McNary Dam Avian Deterrence Concept Design Evaluation

Concept Design Workshop

Challenging today.
Reinventing tomorrow.

Problem Statement and APDA Objectives

- APDA objectives
  - Biological effectiveness
  - Device reliability
  - Ease of routine maintenance
  - Does not adversely impact dam operations
    - Tailrace access by boats and personnel
    - O&M of dam features
  - Identify ROM costs for cost/benefit analysis

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Wire Array Design Considerations

- General
  - According to USDA, newest wire array at John Day is designed with kevlar rope and has distinct disadvantages compared to steel wire: service life of 5 years vs. 20 years; ice builds up more on larger rope; more expensive to install.
  - Achieving maximum wire sag is important to create a more three-dimensional deterrent for gulls.
  - Wire array installers like the USDA team do not measure tension in the wire. Sag and distance to the water are primary installation requirements.
  - Criss-crossing different arrays is not more effective and complicates installation.
  - Sag closer to the water is most effective but needs to consider mean high water elevation.
  - Thin steel gage wire is the most effective for ease of installation, longevity, rigidity, operation (no need to adjust tension)
  - Thin wires are preferable to minimize avian perching.
  - Wire closer to spillways needs to be heavier gage to support potential ice build-up during winter.
  - On parallel arrays using large cable for multiple anchor points, achieving uniform sag is a challenge and not recommended.
  - Will wire arrays impact falconry abatement?

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Array Design Considerations (cont.)

- Avian Behavior Priorities
  - Three major predatory species are gulls, cormorants, and pelicans.
  - Gulls are responsive to wire arrays.
  - Cormorants are diving birds and pelicans forage just below the water surface and may respond to in-water arrays only.
  - See predation priorities slide.

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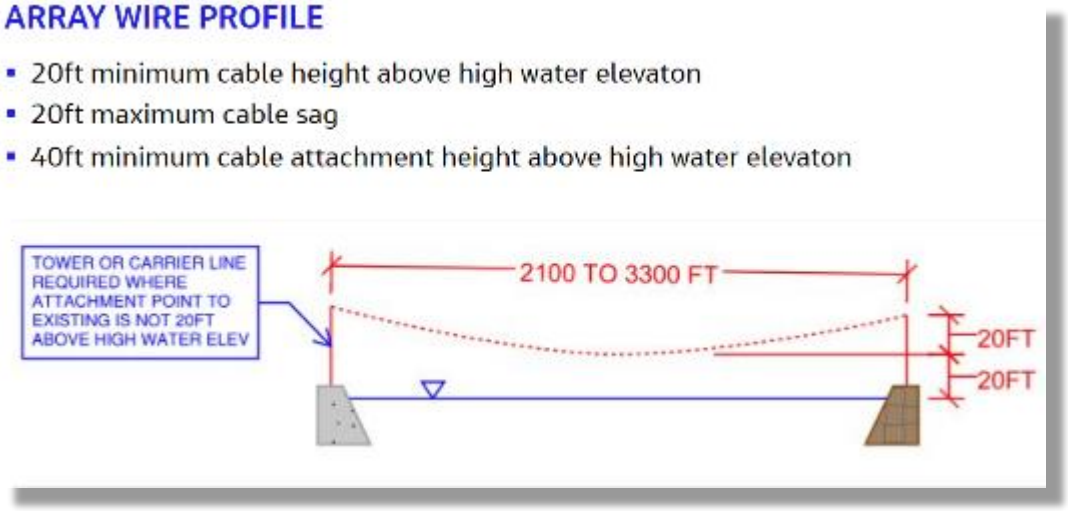
Array Design Considerations (cont.)

- Structural (Includes biological and operational priorities noted in Feasibility Report)
  - Wire spacing is 25-35ft maximum at termination location. Narrower spacing of 10-20ft are likely best for deterring gulls.
  - Avoid wires parallel to wind. Birds tend to fly parallel with wind, so perpendicular or angled orientation is most effective. 45 degrees max angle is preference.
  - Minimum wire height of 20 ft. above normal high tailwater for tailrace access by small boats/work platforms and to avoid entanglement with debris in river. Too high and birds can readily come in from underneath, making the array less effective.
  - Ideally no posts in water but may be acceptable if necessary. If so, avoid high flows areas, such as those associated with TSW outfalls (stay out of spill basin) due to potential fish impacts.
  - Anchorage must stay clear of handrails and light poles while being accessible for O&M purposes.
  - Line tensioners and dampeners are necessary for larger arrays/spans based on lessons learned at JDA.
  - Line tensioners & dampeners should be readily accessible w/o needing specialized equipment by project personnel.



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Wire Array Design Considerations (cont.)

- Structural (cont.)
  - Wind Load:
    - Assume 15 mph average wind (for synthetic creep analysis) .
    - Able to withstand 72 mph sustained wind, and 85 mph gusts (check)
  - Assume ¼" ice load added to the diameter of the wire rope (check).
  - Temperature Range:
    - Assume Average Max Temp 61 °F, Average Min Temp 38 °F.
    - Recorded temperature ranges from -28 °F to 108 °F.
    - These ranges will be used for thermal expansion and synthetic creep analysis. JDA has seen significant differences in amount of synthetic line creep between summer and winter periods which must be addressed in design of new APDA's.
  - Structural strength limits:
    - 60% of the minimum breaking strength for steel wires.
    - 80% of the minimum breaking strength or synthetic wires.
- Electrical
  - Per Unified Facilities Criteria (UFC) 3-575-01, all steel lines need to be grounded to prevent static and/or induced charges from the overhead power transmission lines.
  - Grounding is required for safety, protection, and prevention of electrical hazards.
  - The anchor pole for the wire arrays is required to be grounded. See image for a detail from John Day Dam Avian Predation deterrent array drawings (sheet detail B on S-401).

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Wire Array Design Considerations (cont.)

- Constraints:
  - Navigation channel cannot be blocked.
  - APDAs cannot be placed west of the BRZ.
  - Debris flow during spring.
  - Limited construction window?
  - USDA APHIS Team uses reel truck to spool wire.
    Care should be taken to consider location of tower (not on outfall pier or lock guidewall).

