



# What's In That Tube 2?

(Sequel to What's In That Tube ?)

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Presented by:

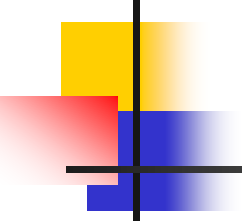
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Hawaii Water Environment Association Conference

March 15, 2010

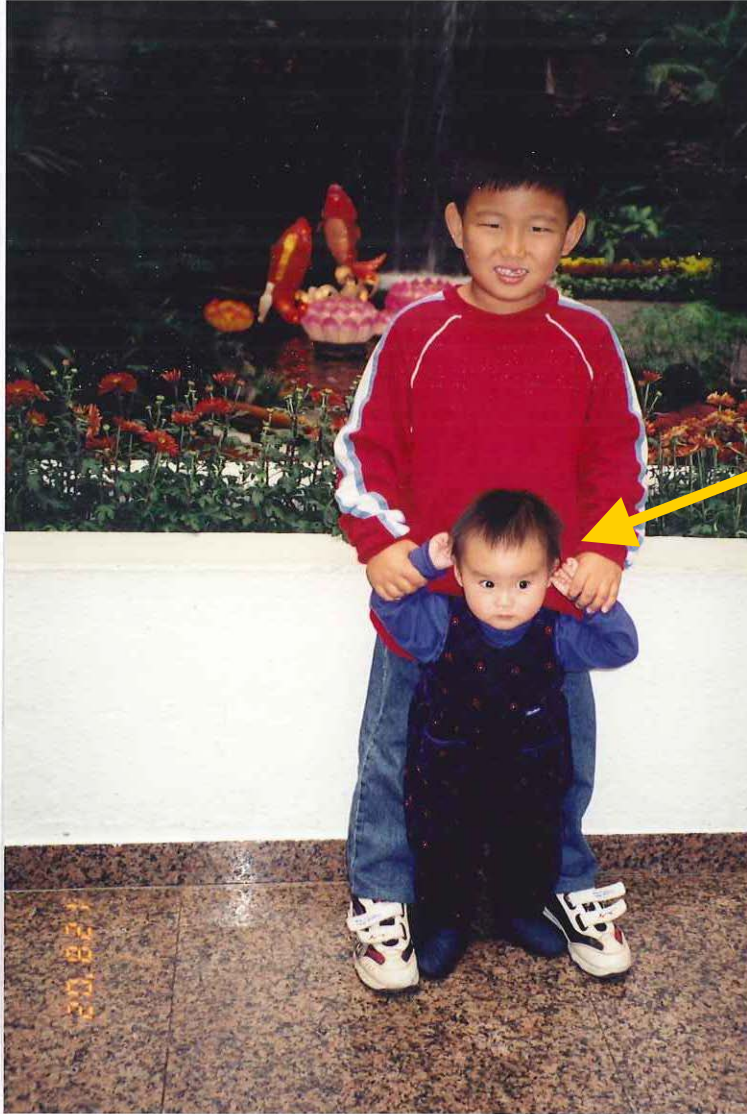
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- Part 1- Review of “What’s In That Tube?” (Ala Moana Force Main No. 1)
  - Part 2 – “What’s In That Tube 2” (Inspection of Ala Moana Force Main No. 2)



# What's In That Tube?

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- Inspection of Ala Moana FM#1 in 2001
- Results *WERE* to be presented at the 2002 HWEA Conference but was delayed due to. . . . .



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**Adoption of  
Our Daughter  
In Jan 2002**

8 Years Later. . . .



**She's  
scoring  
soccer  
Goals  
and  
telling  
riddles  
such as**

. . . .



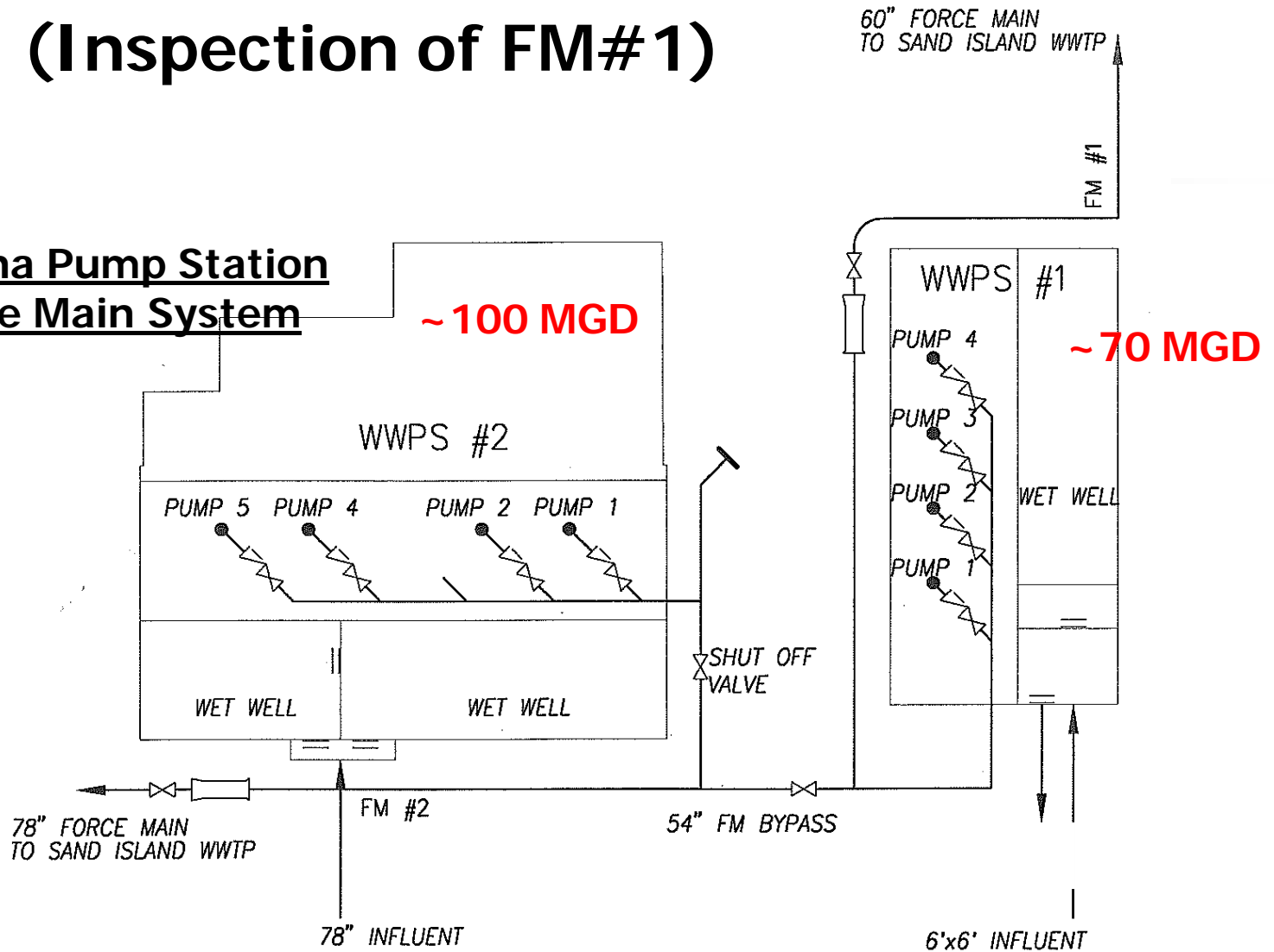
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**HOW DO YOU KILL LADY  
GAGA?**

**POKER FACE**

# What's in that Tube? (Inspection of FM#1)

## Ala Moana Pump Station and Force Main System





**LEGEND :**

- PRESSURE MANHOLE ON FM #1
- PRESSURE MANHOLE ON FM #2





# Ala Moana FM#1

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- 50 year old pipeline (currently at 60)
- *54" - 60" RCP*
- 8,000 LF
- Concerns with age of pipe.
- Proceed with design of new pipe?
  - RMTC suggested inspect first, might be worth the investment.



