

Lower Granite Lock and Dam *Juvenile Bypass System (JBS) Primary & Secondary Dewatering Design and Construction*

2019 Pacific NW Fish
Screening and Passage
Workshop

September 19, 2019

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Technical Lead

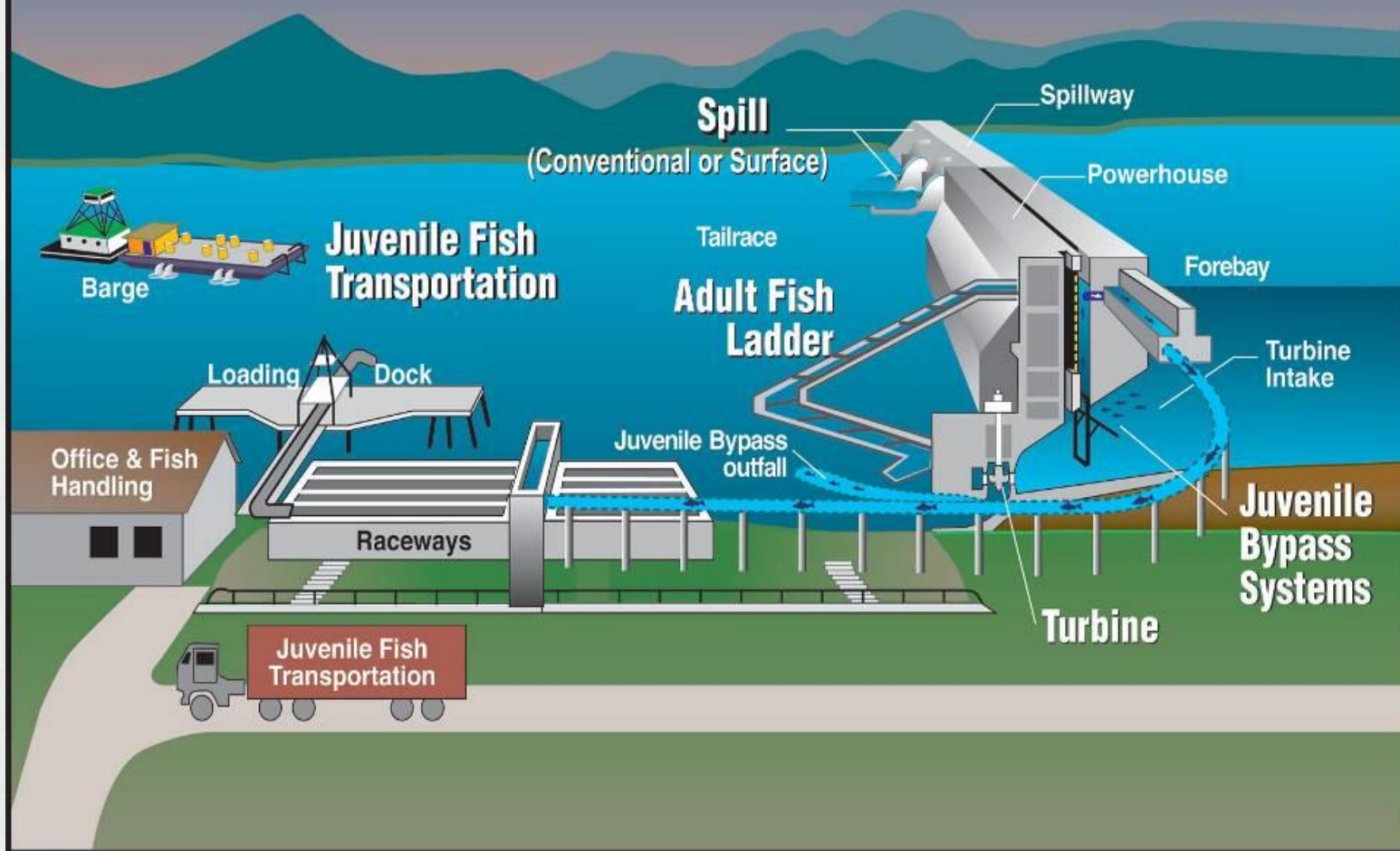


Outline

- Background
 - ▶ Previous Lower Granite JBS
 - ▶ Overall Upgrade
- Design
 - ▶ Focus on Primary Dewatering Screen
 - Sizing, baffling, water surface control, cleaning
 - ▶ Secondary Dewatering Screen also discussed
- Construction
 - ▶ Issues & resolutions during construction
- Post Construction Testing specific to screens
 - ▶ Mark Morris to cover



Fish Passage Routes



Lower Granite Dam

■ Existing System

- ▶ 10" orifices to downwell, to 1700 ft of pressure pipe, to upwell, to undersized dewatering screen

■ Purpose of Project

▶ Improve Survival

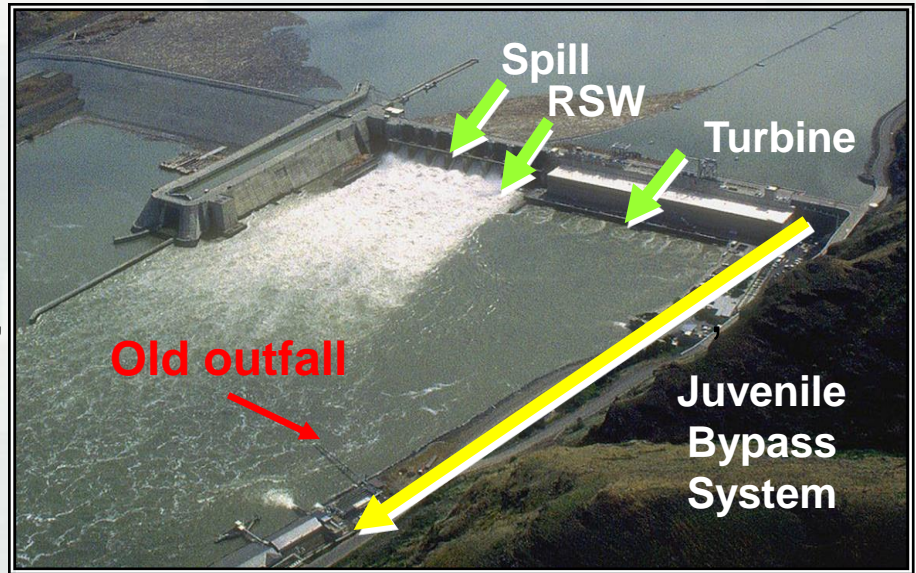
- New primary bypass outfall for return to river fish easier and in better location in the river