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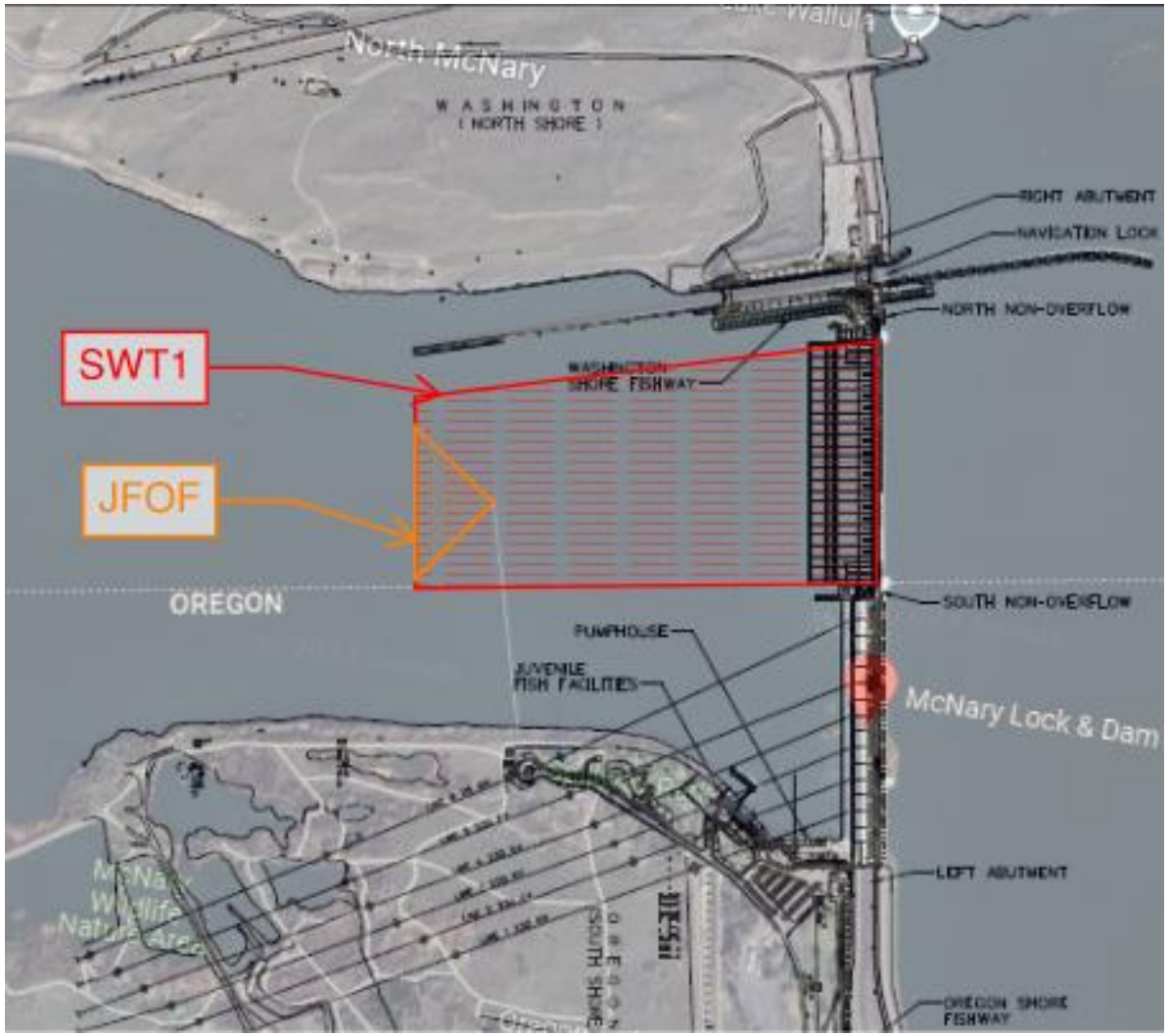
Primary Avian Predation Zones

- Input from Bobby Johnson and Chris Peery during Site Visit.
- FFDRWG comments regarding change of dam operations where a majority of juvenile salmonid pass through spillways.



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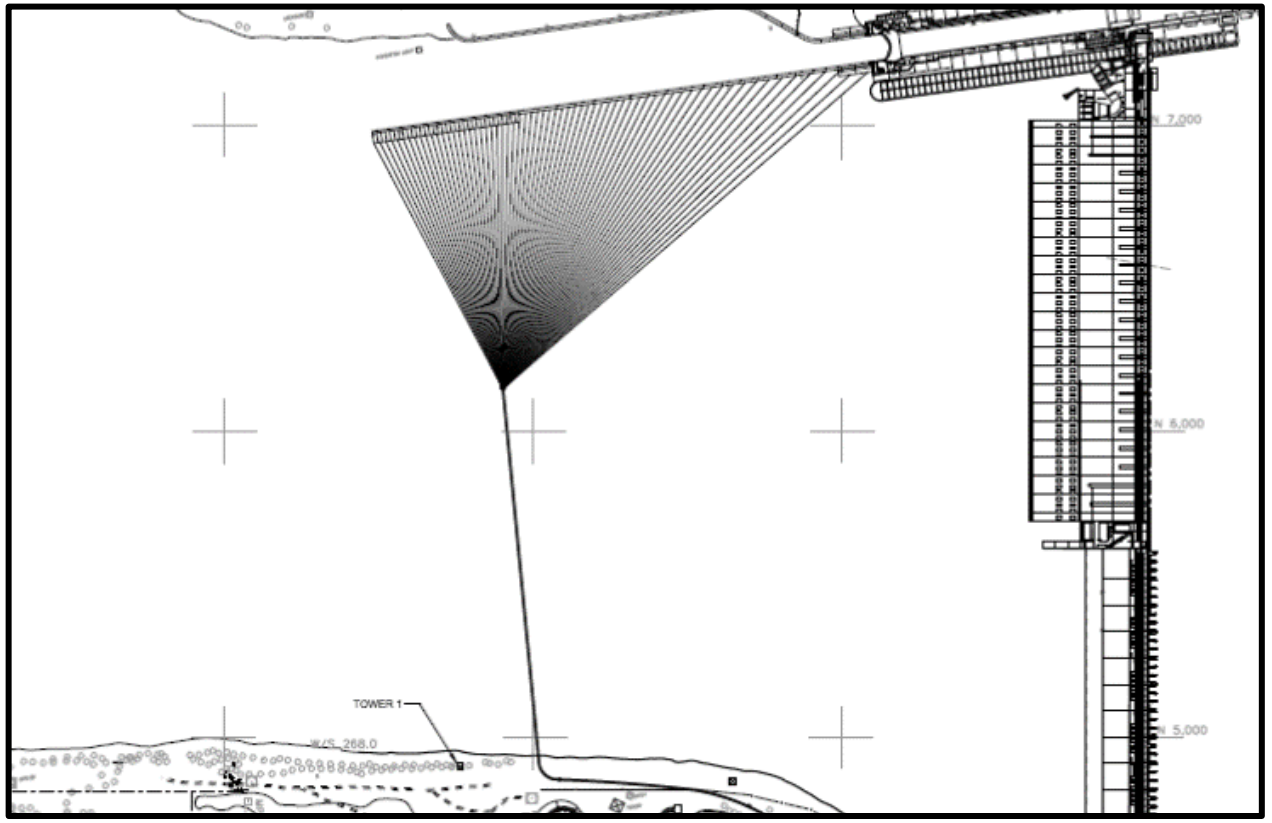
Alternative 1. (feasibility report alternative)

JBS Outfall Pier to Nav Lock Guidewall.

- Screened out due to structural load on outfall pier.



