April 26, 2018

BUTTERFIELD INTAKE SCREEN REPLACEMENT

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PROJECT LOCATION

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INTAKE STRUCTURE BACKGROUND

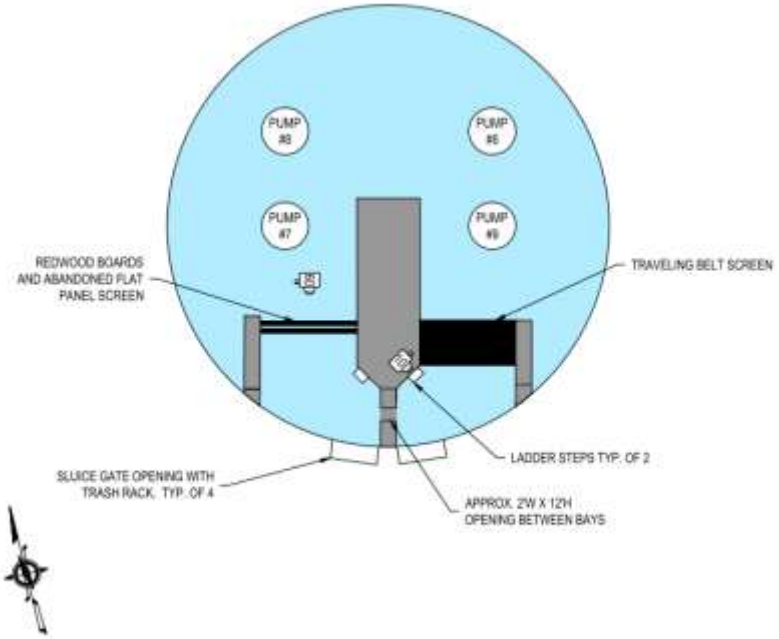
- Originally constructed in 1952
- Modified in 1985 with new traveling belt screen and mechanical equipment
- Pumps raw Columbia River water to City's Butterfield WTP (28 to 30 MGD)
  - Future 34 MGD capacity

TRAVELING BELT SCREEN BACKGROUND

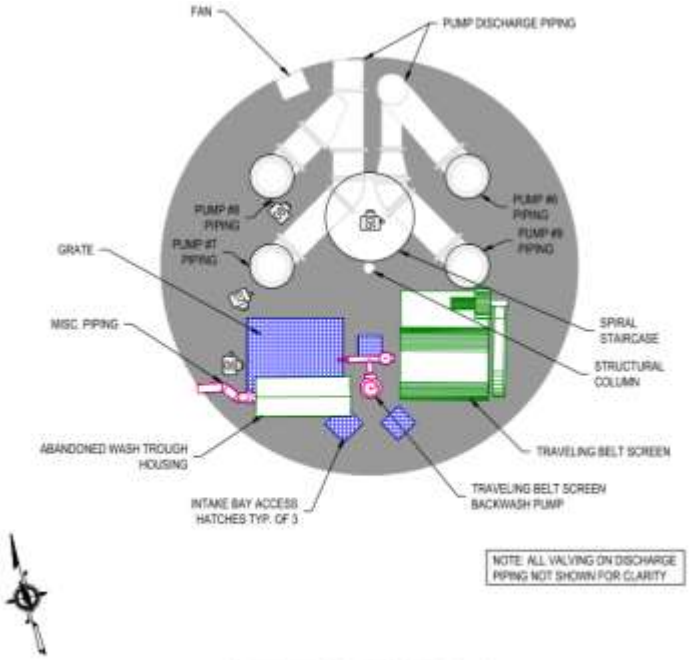
- 24 MGD capacity
- Beginning to fail – in need of cleaning and repair
- Does not meet WDFW or NMFS fish protection guidelines

ORIGINAL SCOPE

- Refurbish existing traveling belt screen
- Design 2nd traveling screen for redundancy and to meet future WTP capacity



INTAKE BAY PLAN



1ST (BOTTOM) FLOOR PLAN

PRELIMINARY DESIGN

- Existing intake bay dimensions
- WDFW and NMFS Fish Protection Guidelines

Description	WDFW	NMFS
Maximum Opening Between Wire Mesh (inches)[1]	0.09375	3/32[1]
Minimum Wire Mesh Diameter (inches)	0.080	None Provided
Maximum Approach Velocity (fps)	0.40	0.40

(1) The maximum opening between wire mesh is measured diagonally. The resulting dimensions that provide the largest open area is a 0.0663-inch by 0.0663-inch square.