▶ Reduce Delay

- 10" orifices replaced by 14" orifices
- 2013 study should $\frac{1}{2}$ of the gatewell residence time for 14" compared to 10" orifice

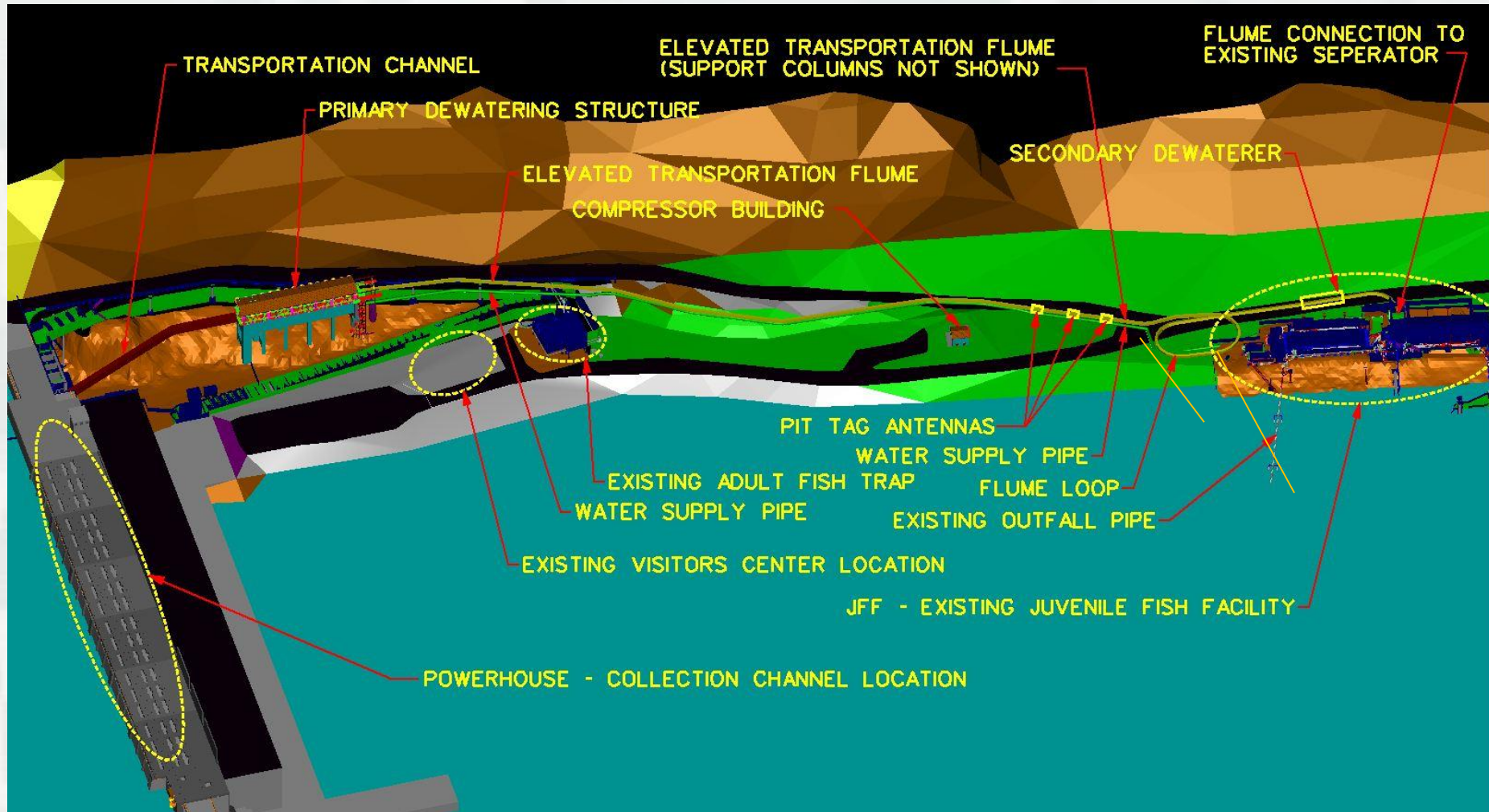
▶ Reduce Injury

- Open channel transport with correctly sized dewatering & automatic cleaning system



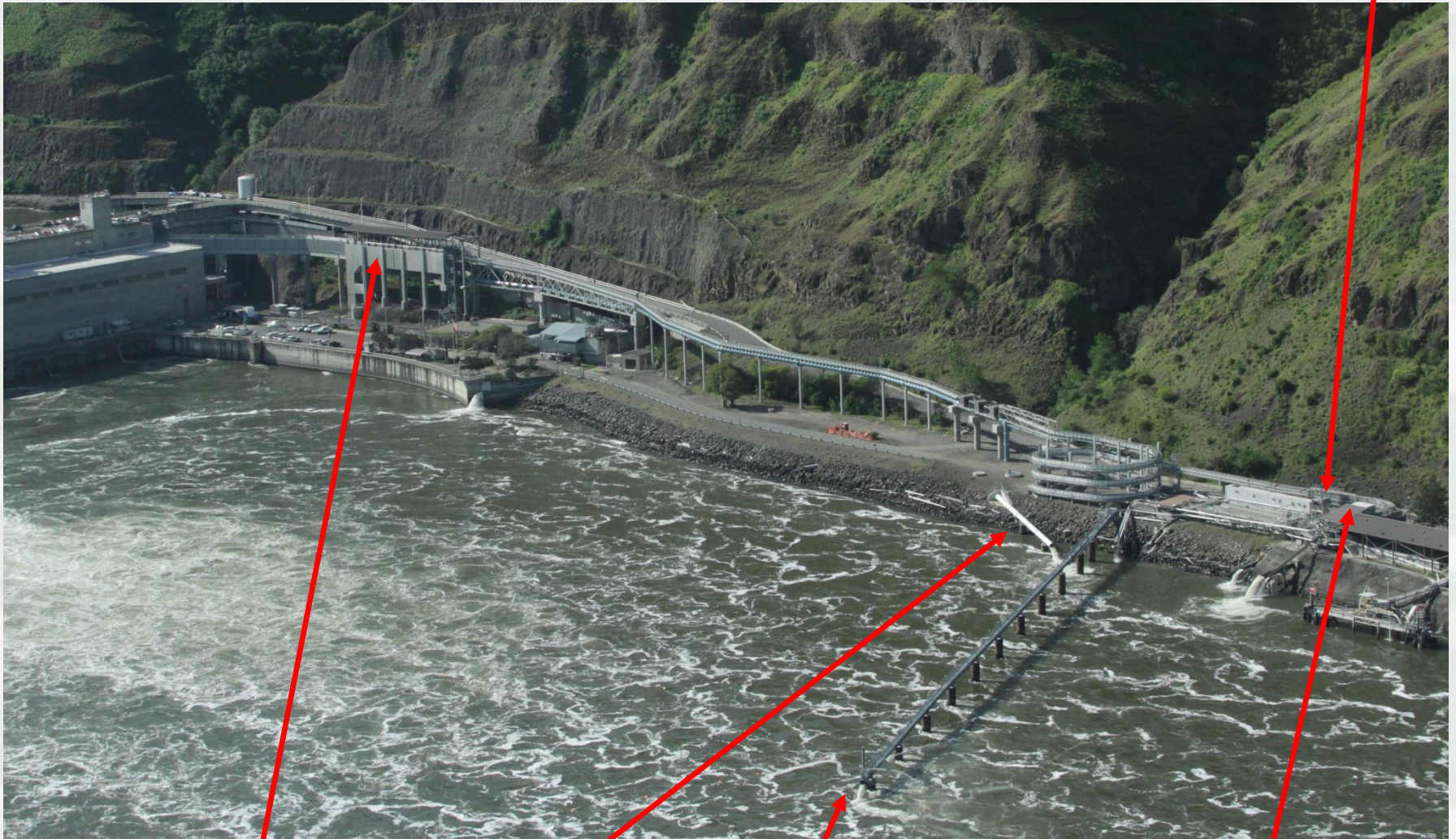
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Overall JBS Upgrade