# FM#1 Inspection Findings

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- No crown corrosion.
- Only superficial softening of the concrete.
- Grit accumulation – very little.
- Remaining life
  - Cannot be defined.
  - RCP in very good condition after 50 years.



# PART 2

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Presented by Michael Hong




What's in Tube No. 2?

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*(What's in FM#2?)*

# FM#2 ALIGNMENT

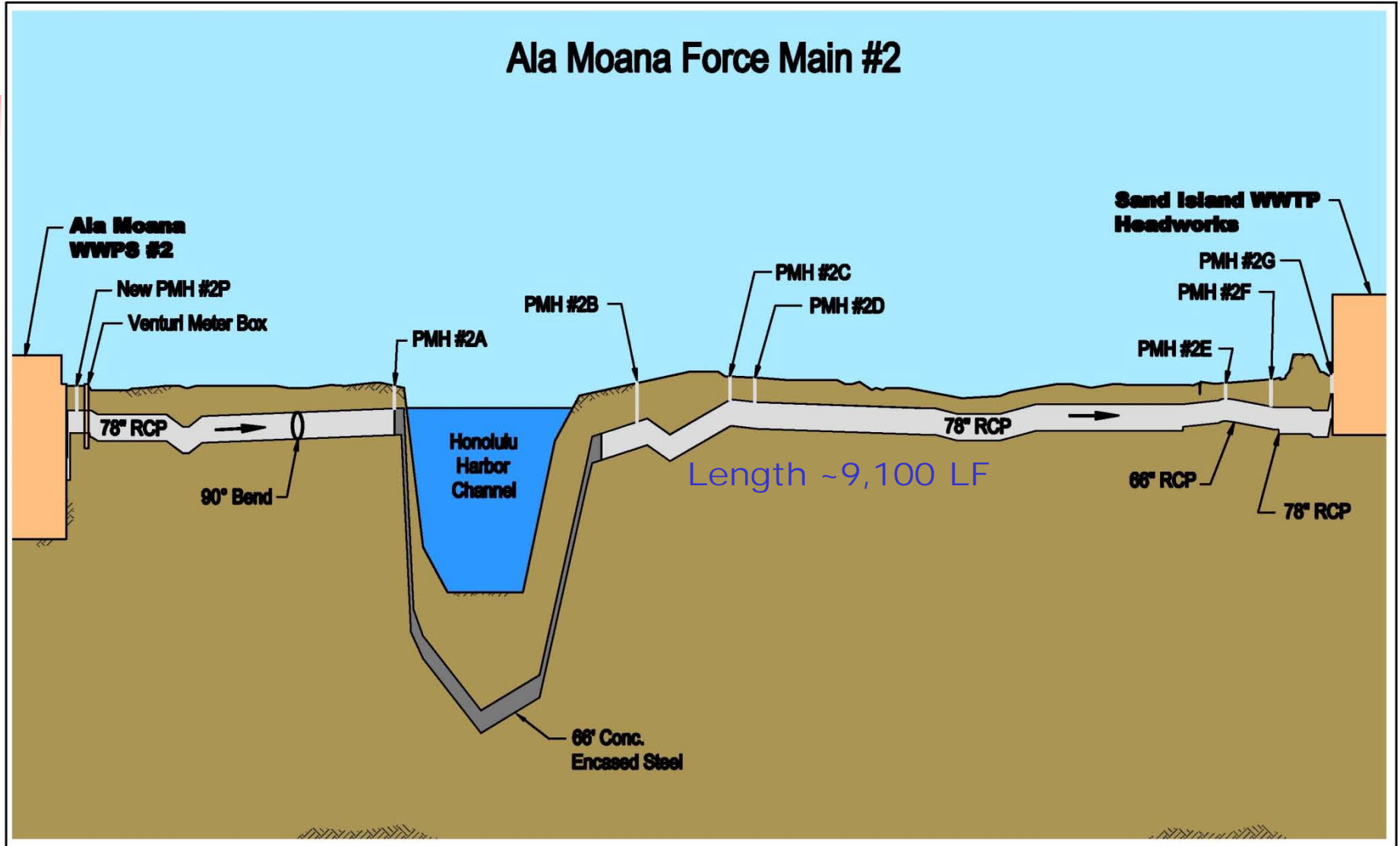




WARNING  
DO NOT ANCHOR  
SEWER LINE  
CROSSING CHANNEL

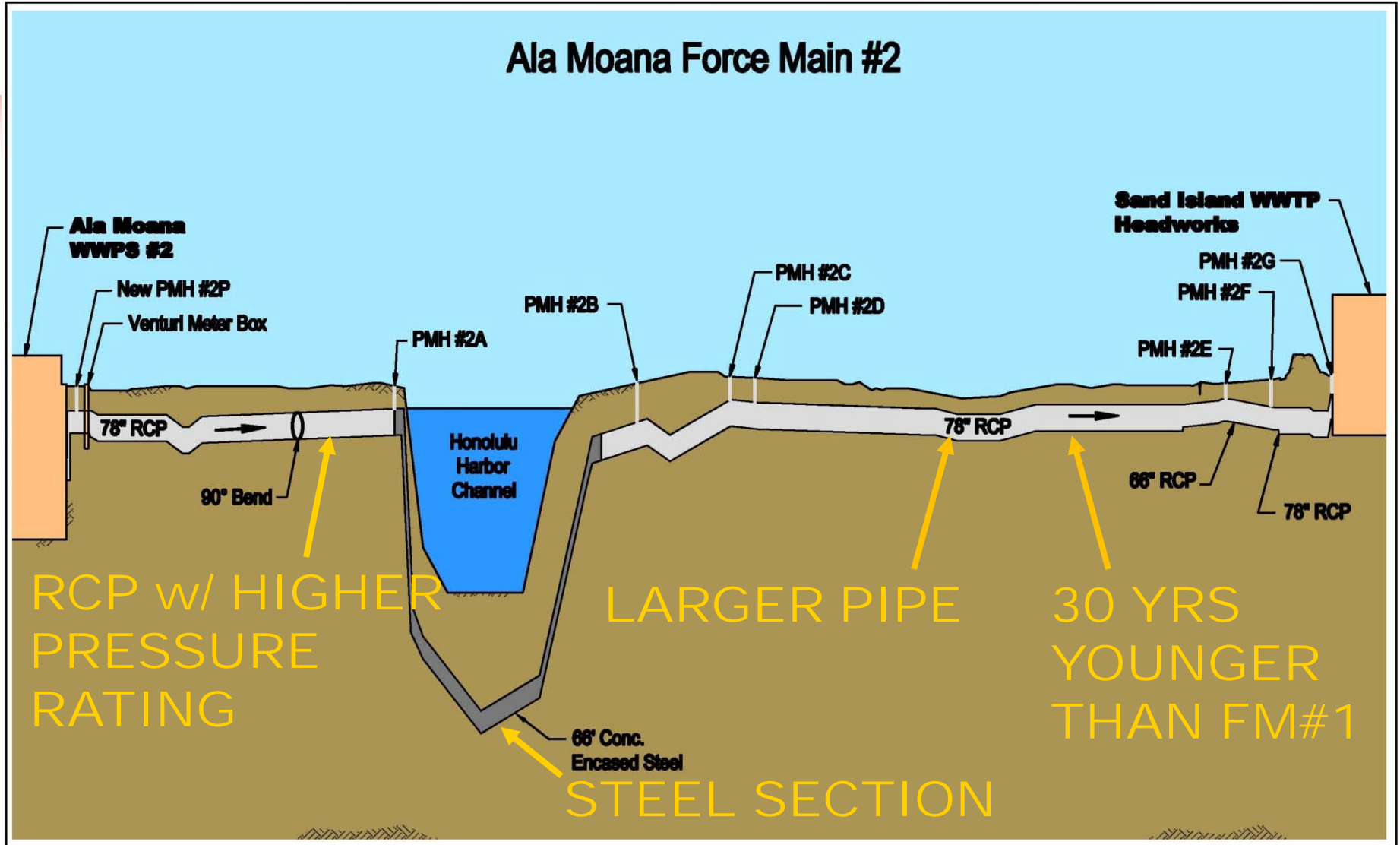
# FM#2 PROFILE

## Ala Moana Force Main #2



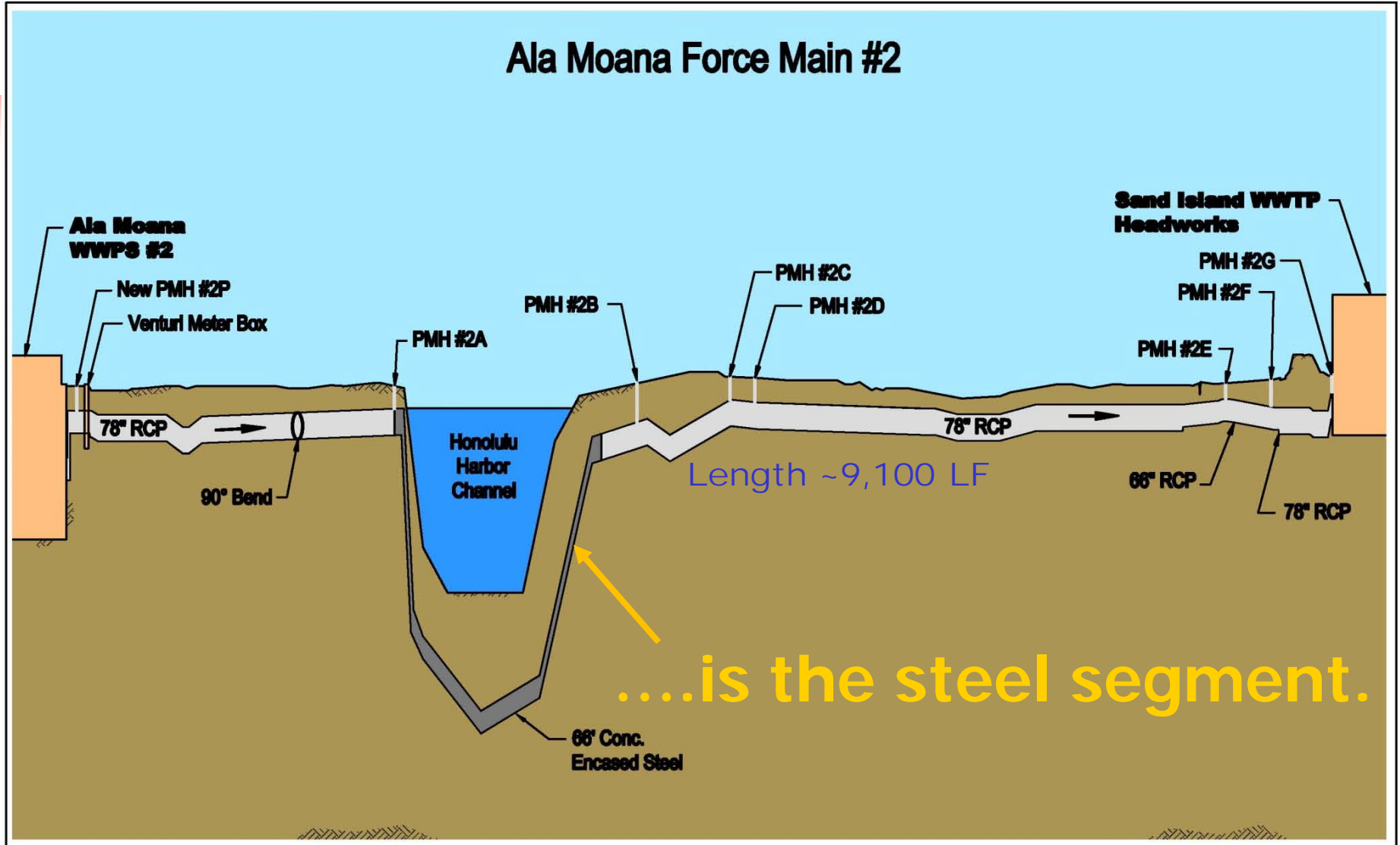
# COMPARISON OF FM#2 TO FM#1

## Ala Moana Force Main #2



# The Achilles Heel of FM#2....

## Ala Moana Force Main #2





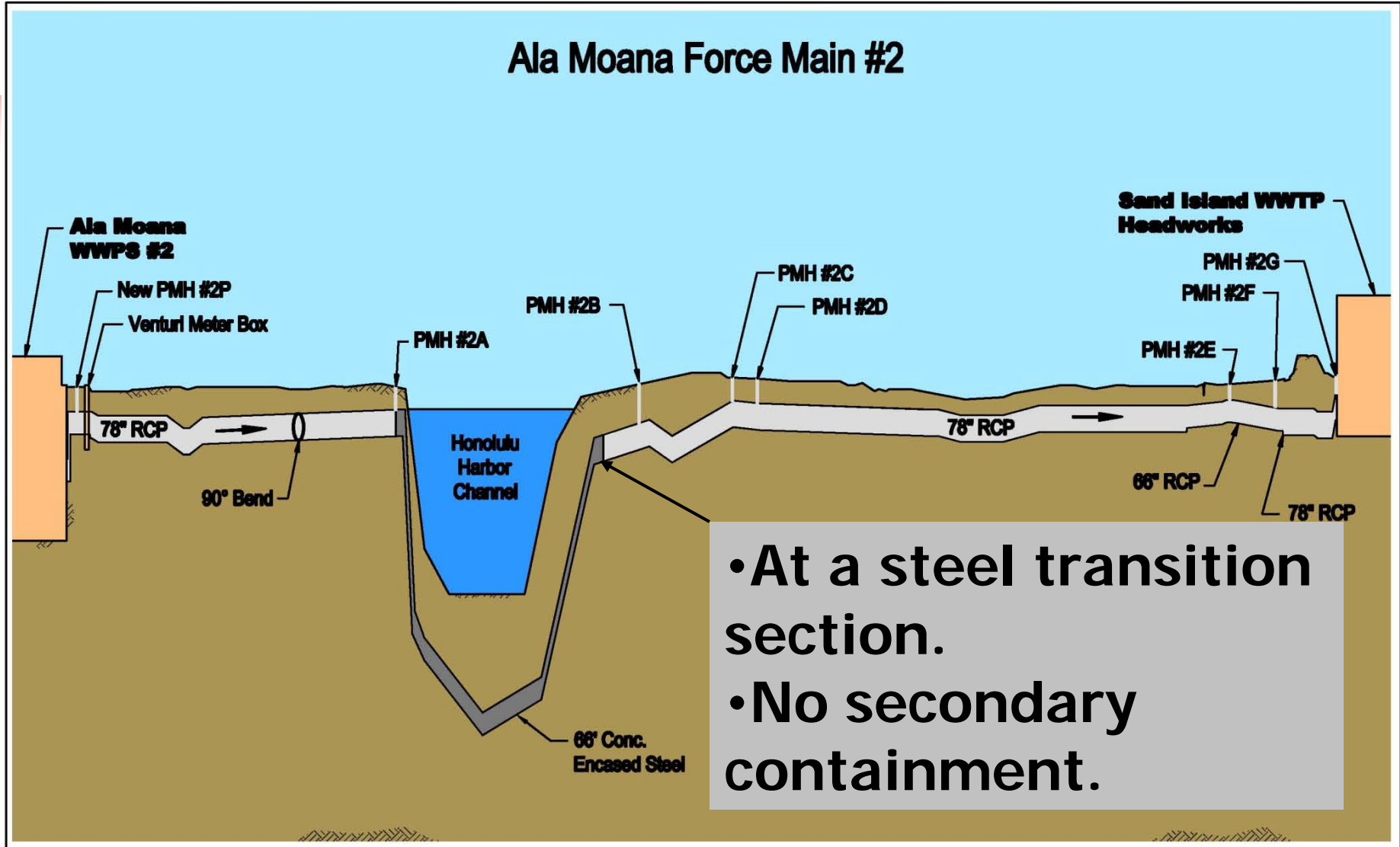
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**Stay Tuned  
For the Final Episode of**