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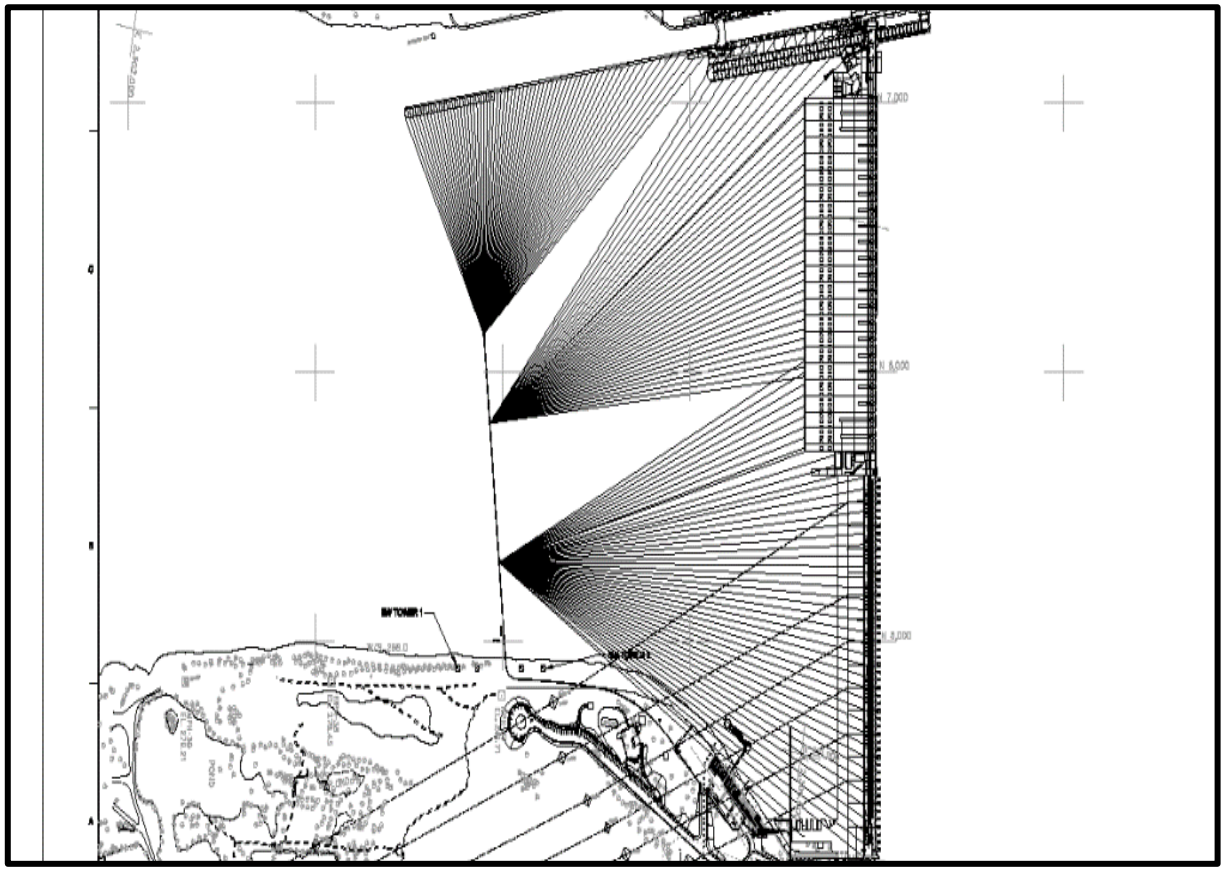
Alternative 2. (feasibility report alternative)

JBS Outfall Pier to Nav Lock Guidwall, Spillway, and Powerhouse.

- Screened out due to structural load on outfall pier.



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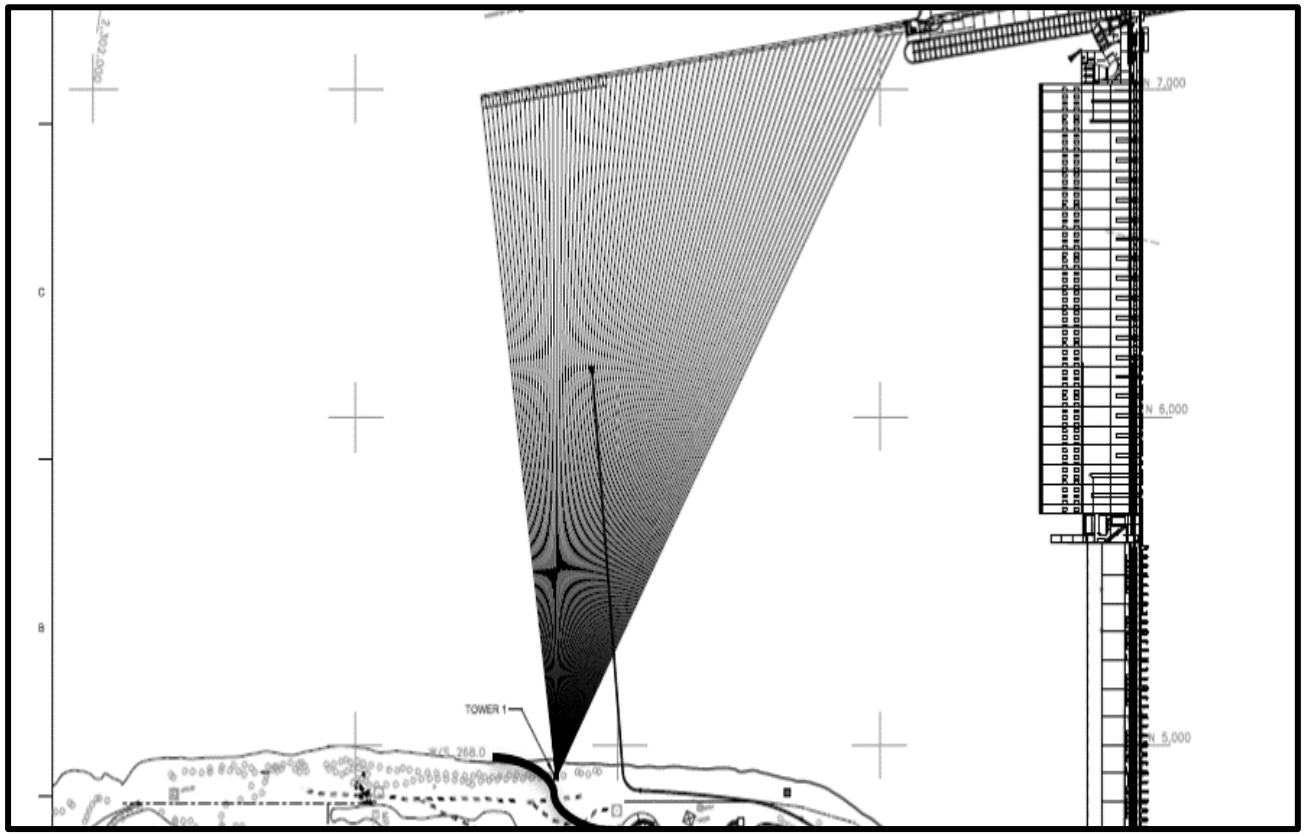
Alternative 3. (feasibility report alternative)

Oregon Shoreline to Nav Lock Guidewall.

- Highest predation concentration area coverage.
- Not attached to spillway/powerhouse.
- Little impact on project operations.



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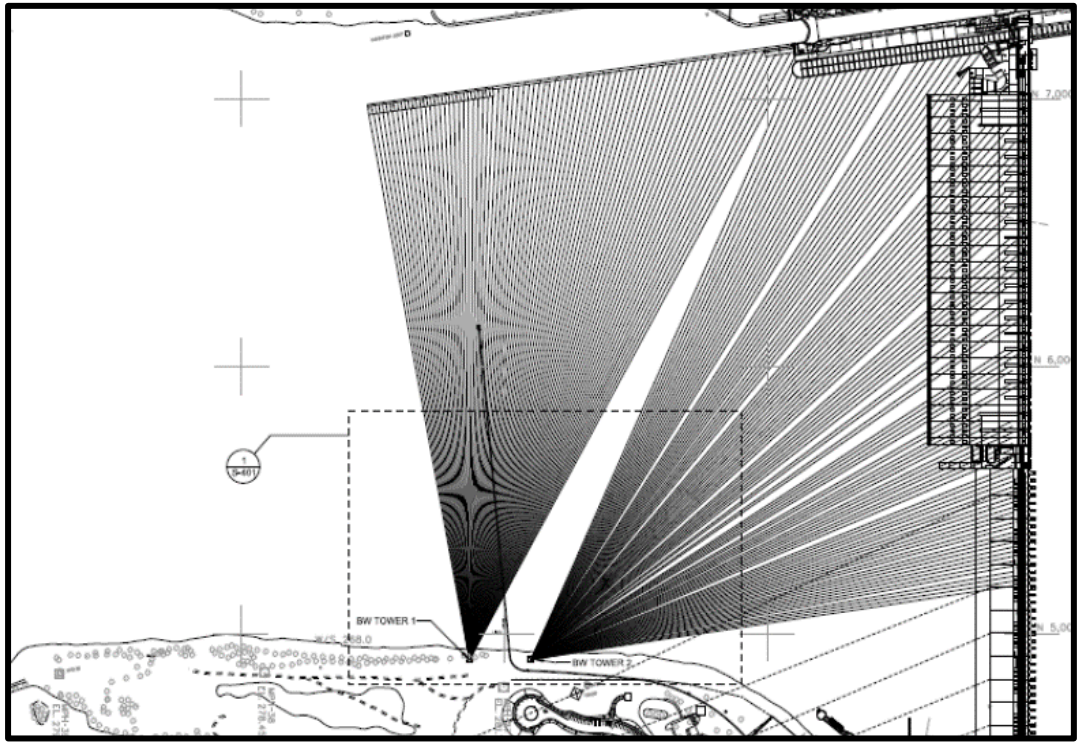
Alternative 4. (feasibility report alternative)