- Traveling screen manufacturer specifications and recommendations
- Original screen design
  - 0.125-inch openings
  - 0.77 fps approach velocity

PRELIMINARY DESIGN (CONT.)

- Intake screen capacity

Fish Protection Guideline Agency	Traveling Screen Capacity (MGD)	
	1 Intake Bay	2 Intake Bays
Extreme Low River Water Surface Elevation		
WDFW (14 Gauge Wire Mesh and 0.09375" Openings)	6.8	13.7
NMFS (14 Gauge Wire Mesh and 3/32" Openings)	4.8	9.7
NMFS (18 Gauge Wire Mesh and 3/32" Openings)	8.1	16.1
Siemens (18 Gauge Wire Mesh and 0.078" Openings)	9.2	18.3
Normal River Water Surface Elevation		
WDFW (14 Gauge Wire Mesh and 0.09375" Openings)	8.6	17.3
NMFS (14 Gauge Wire Mesh and 3/32" Openings)	6.1	12.2
NMFS (18 Gauge Wire Mesh and 3/32" Openings)	10.2	20.3
Siemens (18 Gauge Wire Mesh and 0.078" Openings)	11.6	23.1

- Evaluated increasing width of intake bays

PRELIMINARY DESIGN (CONT.)

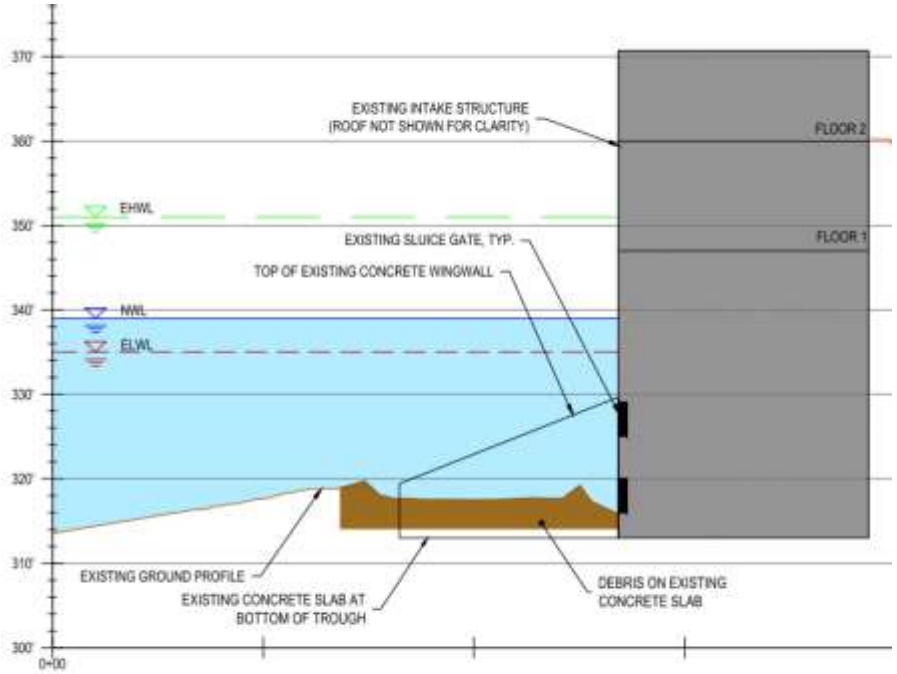
- Conclusion
  - Capacity of two new screens would be significantly less than capacity of existing screen and existing or future WTP capacity.