**“THE ACHILLES HEEL  
OF FM#2”**

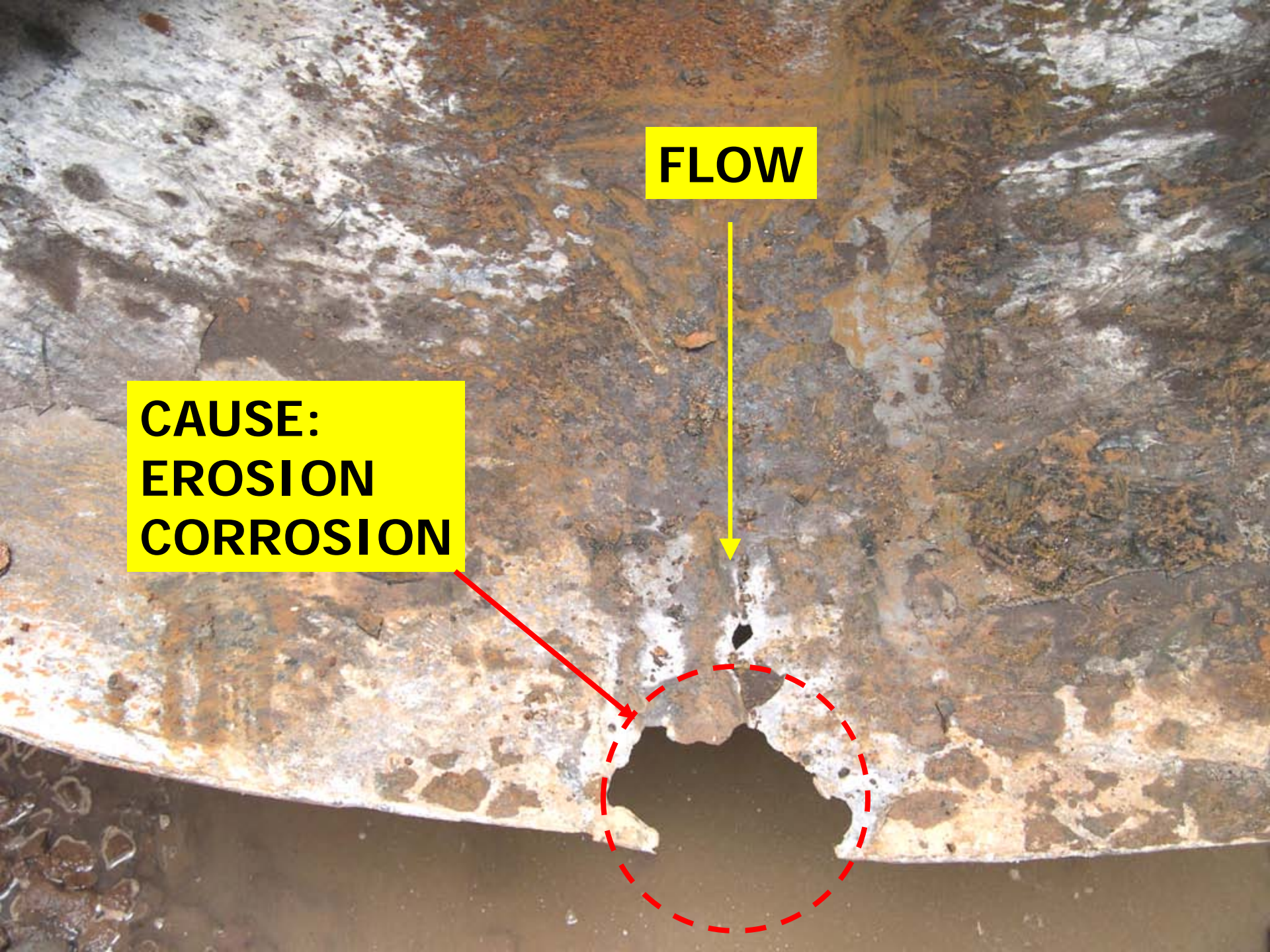
# THE ALA MOANA FM#2 BREAK OF 2004

## Ala Moana Force Main #2



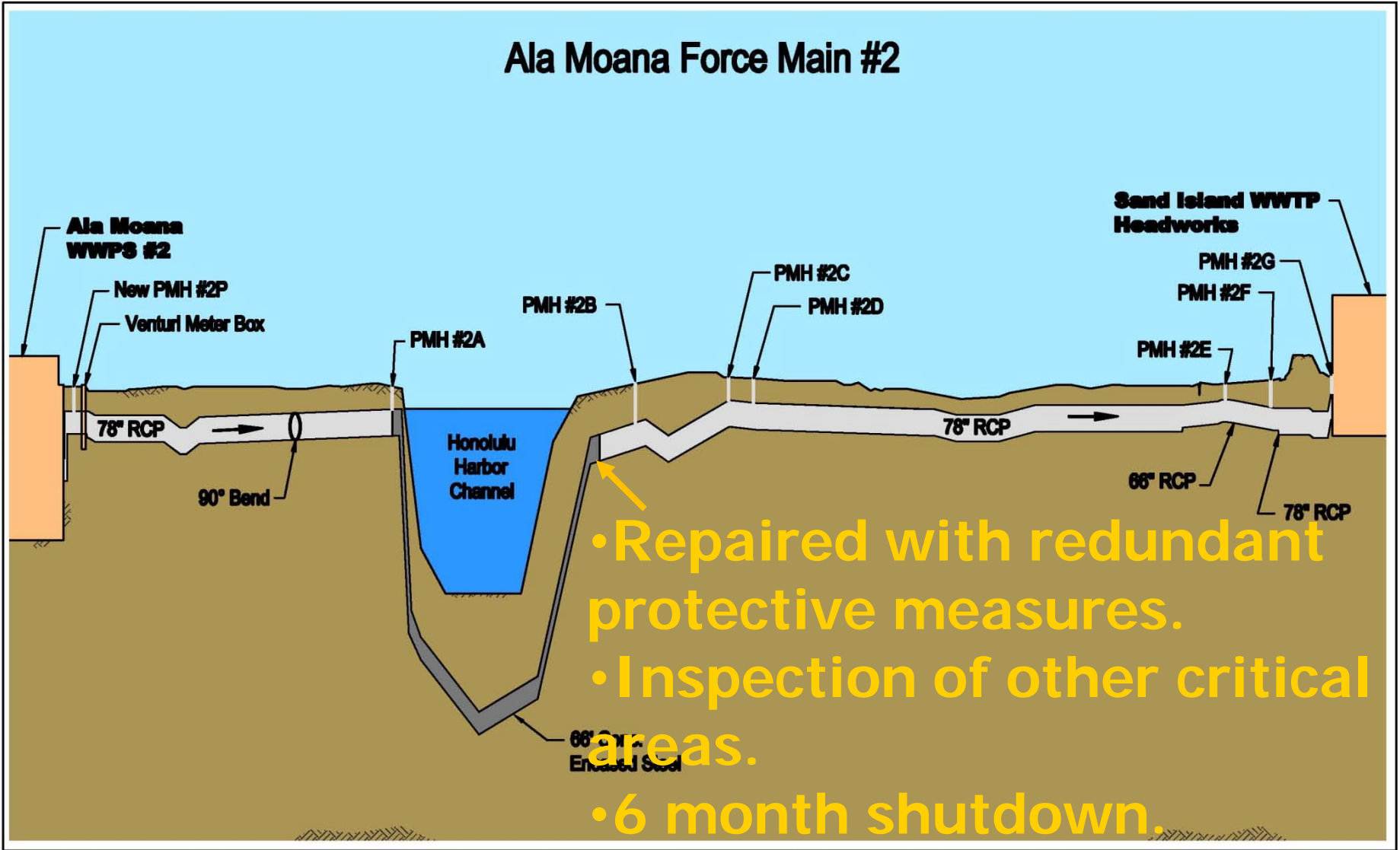
**FLOW**

**CAUSE:  
EROSION  
CORROSION**



# Break in 2004 – Corrective Actions

## Ala Moana Force Main #2

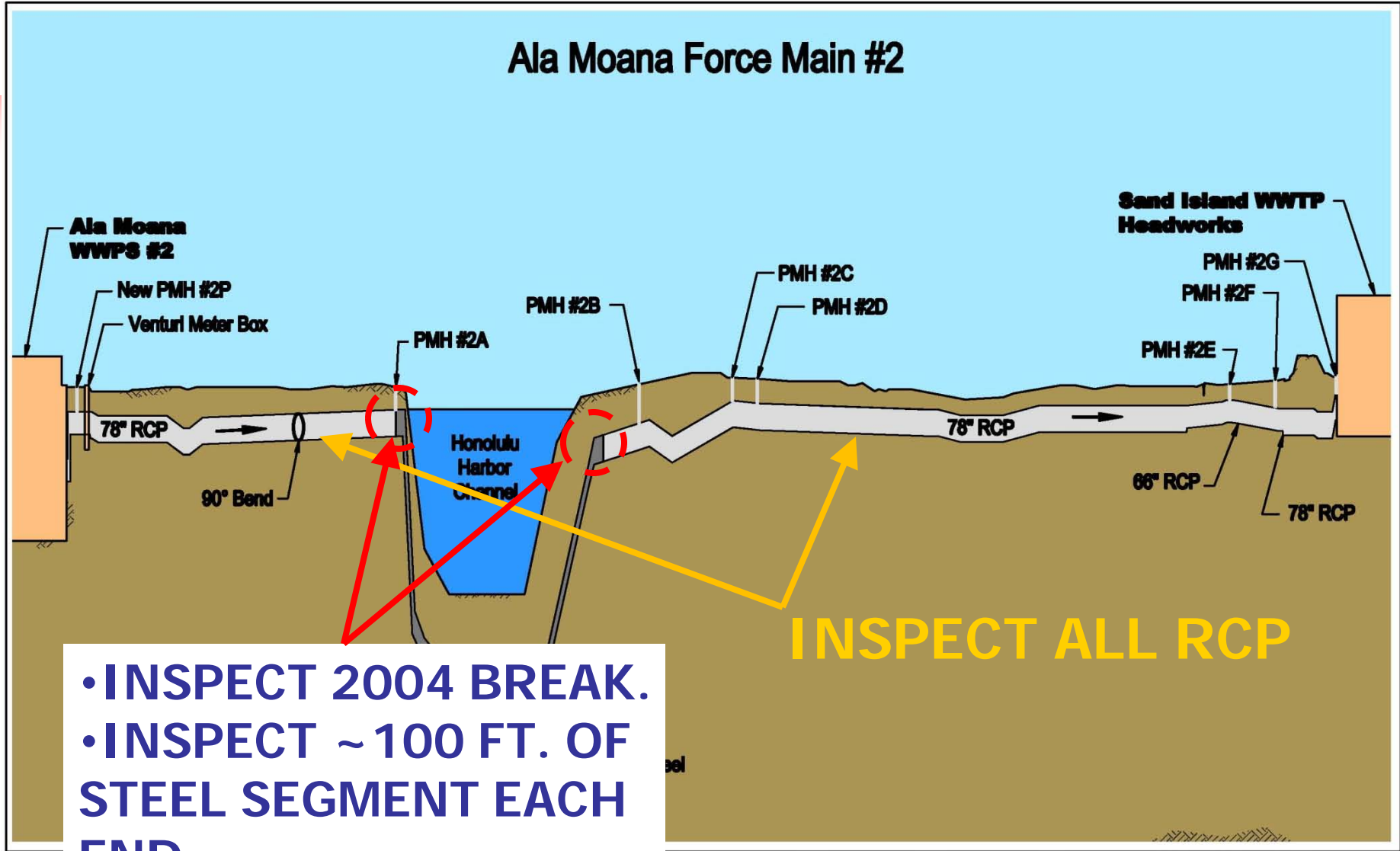


- Repaired with redundant protective measures.
- Inspection of other critical areas.
- 6 month shutdown.