Oregon Shoreline to Nav Lock Guidewall, Spillway, and partial powerhouse.

- Covers area where most predation occurs.
- Spillway/powerhouse install/maintenance would impact operations.
- Few smolts pass through powerhouse.
- Turbulence in tailrace below spillway prevents predation in high spill operations.



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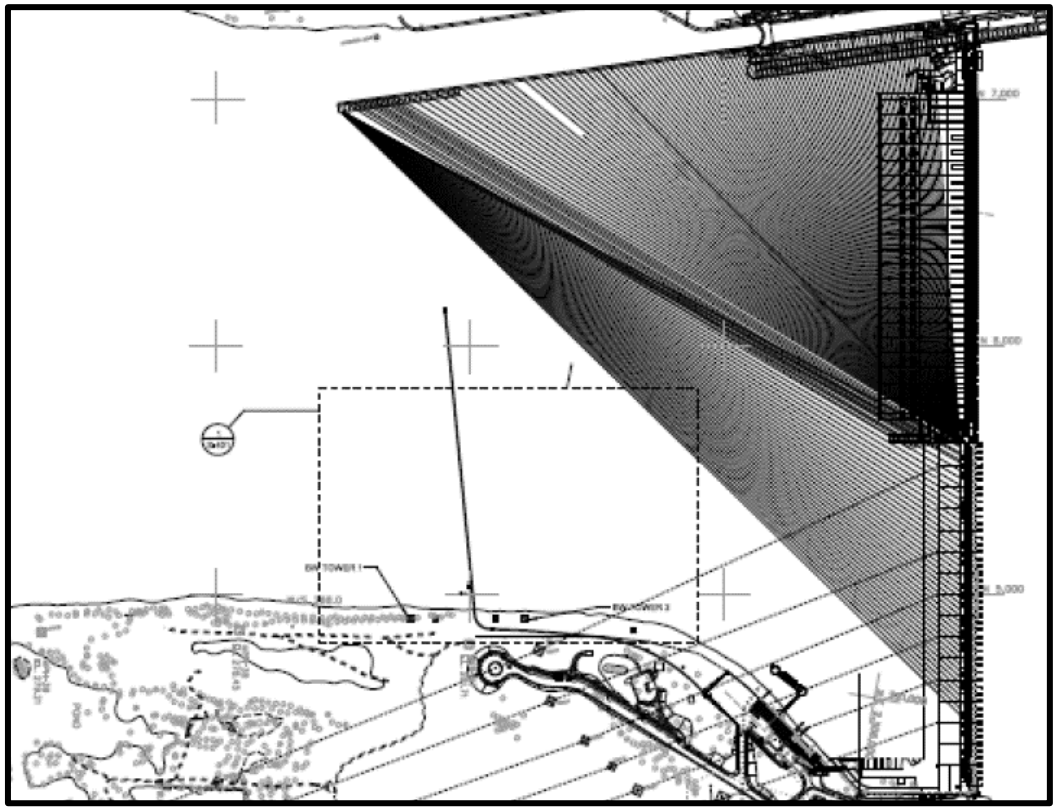
Alternative 5. (feasibility report alternative)

Powerhouse and Spillway to Nav Lock and guidewall.

- Overlaying wires difficult to install/repair.
- Few smolts pass through powerhouse.
- Turbulence in tailrace below spillway prevents predation in high spill operations.
- Spillway/powerhouse install/maintenance would impact operations.



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Jacobs Alternatives

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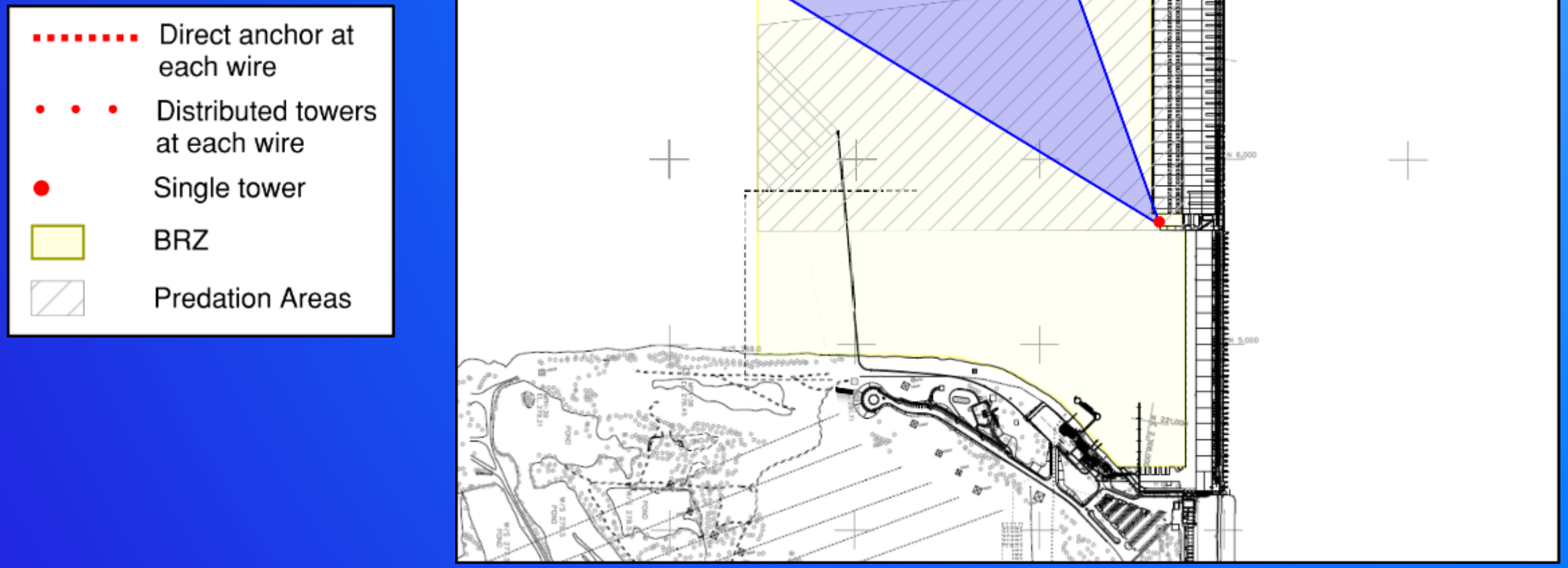
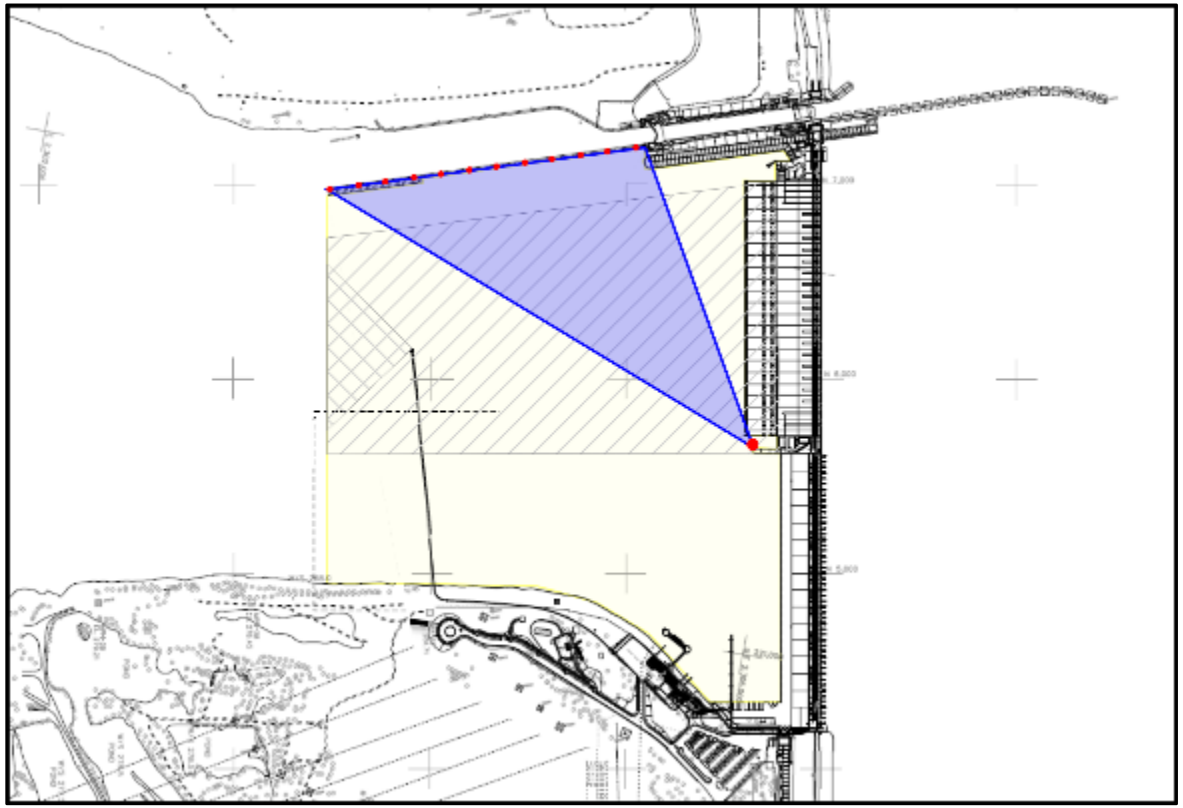
Alternative 6. Tailrace Pier – Navigation Lock and Guidewall Array