Overall JBS Upgrade

Secondary Dewatering



Primary Dewatering
Structure

Emergency Bypass Outfall

Primary Bypass Outfall

Existing
Separator



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Primary Dewatering (PDS)

- Large structure with 365 cfs dewatering capacity



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PDS similar design to Previous Designs

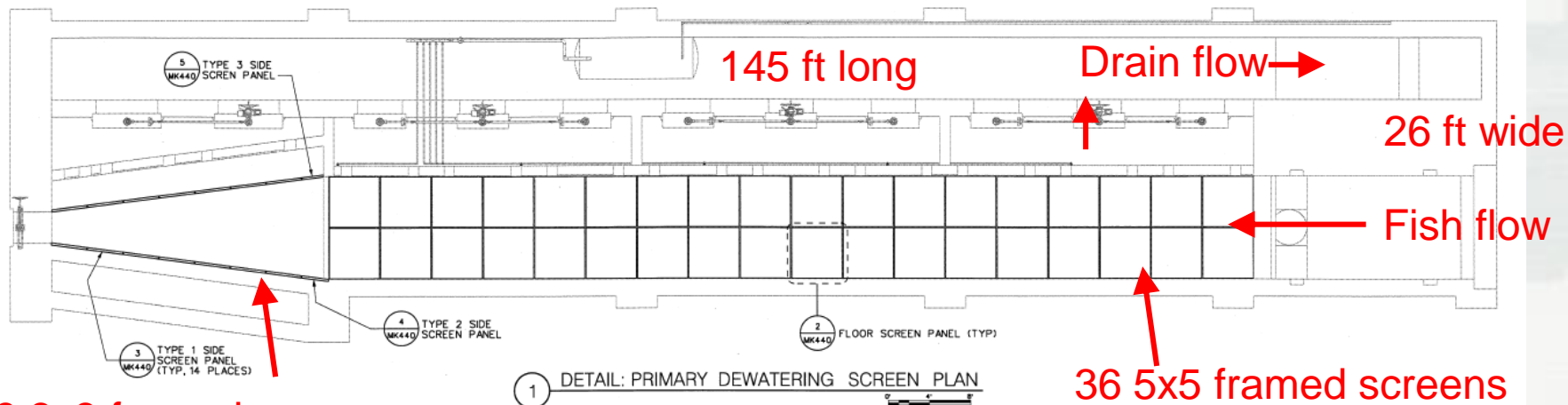
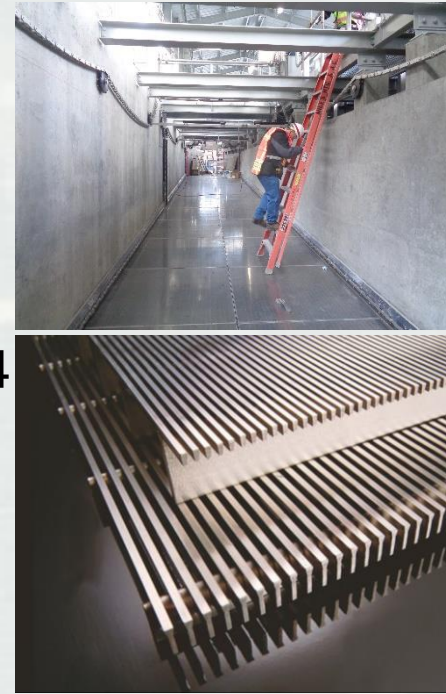
- Lower Monumental & Little Goose PDS similar



Primary Dewatering Structure (PDS)

■ Sizing of PDS

- ▶ 14" orifices double the flow ~ 180 – 380 cfs into PDS and 25 – 40 cfs out to flume
- ▶ Meet NMFS criteria for active cleaned screens 0.4 fps approach implies at least 915 ft² of screen.
- ▶ Effective screen area 840 ft² floor screen and 100 ft² side screen
- ▶ Profile bar used for all screen in PDS