# 2008-2009 Inspections - Scope

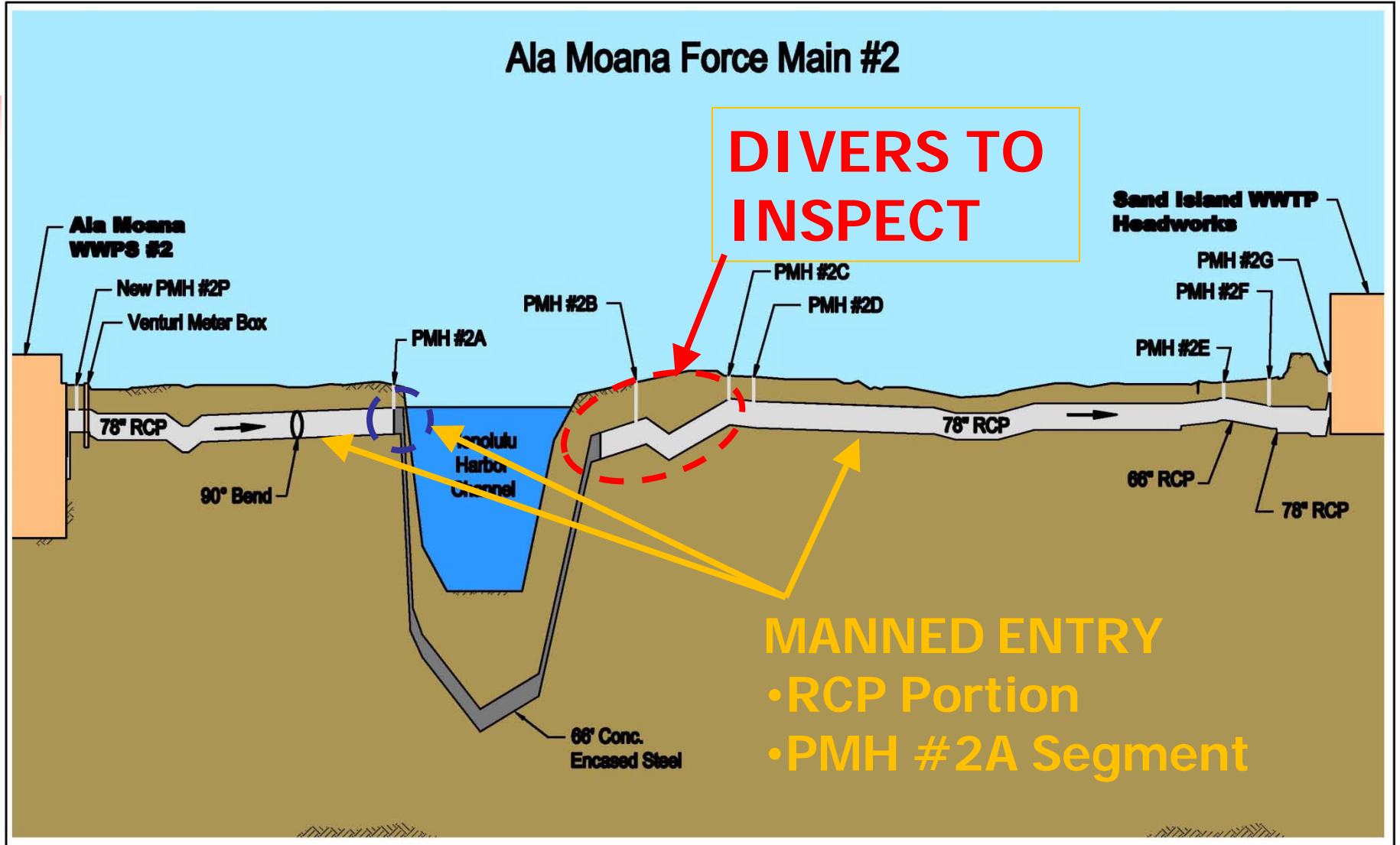
## Ala Moana Force Main #2



**INSPECT ALL RCP**

- INSPECT 2004 BREAK.
- INSPECT ~100 FT. OF STEEL SEGMENT EACH END

# 2008-2009 Inspections - Method





# Recall FM#1 Inspection

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- Manned Entry
- No problems draining line.
- Little solids accumulation.



# FM#2 Manned Entry – SNAGS!

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- Could not drain line adequately.
- Significant solids accumulation (Little in FM#1).
  - Partially blocked draining of line.
- H<sub>2</sub>S release during manned entry.
  - Ventilation of the FM inadequate.
  - Limited penetration with oxygen tanks.



# FM#2 Manned Entry – MORE SNAGS!

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- 4,000 LIN FT. BETWEEN MANHOLES
- SPECIAL PURCHASE OF \$40,000 AIR HOSE



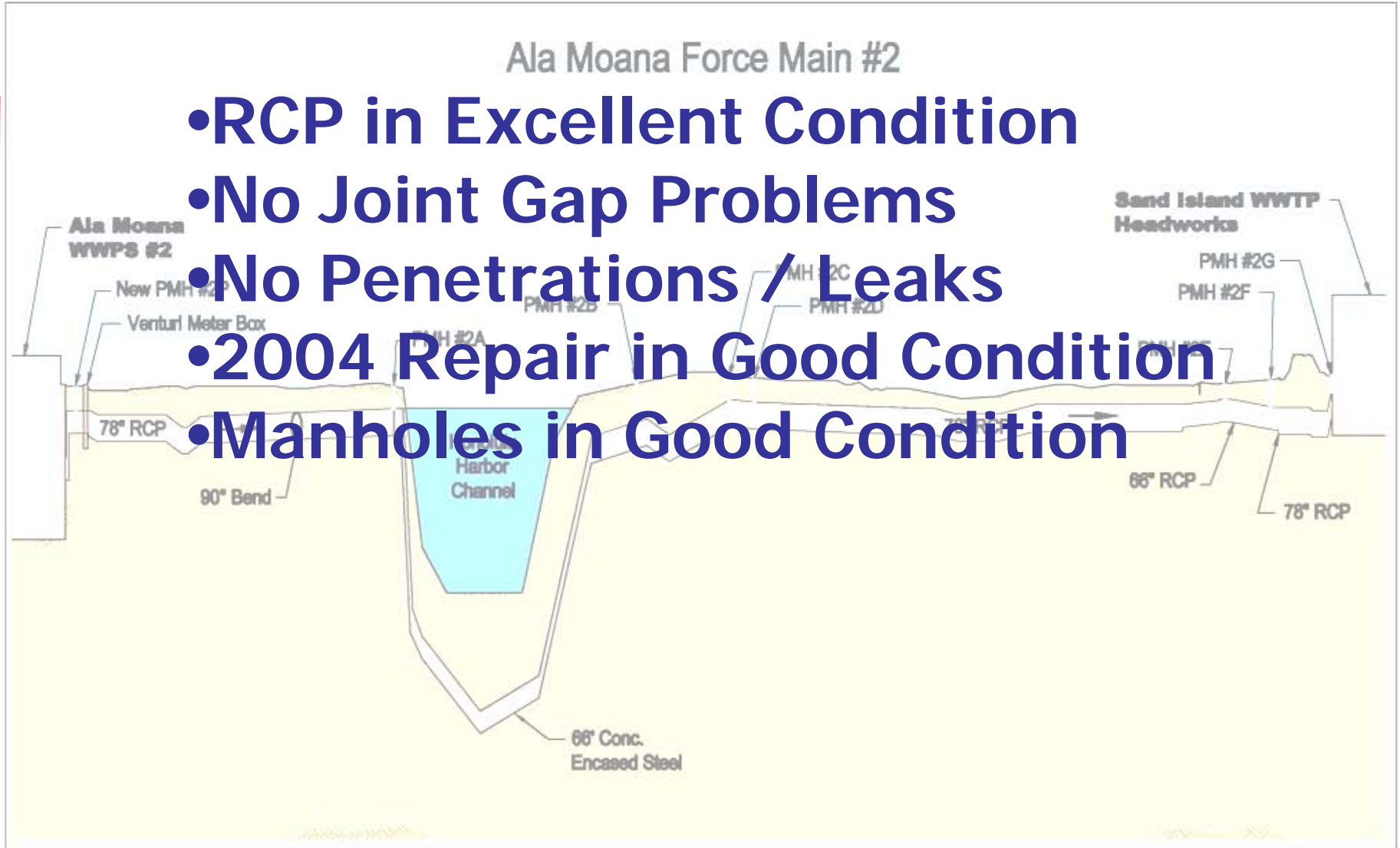
# FM#2 Inspection Method

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- SCUBA DIVERS
- FEEL JOINTS & CONCRETE
- MEASURE JOINT GAPS
- HARDNESS TAPPING