Alternative 6. Tailrace Pier – Navigation Lock and Guidewall Array

- Pros
  - Partial coverage of spillway tailrace.
  - No new structural support needed in water.
- Cons
  - No coverage at JFOF or downstream tailrace.
  - Single or distributed towers needed at all wire attachment points.
  - Max wire span about 2,600 ft.



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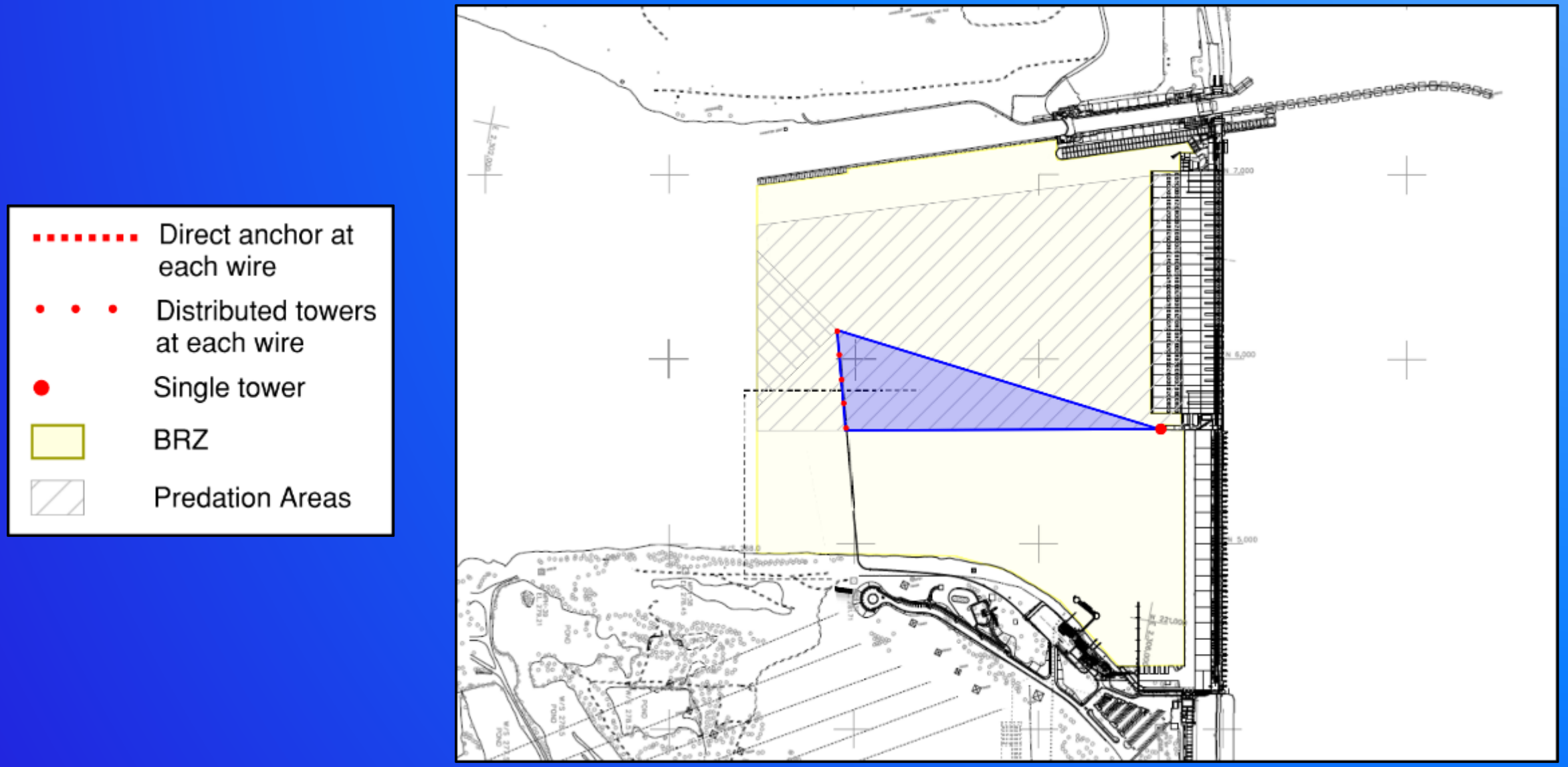
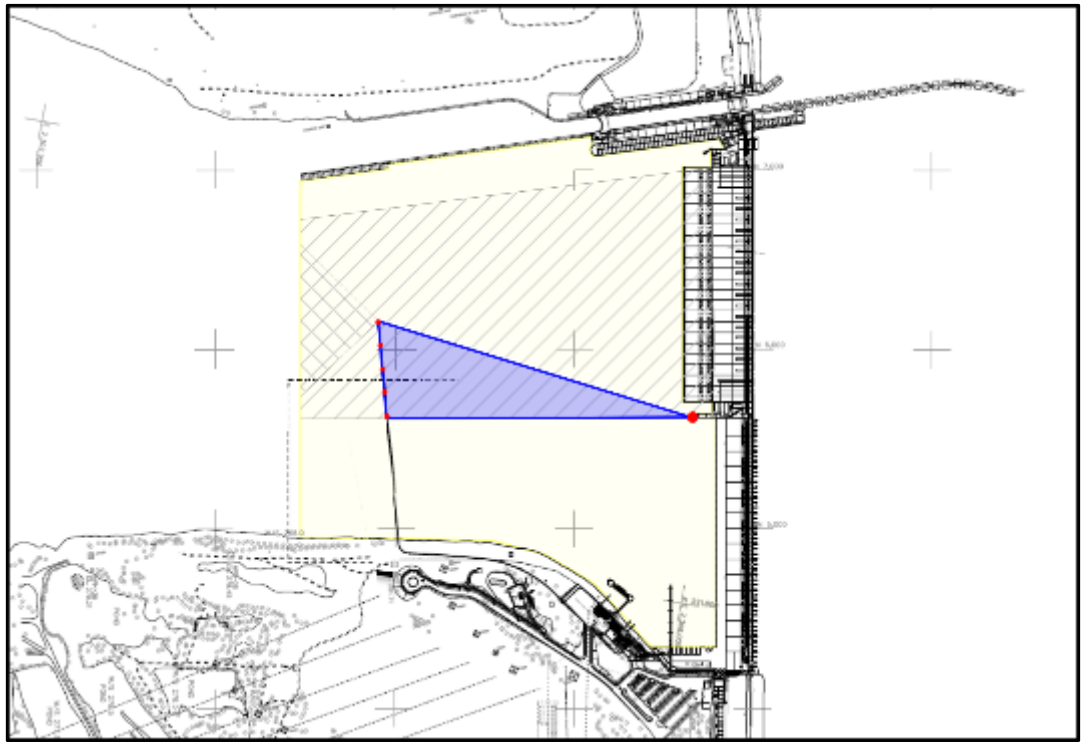
Alternative 7. Tailrace Pier to JBS Outfall Pier