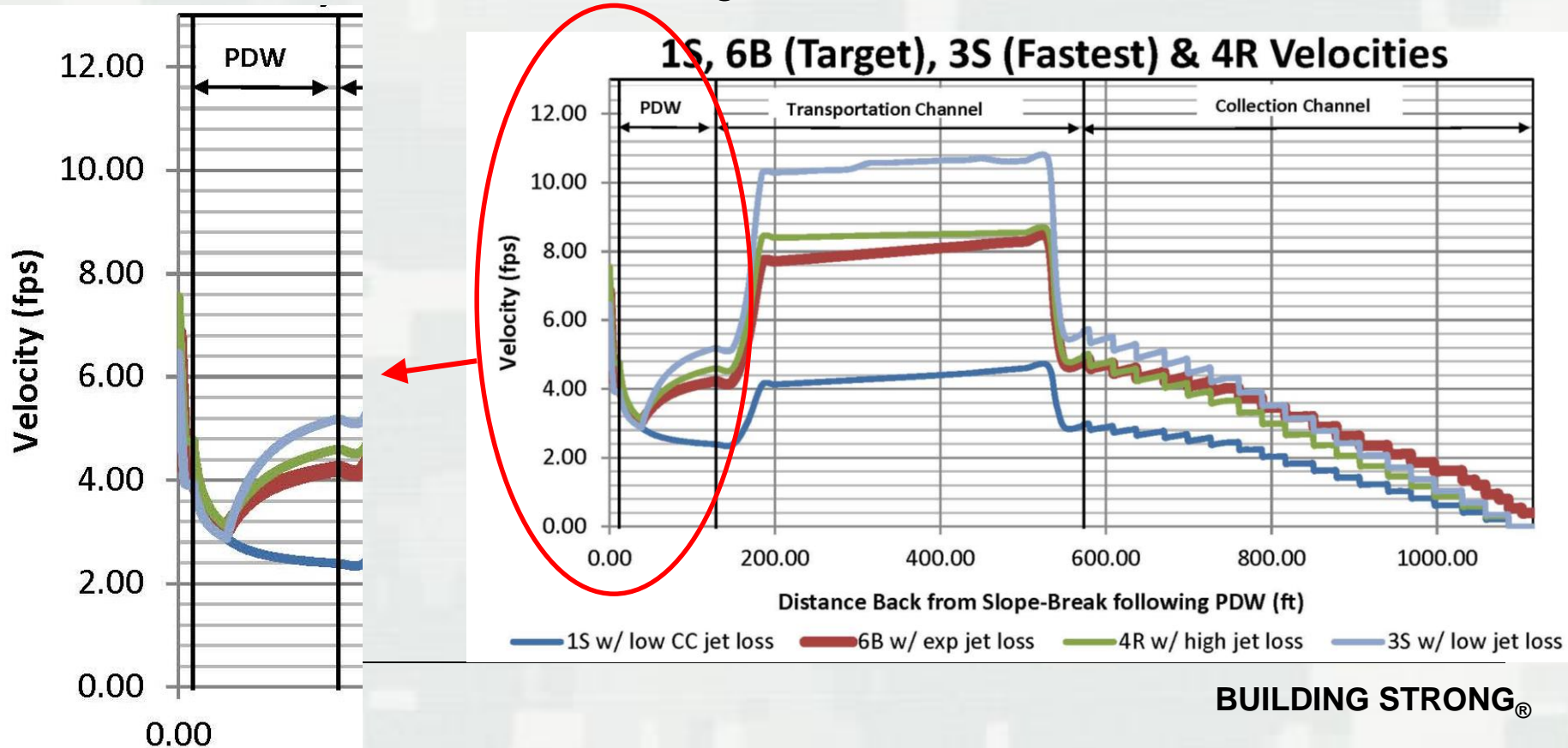


9 3x3 framed screens
each side

Primary Dewatering Structure (PDS)

■ Design Velocities through PDS

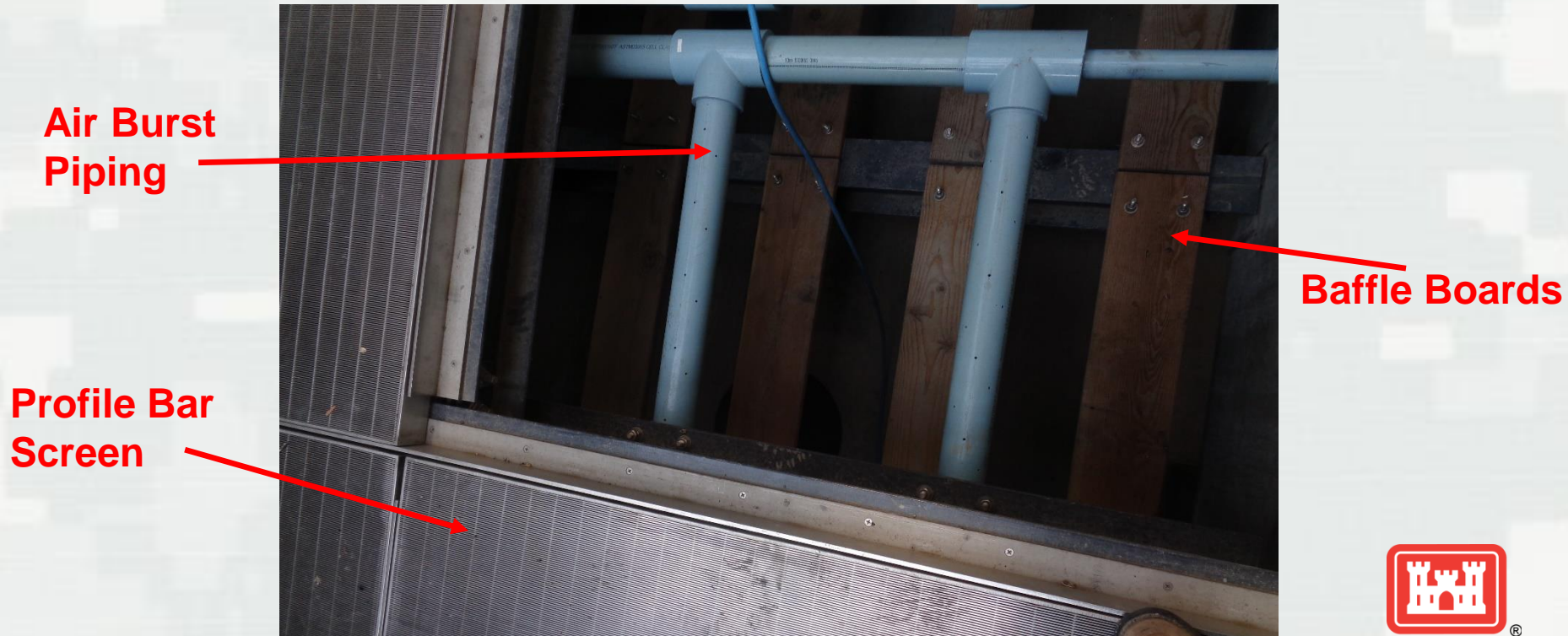
- ▶ Due to shallow angle inclined screen discussed with NMFS to have a target PDS velocity of 3-5 fps despite transport between 6-12 fps
- ▶ Attempted to maintain near constant velocity and not violate 0.2 fps/ft acceleration criteria over range inflow conditions



Primary Dewatering Structure (PDS)