REVISED APPROACH

- Bathymetric survey (April 2014)
- City performed dive to inspect trough
  - Confirmed dimensions (10-foot width)

EXISTING BUILDING AND SITE OBLIQUE
NOT TO SCALE

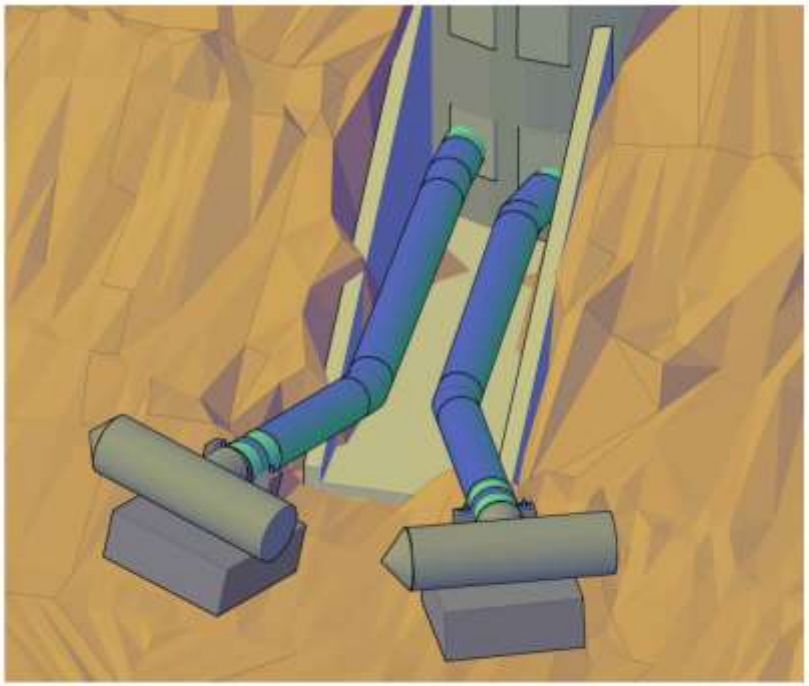
NOTE: SLUICE GATE STEMS AND FRAMES NOT SHOWN FOR CLARITY. SEE PHOTO 1 FOR DETAILS. THIS SHEET.



EXISTING BUILDING AND SITE PROFILE
FULL SIZE (34" x 22"): H: 1" = 10', V: 1" = 10'
HALF SIZE (17" x 11"): H: 1" = 20', V: 1" = 20'

REVISED CONCEPT

- Install barrel screens beyond trough
  - Two 17 MGD barrel screens
  - 15-foot depth at low water level
- Route piping within trough
  - 36-inch diameter HDPE piping
- Install bedding and backfill material within trough
  - Additional anchoring
  - Pipe protection



NOTE: FLANGES NOT SHOWN FOR CLARITY

PROPOSED BARREL SCREEN OBLIQUE

NOT TO SCALE

PERMITTING

- Agencies
  - ACOE, DNR, WDFW, USFWS, NMFS, Ecology, City of Pasco, Franklin County
- SEPA checklist and DNS
- Critical areas ordinance
- Shoreline substantial development
- Hydraulic Project Approval (JARPA)
- Aquatic Use Authorization
- Section 404/10
- Nationwide Permit
- Biological Assessment

PERMITTING (CONT.)

- Site visit with ACOE and WDFW (May 2014)
- Review agency feedback
  - Fish work windows
    - December 15 – February 28
    - July 16 – September 30
  - Permitting guidance
  - Agreed with revised concept
  - Considered an improvement for fish and environment

DESIGN

- Mechanical design
  - Equipment removal
  - Construction sequence
    - Facility to remain operational throughout construction
  - Anchoring
    - Dual-purpose: to elevate screens off river bottom
  - Screen sizing
    - 42-inch diameter, 146-inch length
  - Screen isolation
  - Barrel screen cleaning

DESIGN (CONT.)

- Structural design
  - Barrel screen anchoring
  - Plugging existing intake bays
  - Reinforcing traveling belt screen void in floor
- Electrical design
  - New VFDs, harmonic filters, control panels, and soft starts
- SCADA design
  - Automatic control of VFDs and hydroburst system