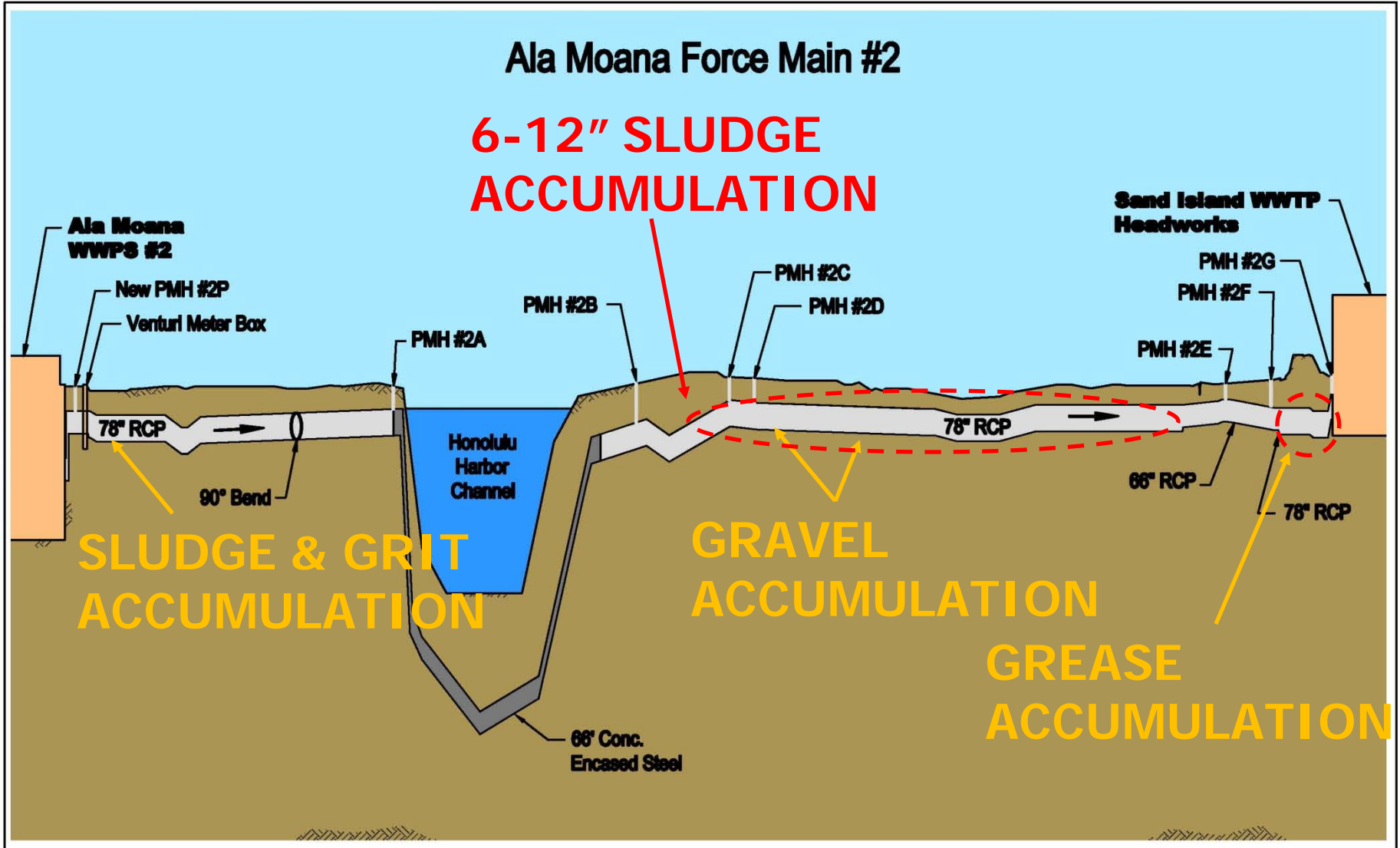
# RESULTS: THE GOOD

- RCP in Excellent Condition
- No Joint Gap Problems
- No Penetrations / Leaks
- 2004 Repair in Good Condition
- Manholes in Good Condition