- Baffling

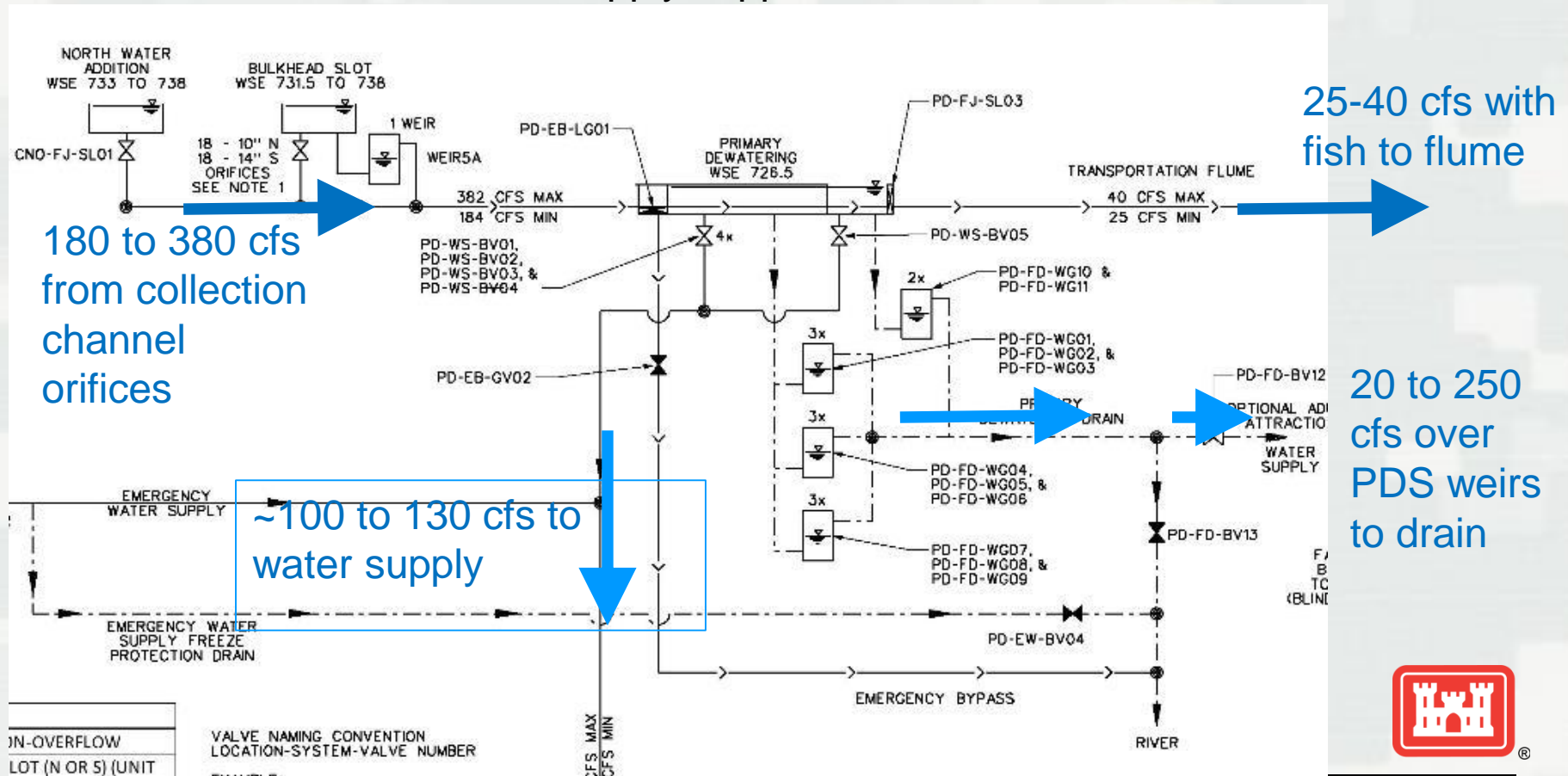
- ▶ Baffles boards used to break up water withdraws under screens
- ▶ No baffling under profile bar screens
- ▶ Approach similar to Lower Monumental and Little Goose



Primary Dewatering

■ Use of Screened Water

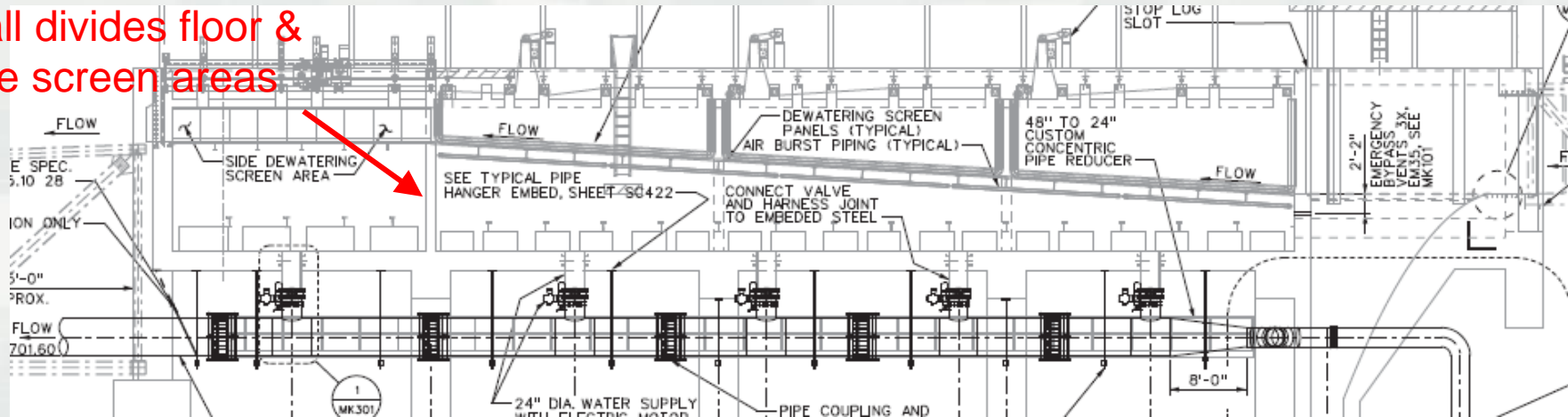
- ▶ Water pulled through screen supplies water supply for JFF
- ▶ Water not used for water supply supplements adult ladder attraction water



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Primary Dewatering – Use of Screened Water

Wall divides floor & side screen areas



Flow over weir into drain channel



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- PDS Cleaning

-



Secondary Dewatering (SDW)

- SDW just prior to existing facility
 - ▶ Original design had only 15 cfs being pulled out at porosity control prior to existing separator
 - ▶ Therefore need to pull out up to 22 cfs if going to existing facility
 - ▶ Size to meet 0.4 fps approach
 - ▶ Uses bubblers for cleaning
 - ▶ Maintains steep slope to maintain supercritical flow



Construction – Issues and Resolutions

- PDS was in difficult location to install support piers
 - ▶ ISSUE: The larger drilled shaft equipment could not access the areas needed for install piers for PDS
 - ▶ RESOLUTION: The steep hill had to be benched with some cut and mostly fill.



