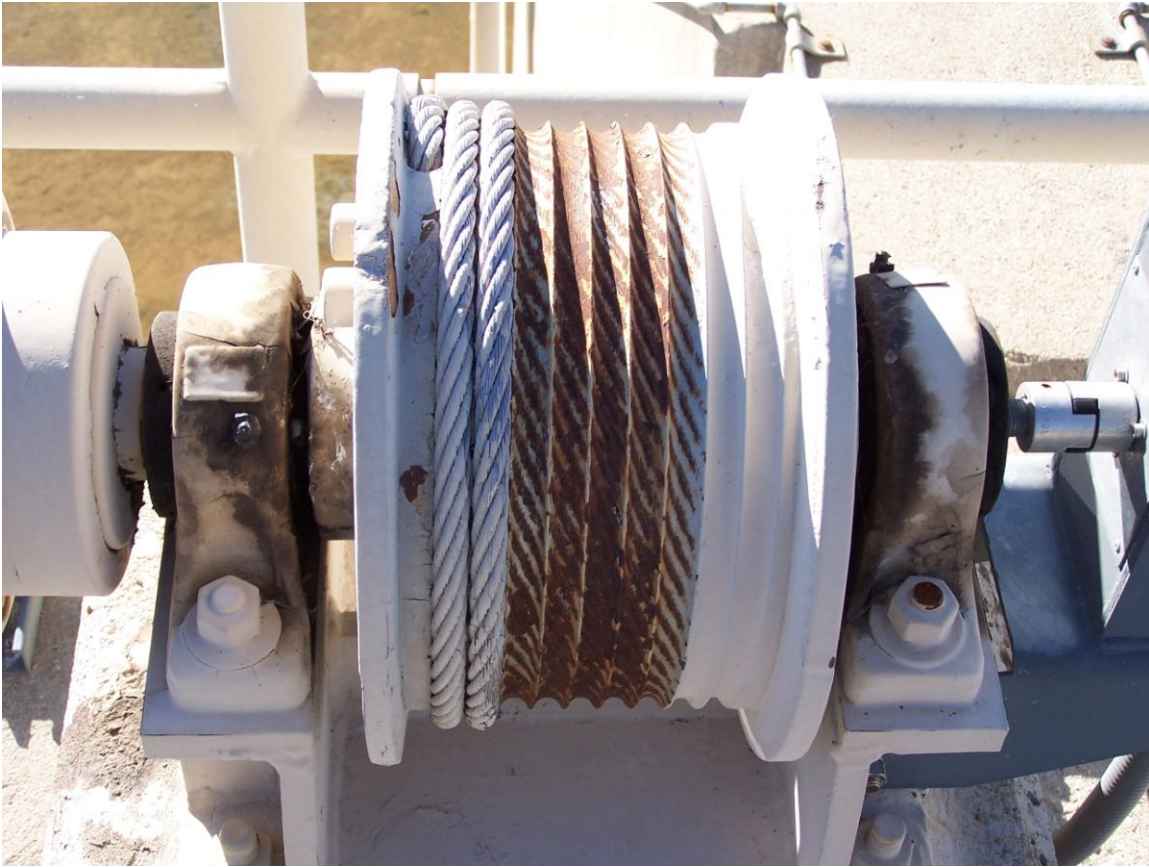


Photo 21 - Hoist Drum and Pillow Block Bearings (Revolution counter on right.)





Photo 22 - Wire Rope



Photo 23 - Wire Rope at Top of Gate





Photo 24 - Wire Rope at Middle of Gate





Photo 25 - Wire Rope Connection to Bottom of Gate

## **1.6 Observation Details**

### Gate 1

- Very slight silt accumulation on right strut arm.
- Coating has slight, splotchy, loss and is thinning on top surface of top girder.
- No evidence of corrosion or section loss.
- Drain holes open in girders; right strut arm has a rock covering drain.
- No leakage (upstream water depth approximately 1-foot)

### Gate 2

- Very slight accumulation of silt on strut arms.
- Small woody debris on girders.
- Slight, splotchy, loss of topcoat especially on lower portion and right side of girders.
- Coating thinning on top surface of the top girder and around mid-span of lower four girders.
- Drain holes open in girders and strut arms.
- Approximately 5 gpm leakage from left corner (upstream water depth approximately 1-foot)

### Gate 3

- Very slight accumulation of silt on strut arms
- Slight, splotchy, loss of topcoat especially on lower portion and right side of girders.
- Coating thinning and blistered on top surface of the top girder.
- Drain holes open in girders and strut arms.
- No leakage (upstream water depth approximately 1-foot)

### Gate 4

- Minor silt accumulation on strut arms.
- Coating thinning on top surface of top girder.
- Drain holes open in girders and strut arms.
- Approximately 2 gpm leakage from left corner and 0.5 gpm from right corner (upstream water depth approximately 1-foot)

### Hoist 1

- Light corrosion on the drum grooves.
- Drum center to center distance is approximately 8'-4".