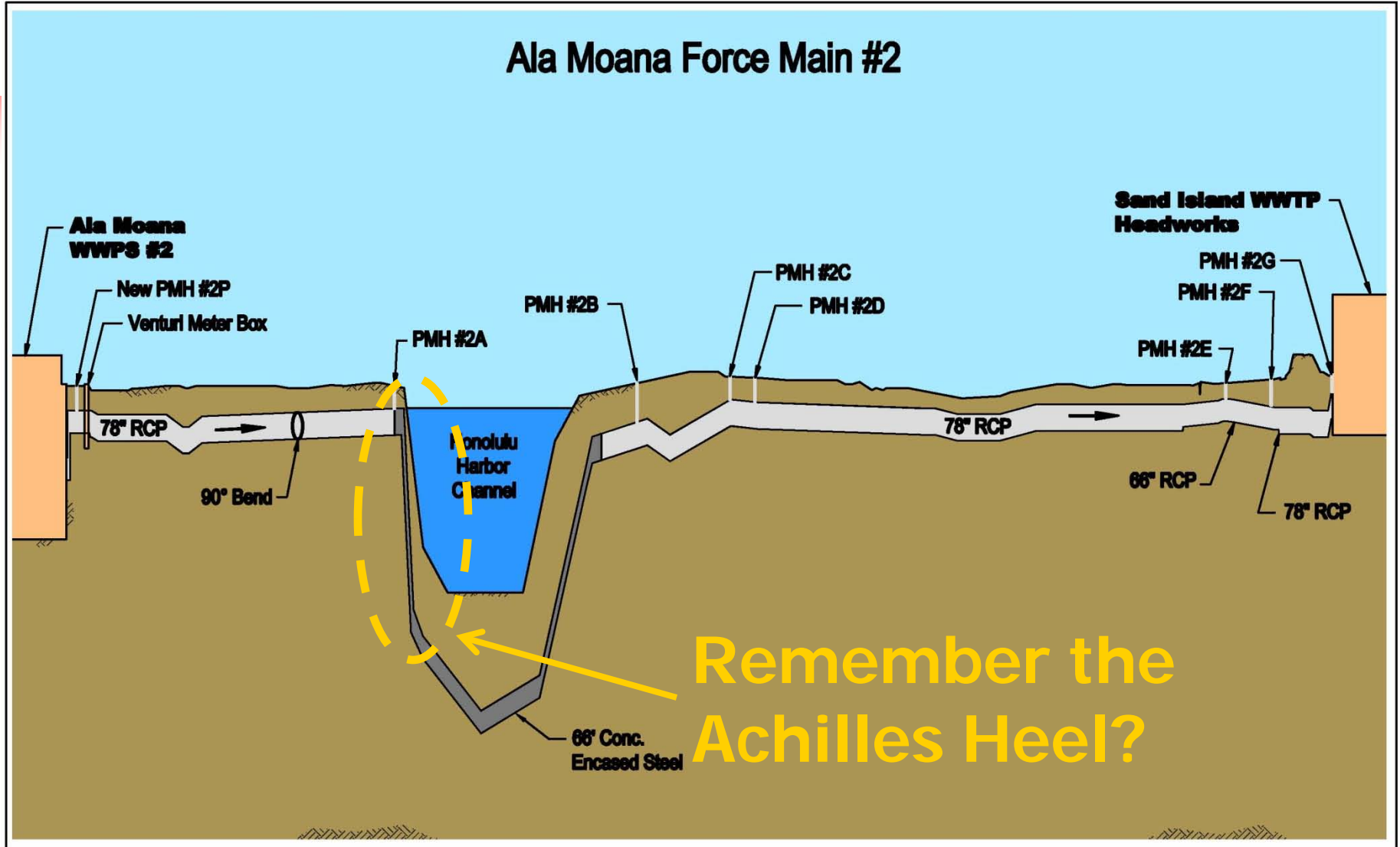




# RESULTS: THE BAD (But not too bad)

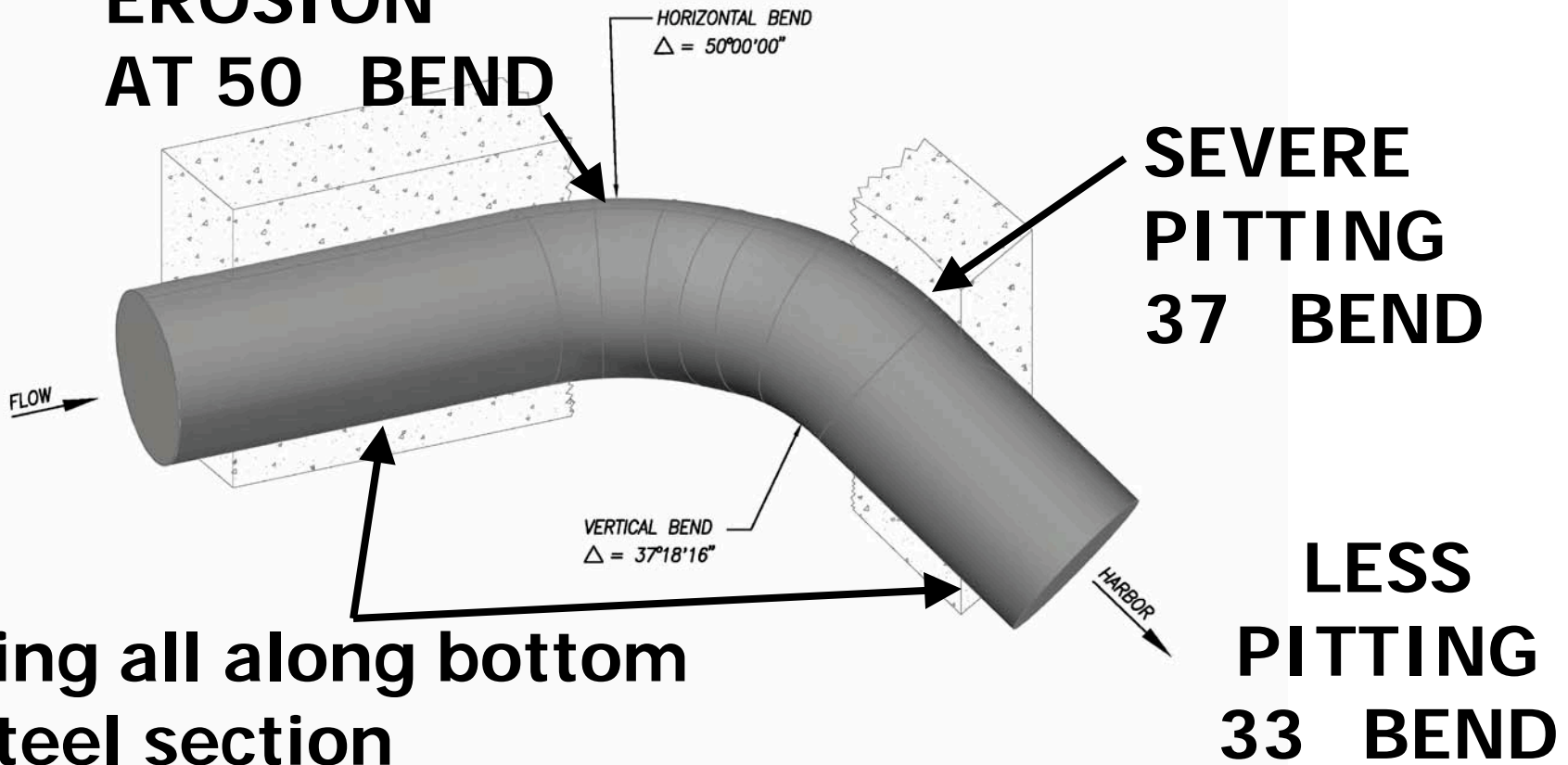


# RESULTS: THE UGLY

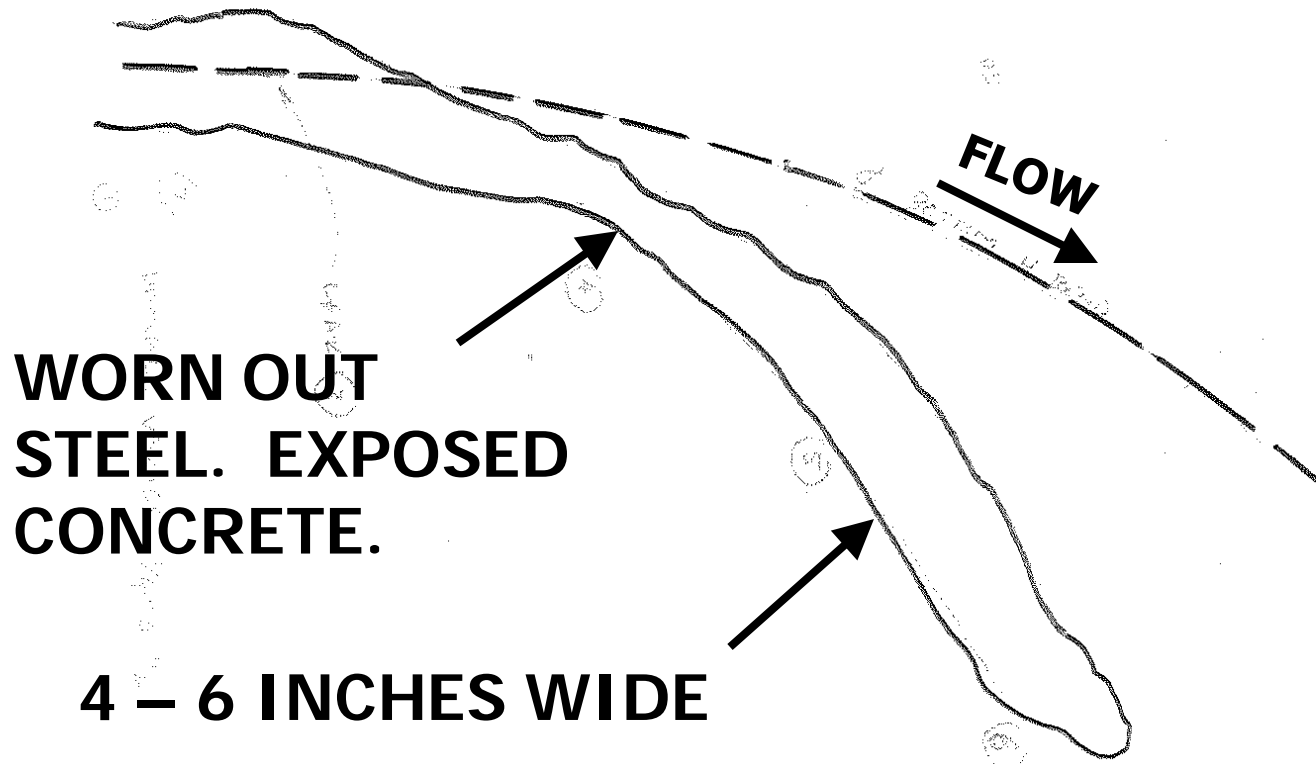


# The Achilles Heel

**WORST  
EROSION  
AT 50 BEND**



# Condition Of 50 Bend



**WORN OUT  
STEEL. EXPOSED  
CONCRETE.**

**4 - 6 INCHES WIDE**

**BEGINNING OF  
WORN STEEL  
SECTION**



**MIDWAY THRU  
WORN STEEL  
SECTION**



**REPAIR OF  
50 BEND**





# Lessons Learned

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- Steel vulnerability  $\gg$  RCP.
- The greater the bend the greater the deterioration.
- RCP does not deteriorate under full flow conditions. (Similar to FM#1)
- Solids accumulation in FM#2  $\gg$  FM#1
  - Lower velocities



# Lessons Learned - Inspection

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- Solids deposition interferes with draining of the line.
- Solids accumulation will deter ventilated manned entry.
- Have PMH's at regular intervals.
- Have a PMH at Pump Station



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