Construction – Issues and Resolutions

- Construction access for PDS was limited



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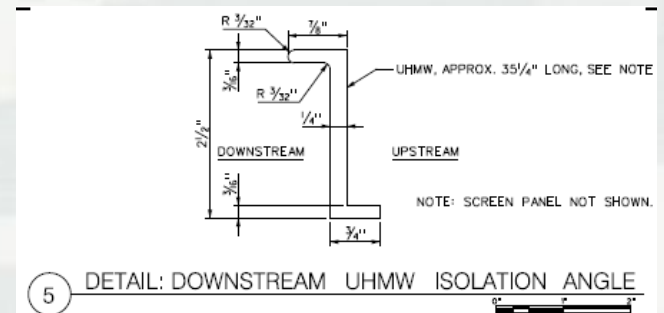
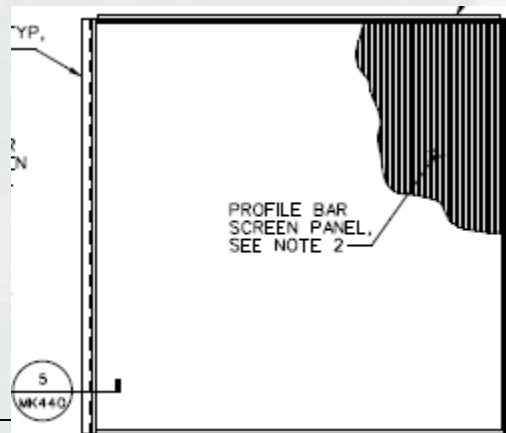
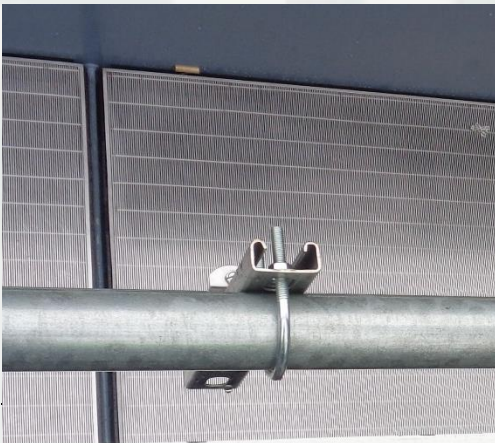
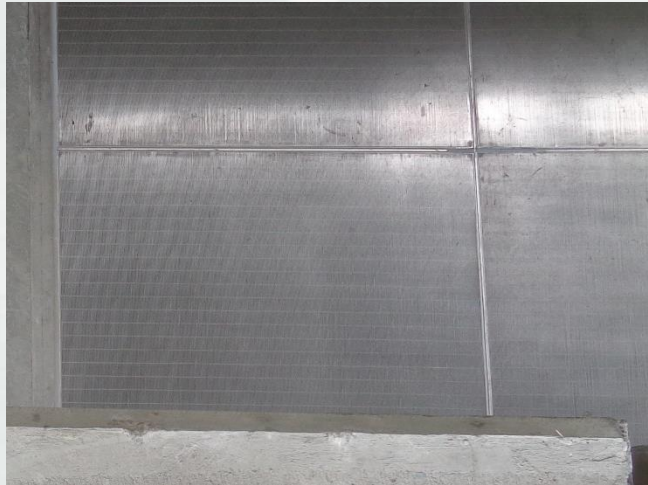
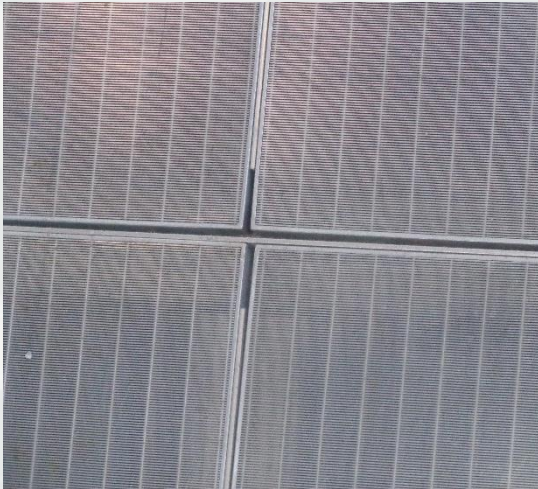
Construction – Issues and Resolutions

- PDS water supply crushed by vacuum
 - ▶ ISSUE: Contractor had air release/vacuum breaker isolated during pressure testing and then emptied pipe.
 - ▶ RESOLUTION: Contractor took hit and refabricated pipe and recovered lost schedule.



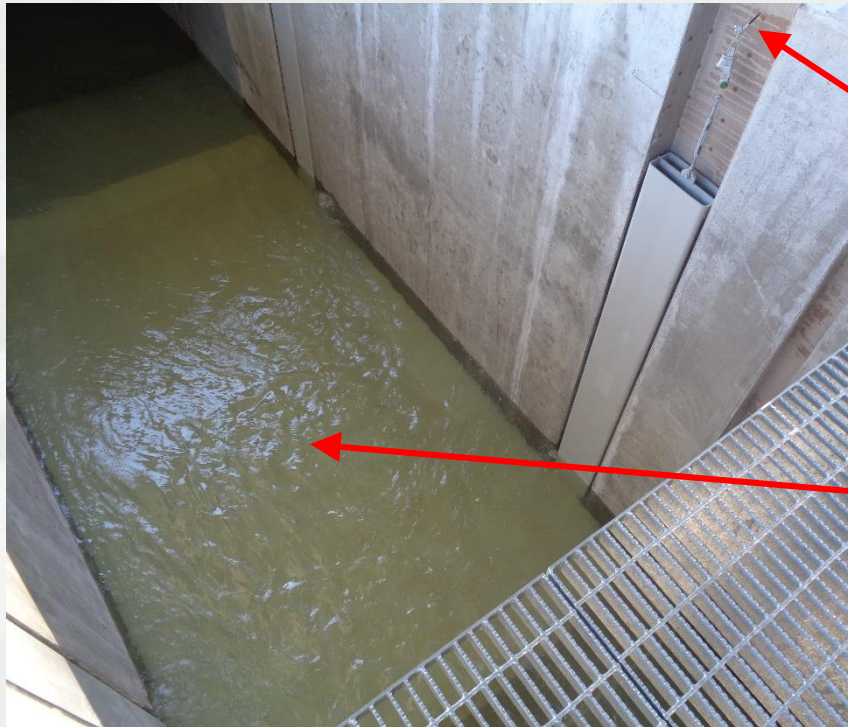
Construction – Issues and Resolutions

- PDS & SDW gaps between screens
 - ▶ ISSUE: Gaps present potential injury issue especially in SDW.
 - ▶ RESOLUTION: Used caulk for PDS & UHMW for SDW to fill gaps.