Alternative 7. Tailrace Pier to JBS Outfall Pier

- Originally Screened out due to structural load on outfall pier. Considered feasible after further investigation.
- Pros
  - Partial coverage of spillway tailrace.
  - No new structural support needed in water.
  - Max wire span about 1,900 ft.
- Cons
  - No coverage at JFOF and limited coverage at north tailrace.
  - Single or distributed towers needed at all wire attachment points.



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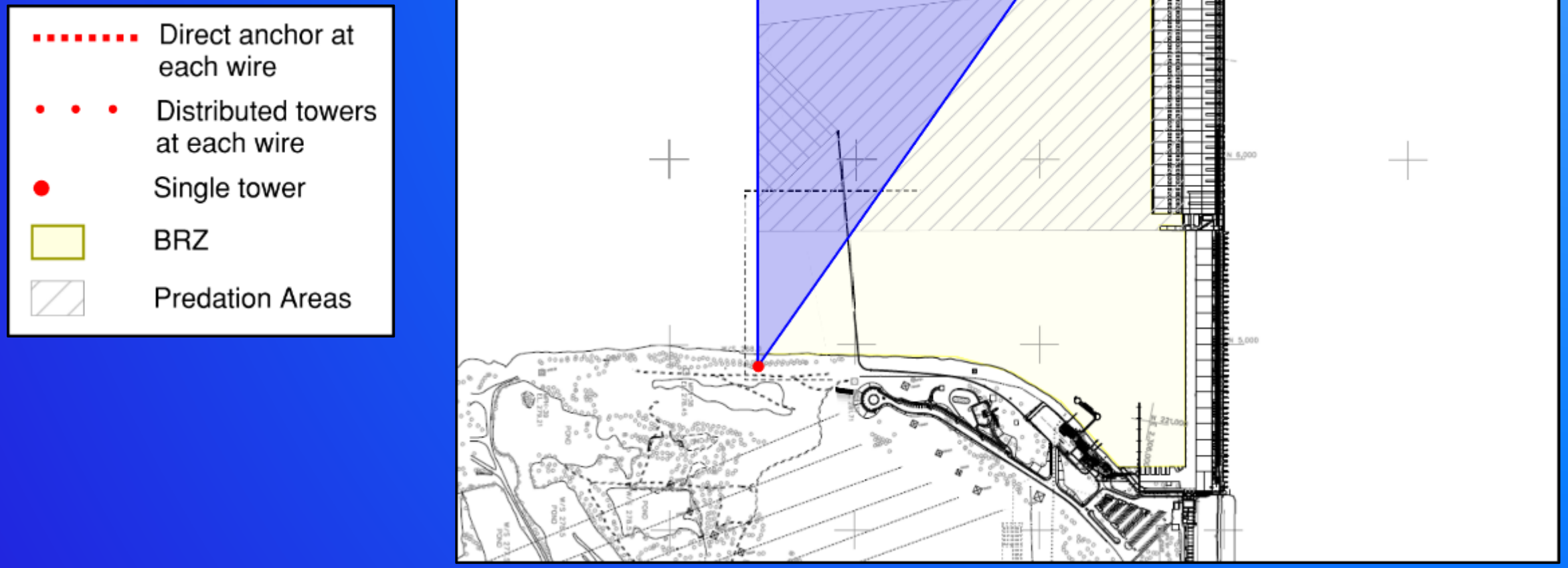
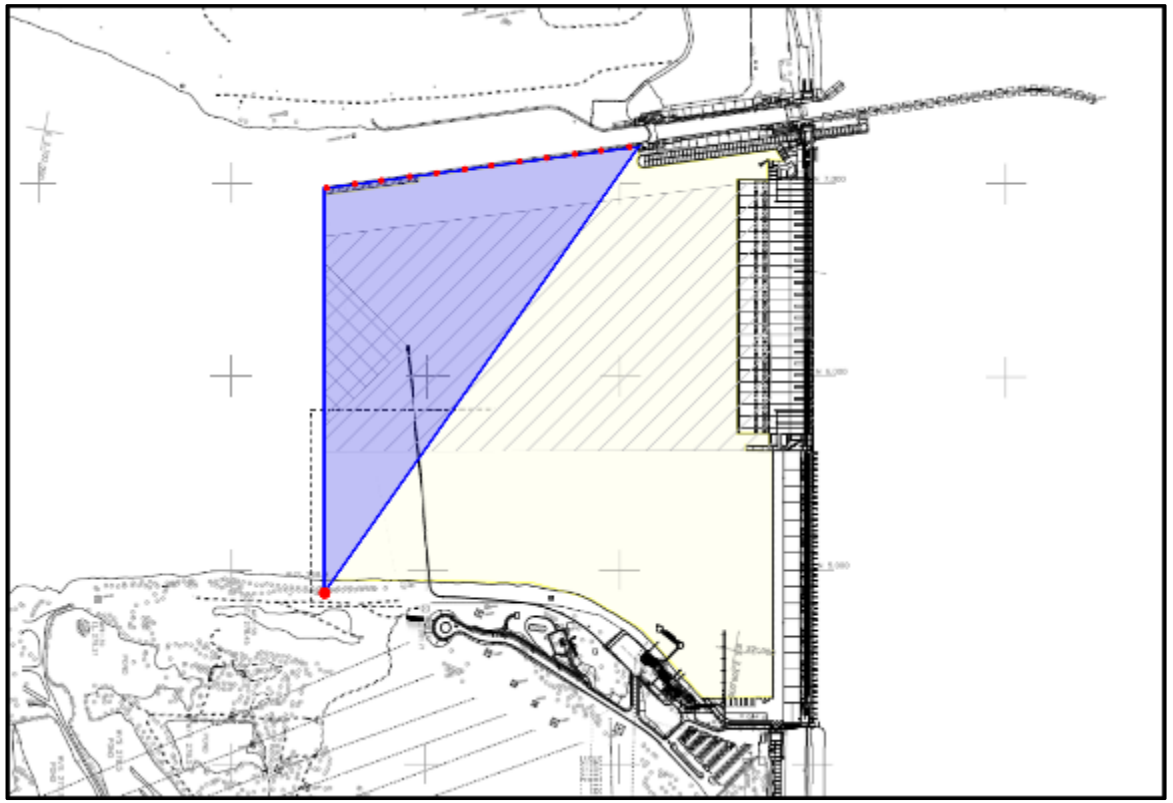
Alternative 8. Oregon Shore to Navigation Lock Guidewall Array