- Motor and gear reducer appears to be in good condition.
- Pillow blocks appear to be recently greased.

#### Hoist 2

- Light corrosion on the drum grooves.
- Drum center to center distance is approximately 14'-6".
- Motor is not grounded.
- Gear reducer appears to be in good condition.
- Pillow blocks appear to be recently greased.

#### Hoist 3

- Size and construction is similar to Hoist 2.
- Light corrosion on the drum grooves
- Light corrosion and loss of paint on the drive shafts.
- Motor and gear reducer appear to be in good condition.
- Pillow blocks appear to be recently greased.

#### Hoist 4

- Size and construction is similar to Hoist 2 and Hoist 3.
- Light corrosion on the drum grooves
- Light corrosion and loss of paint on the drive shafts.
- Motor and gear reducer appear to be in good condition.
- Pillow blocks appear to be recently greased.

## 2.0 Electrical Evaluation

### 2.1 General

INCA electrical staff attended a site visit to evaluating the electrical system for the Robles Diversion project. This was in support of the analysis and design for the proposed High Flow Bypass. INCA staff met with Todd Evans of Casitas Municipal Water District.

Observers	Dave Stewart
Date	20 February 20, 2009

### 2.2 Power Supply

Power is supplied to the site with a 200 amp serviced at 240 volts, 3 phase. Two circuit breaker panelboards distribute this power to the various loads within the site.



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Figure 2 Main circuit breaker panelboard

A 50A, 3P circuit breaker provides power to the existing motor starters operating the existing gates, both spillway and fish ladder.

### 2.3 Gate Hoist Motors

These gates are powered by 1 ½ hp brake motors (the brake is an integral part of the motor).





**Figure 3 Gate hoist brake motor**

Motor starters are housed in two separate enclosures, one for the fish ladder and one for the spillway. These are all size 0 reversing across the line starters. Pushbutton controls are attached to the front of the motor starter enclosures, but are seldom used since the addition of the programmable logic controller (PLC) with an additional set of push buttons.

## ***2.4 Programmable Logic Controller***

The operation of the gates is monitored remotely, but all control functions are local. The PLC provides automatic operation of the gates while the push buttons provide manual operation of the gates. The control package is neat and well organized.

Adequate space may be available to add push button controls for the new gates but it would appear that these controls would be very low and difficult to operate. The PLC has spare capacity for additional control functions, such as the automatic control of the new gates.

There is an existing standby generator to provide power to the site in the event of a loss of utility power. This generator is rated 60kW/75kVA. The generator appears to be in very good condition and well maintained.





Figure 4 Spillway motor starter enclosure and push button controls



Figure 5 Fish ladder controllers with their push buttons.

The new PLC with the manual pushbutton controls are housed in a 2-door enclosure, complete with digital readouts for gate position indication.



Figure 6 PLC and pushbutton enclosure.

## 2.5 Standby Power

The new gates are considerably larger than the existing gates, and the anticipated power requirement would be 10 HP each. This is quite a bit larger than the existing 1 ½ HP motors, and would definitely tax the existing distribution system. At 230 volt (motor rating for operation on a 240 system) the motor draws 6 amperes at full load. Under the same conditions the 10 HP motor draws 28 amperes.

The generator may be underpowered also. 4 – 10 HP motors would total 40kVA, over half the total output of the generator. In addition, when starting each one of the motors the motor inrush could cause unacceptable drop in voltage and frequency. The generator and motor characteristics would have to be analyzed to determine if this generator could safely start these motors.

On the same line, four 10 HP motors, at full load, would draw in excess of 100A, over half the available service supply. Further analysis must be performed to determine if the existing service is adequate for the addition of the new gates.

An alternative may be a new service, probably 480 volt, 3 phase, with a step-down transformer to provide power to the existing panels, and the new gates operating on the 480 volt power.

Concern was expressed about the lack of physical space for adding the motor controls for the new gates. The reversing motor starters for 10 HP motors are considerably larger than the existing starters for the 1 ½ HP motors. It appears difficult to expand the existing building without cutting off access to the fish ladders, and almost all available wall space has already been used up with the existing controls.



**Figure 7 Standby diesel engine driven generator.**