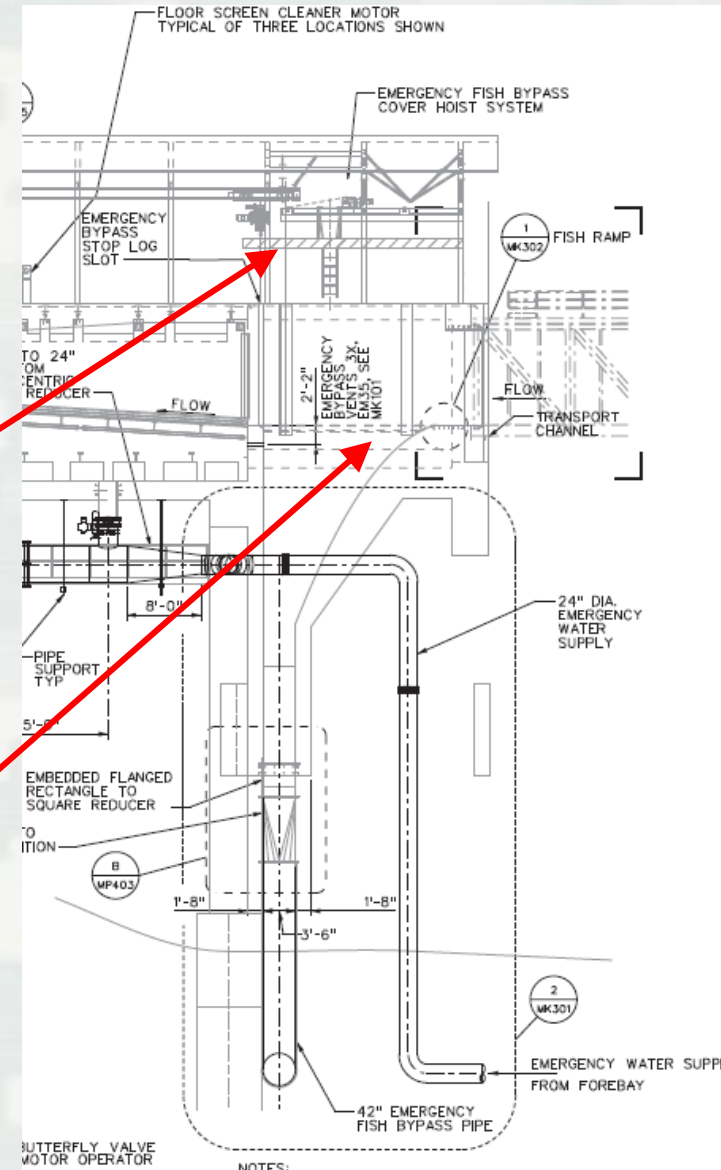
Construction – Issues and Resolutions

- PDS emergency cables broke during testing
 - ▶ ISSUE: Under-predicted water pressure loading to break off EMB plate off seal.
 - ▶ RESOLUTION: Had to abandon cable system due to time and do temporary hoists & slow down initial lift.



1 of 4 cables which broke in later lift

Hatch plate over EMB downwell



Construction – Issues and Resolutions

- PDS water control unstable
 - ▶ ISSUE: Initial control used a different downstream WSE for the weirs behind the side screens (Group D). Also frequency of weir adjustment was too quick to get response from water surface.
 - ▶ RESOLUTION: Initially used Weir Group D in manual & then made software change to correlate with other weir groups. Also made adjustment frequency settable by operator (60 sec worked well (initial 15 sec)).
- Floor Screen Brush bent
 - ▶ ISSUE: Floor brush got stuck on debris and was ran backwards to clear it. However pipe between chains bent.
 - ▶ RESOLUTION: Replace connecting pipe with larger pipe for all 3 brushes. Limit brush head movement so doesn't jam if need to run backwards.



Construction – Issues and Resolutions

- Chain broke on Side Screen Cleaners
 - ▶ ISSUE: Connection of chain broke when changing directions.
 - ▶ RESOLUTION: Improved connection & added pause to direction changes in programming.



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Questions?