Alternative 8. Oregon Shore to Navigation Lock Guidewall Array

- Pros
  - Good coverage of JFOF and partial coverage of spillway tailrace.
  - No new structural support needed in water.
  - Install/maintenance would have little impact on project operations.
- Cons
  - Single or distributed towers needed at all wire attachment points.
  - New tower foundation required at south shore.
  - Max wire span about 2,900 ft.



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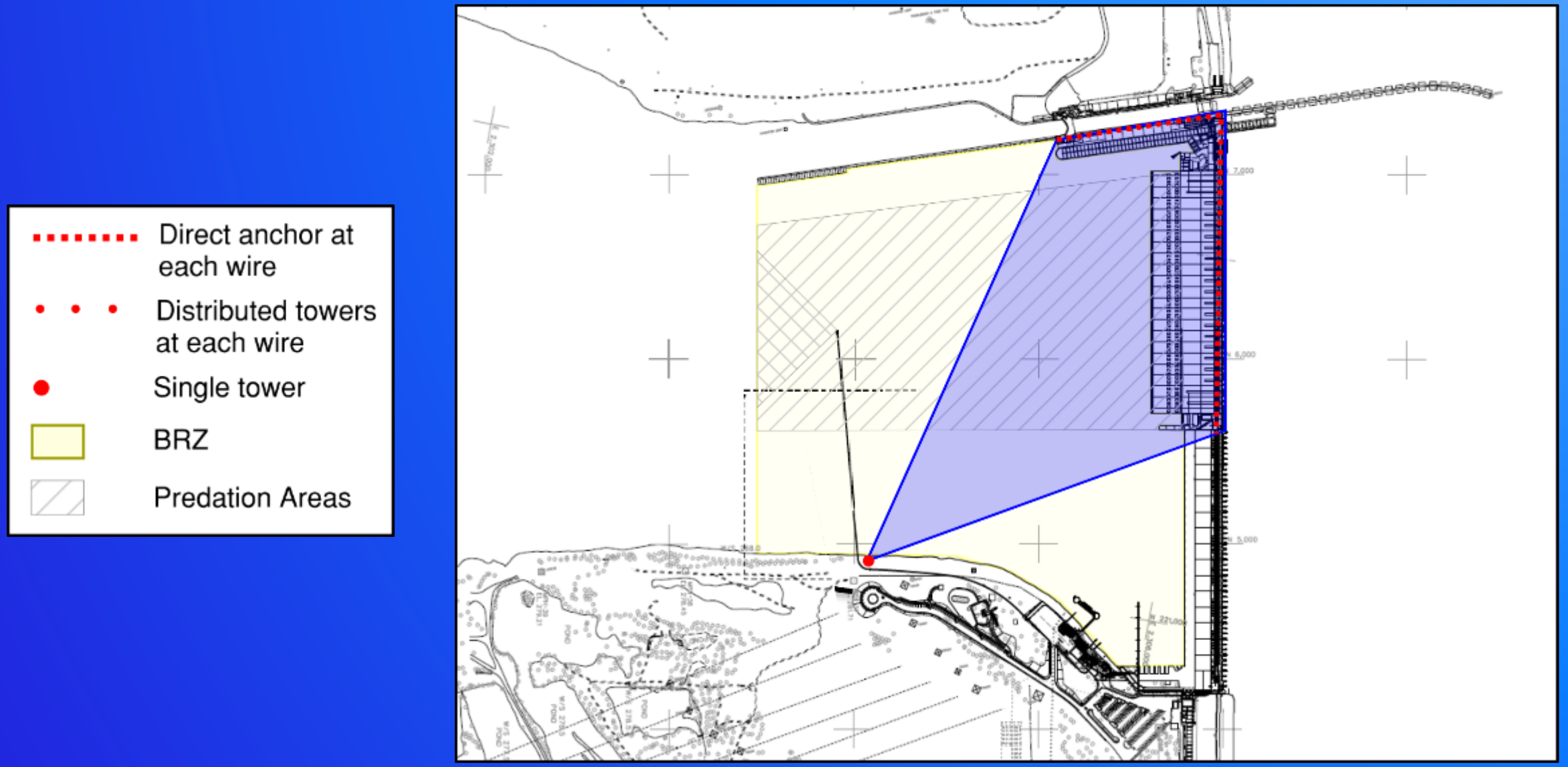
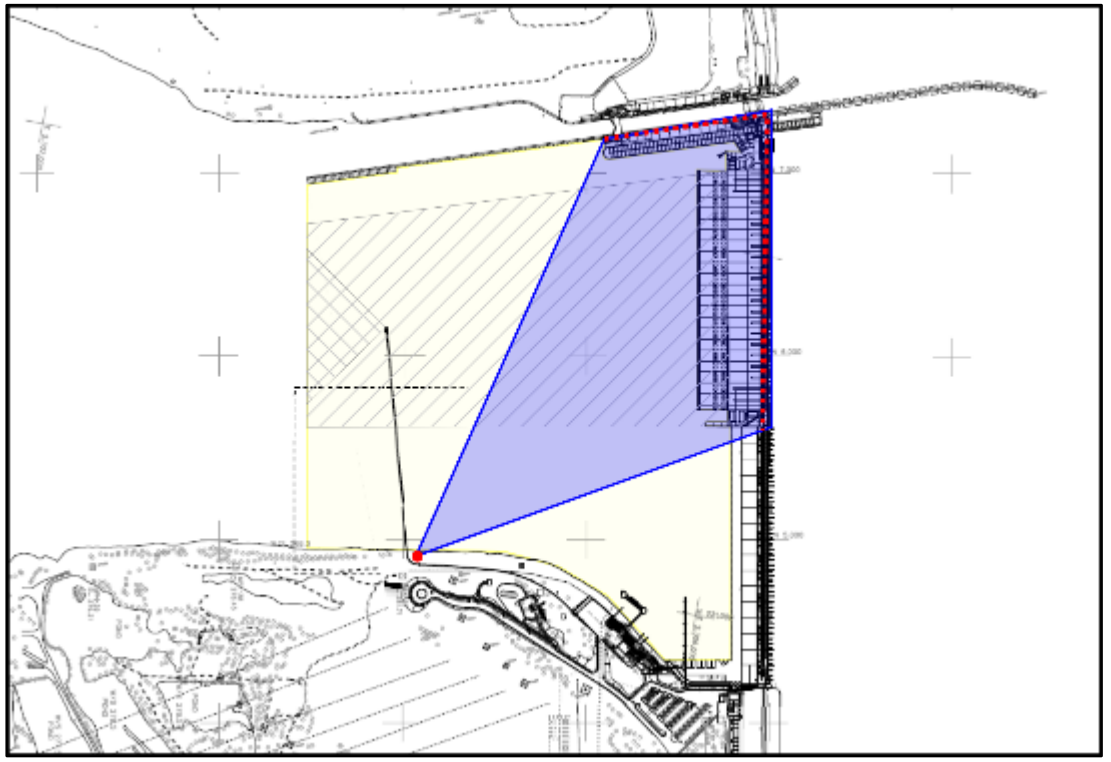
Alternative 9. Oregon Shore to Navigation Lock and Spillway Array



Alternative 9. Oregon Shore to Navigation Lock and Spillway Array

- Pros
  - Partial coverage of spillway tailrace.
  - No new structural support needed in water.
- Cons
  - No coverage at JFOF or downstream tailrace.
  - Single tower needed at south shore.
  - New tower foundation required at south shore.
  - Max wire span about 3,100 ft.
  - Install/maintenance would impact project operations .