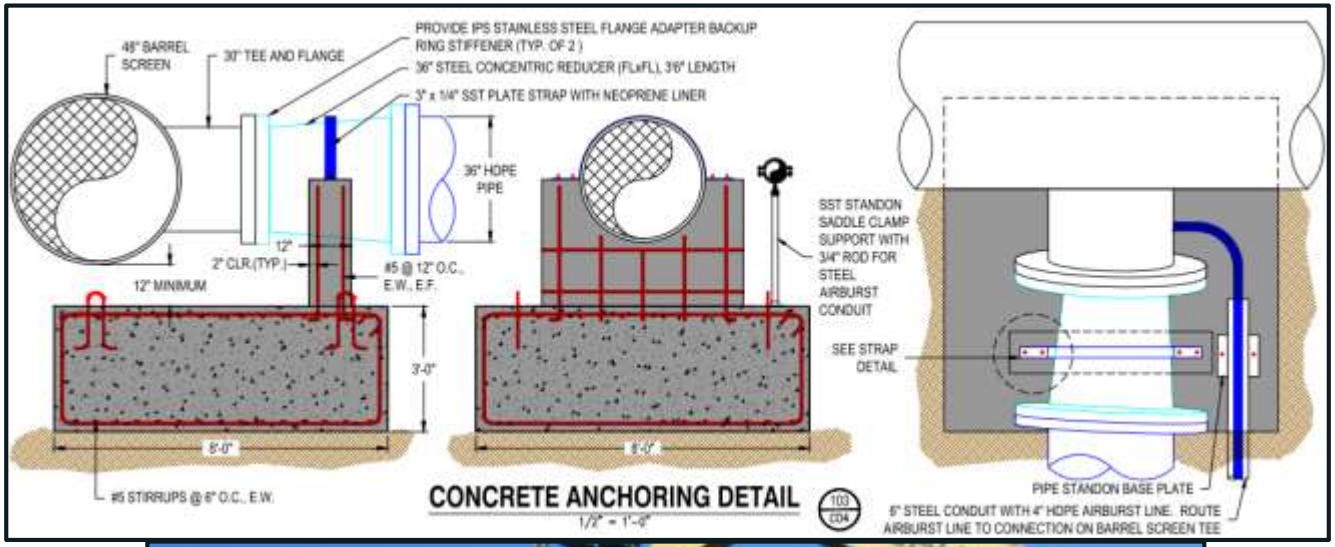
BIGGEST DESIGN CONSTRAINTS

- Marine environment
- Site accessibility
- In-water work window
- Construction sequencing
- Trough and forebay footprint
- Equipment lead time
  - Screens = 8 to 10 weeks
  - Hydroburst = 14 to 16 weeks
  - MCC = 4 to 6 weeks

BARREL SCREENS

IN-WATER INSTALLATION

CONCRETE ANCHOR



HDPE PIPE INSTALLATION

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BARREL SCREEN INSTALLATION

ISOLATION VALVE INSTALLATION

BEDDING AND BACKFILL

HYDROBURST EQUIPMENT

HYDROBURST EQUIPMENT

HYDROBURST EQUIPMENT

ELECTRICAL IMPROVEMENTS

HYDROBURST TEST

TRAINING

FINISHED PRODUCT

FINISHED PRODUCT

CONSTRUCTION CHALLENGES

- Presence of thimbles within sluice gates
- Presence of cold joint in structure wall
  - Reconfiguration of pipe penetration
  - Form installation and removal
  - Additional bedding material

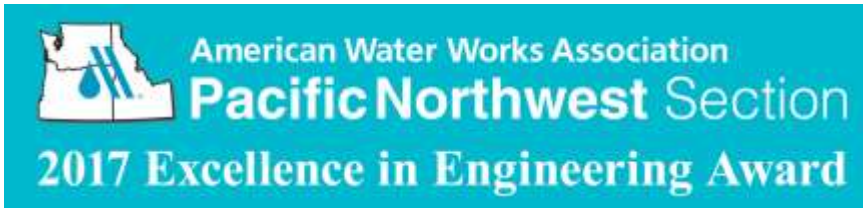
CONSTRUCTION COSTS

Description	Cost
Barrel Screens	$51,000
Hydroburst Equipment and Training	$61,000
Construction/Installation	$779,000
Routine Maintenance	$12,000
Total	$903,000

AWARDS

- 2017 ACEC Washington
  - Engineering Excellence Silver Award
  - Successful Fulfillment of Client/Owner Needs

- 2017 PNWS-AWWA
  - Excellence in Engineering
  - Small project category (under $5M construction cost)



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QUESTIONS?