Mark Morris presenting Testing Next

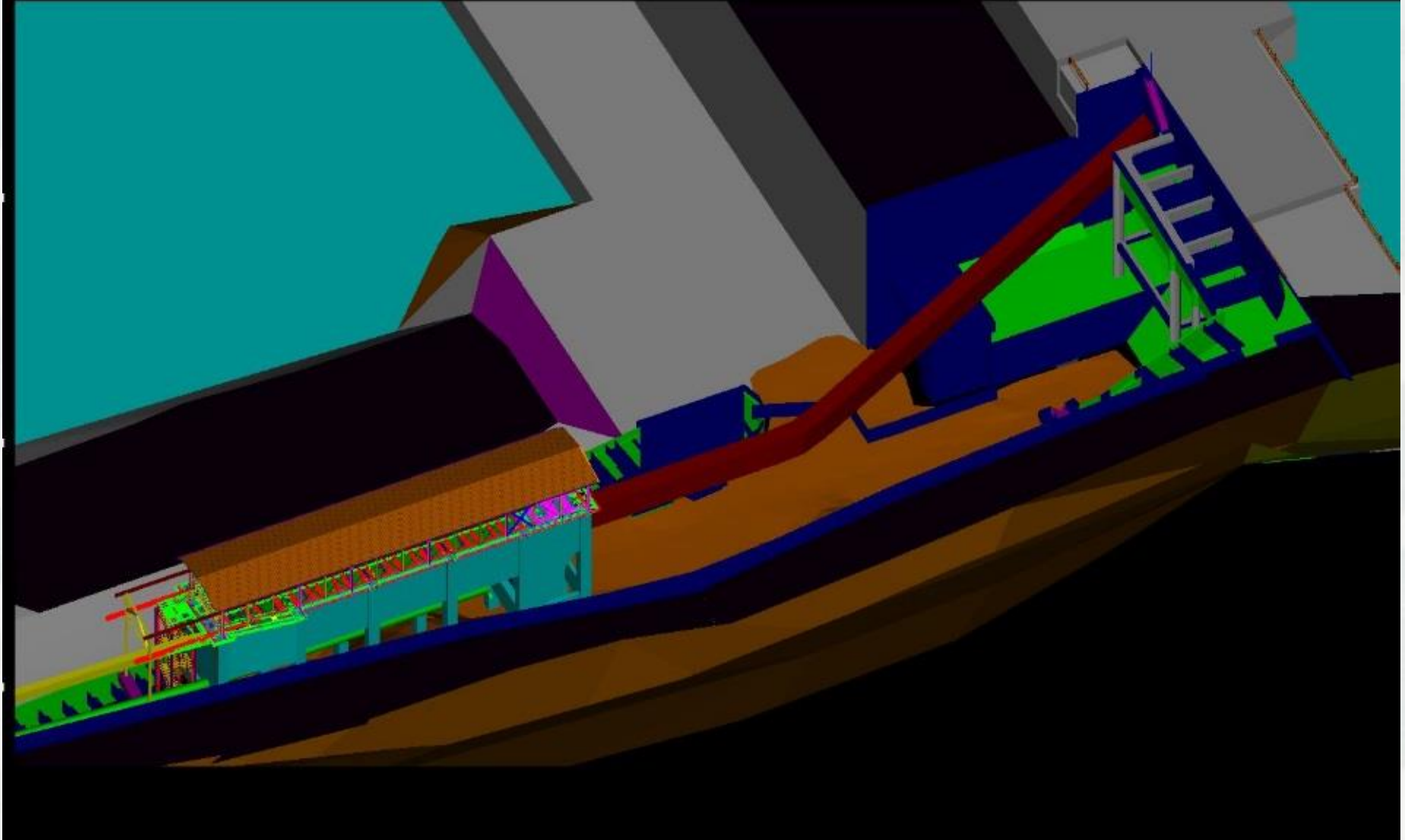
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Closer Figure of PDS



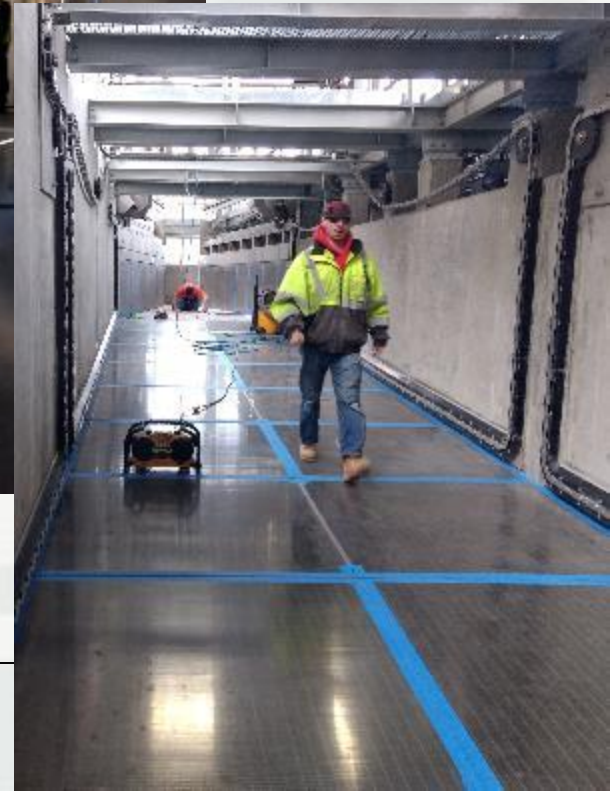
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LGR JBS - Collection Channel



Transport Channel & PDS



*Some gaskets between 'boxes' have been replaced
with flat expansion joints



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PRIMARY DEWATERING WEIR CONTROL

FISH FLUME EXIT
FLOW SETPOINT
(CFS)

40

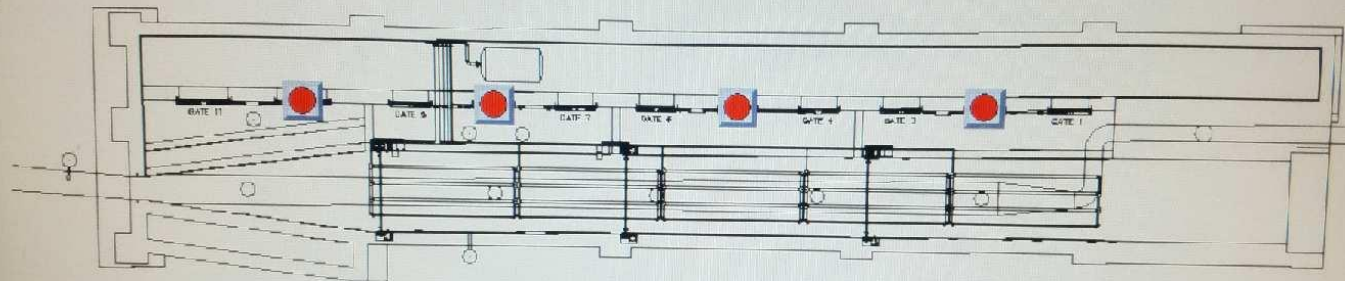
PDS
WEIR GROUP D
PDS-WGD
MANUAL

PDS
WEIR GROUP C
PDS-WGC
AUTOMATIC

PDS
WEIR GROUP B
PDS-WGB
AUTOMATIC

PDS
WEIR GROUP A
PDS-WGA
AUTOMATIC

AUTO/MAN
TOGGLE PDS
WEIRS A, B, C



WEIR GROUP D
MANUAL UP

WEIR GROUP D
ELEV. (WSE)
PDS-WGD-LI
725.728

WEIR GROUP D
MANUAL DOWN

WEIR GROUP C
MANUAL UP

WEIR GROUP C
ELEV. (WSE)
PDS-WGC-LI
725.845

WEIR GROUP C
MANUAL DOWN

WEIR GROUP B
MANUAL UP

WEIR GROUP B
ELEV. (WSE)
PDS-WGB-LI
725.853

WEIR GROUP B
MANUAL DOWN

WEIR GROUP A
MANUAL UP

WEIR GROUP A
ELEV. (WSE)
PDS-WGA-LI
725.875

WEIR GROUP A
MANUAL DOWN

WEIR GROUPS A-D
ADJ. STEP
SETPOINT (FT)

0.050

LOGIN

PDS

PREV NEXT

JUVENILE
FISH
FACILITY

SYSTEM
CONFIG

ALARM
SCREEN

LOGOUT



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