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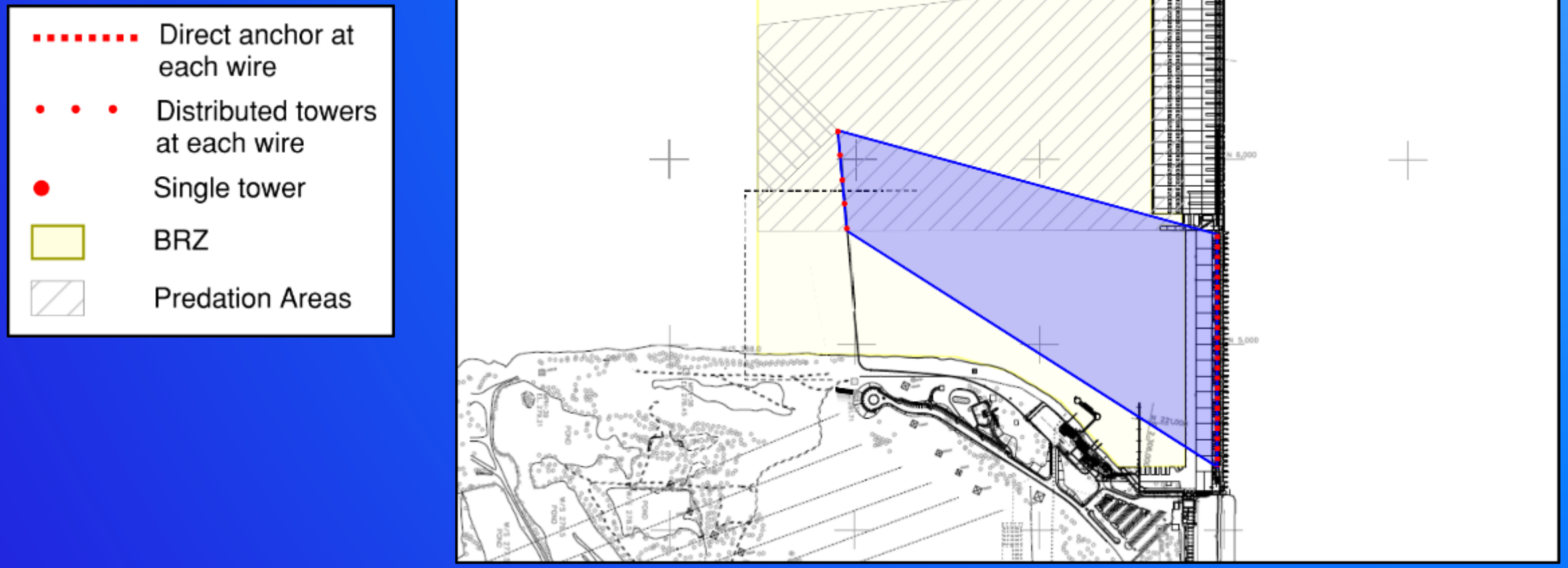
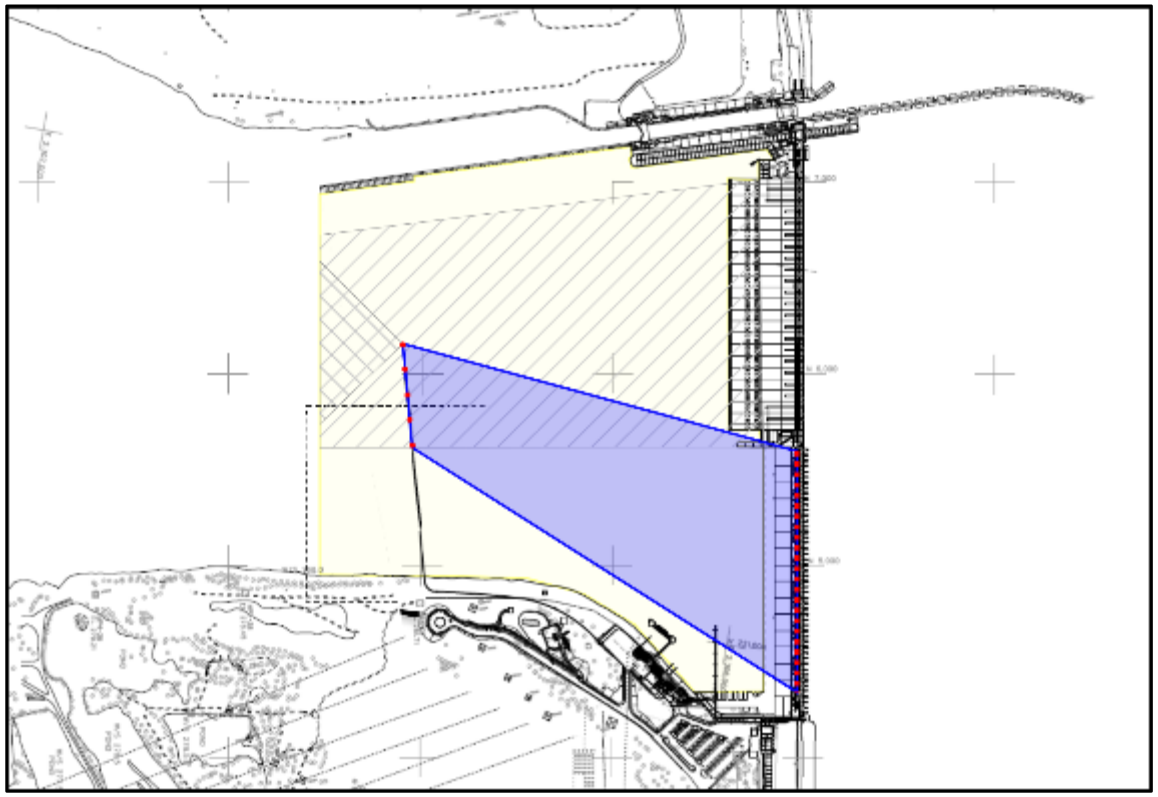
Alternative 10. JBS Outfall Pier to Powerhouse Array



Alternative 10. JBS Outfall Pier to Powerhouse Array

- Originally Screened out due to structural load on outfall pier. Considered feasible after further investigation.
- Pros
  - No new structural support needed in water
  - No large single towers needed and distributed towers limited to small portion of outfall pier
- Cons
  - No coverage at JFOF and limited coverage at north tailrace
  - Distributed towers needed at outfall pier attachment points
  - Max wire span about 2,500 ft



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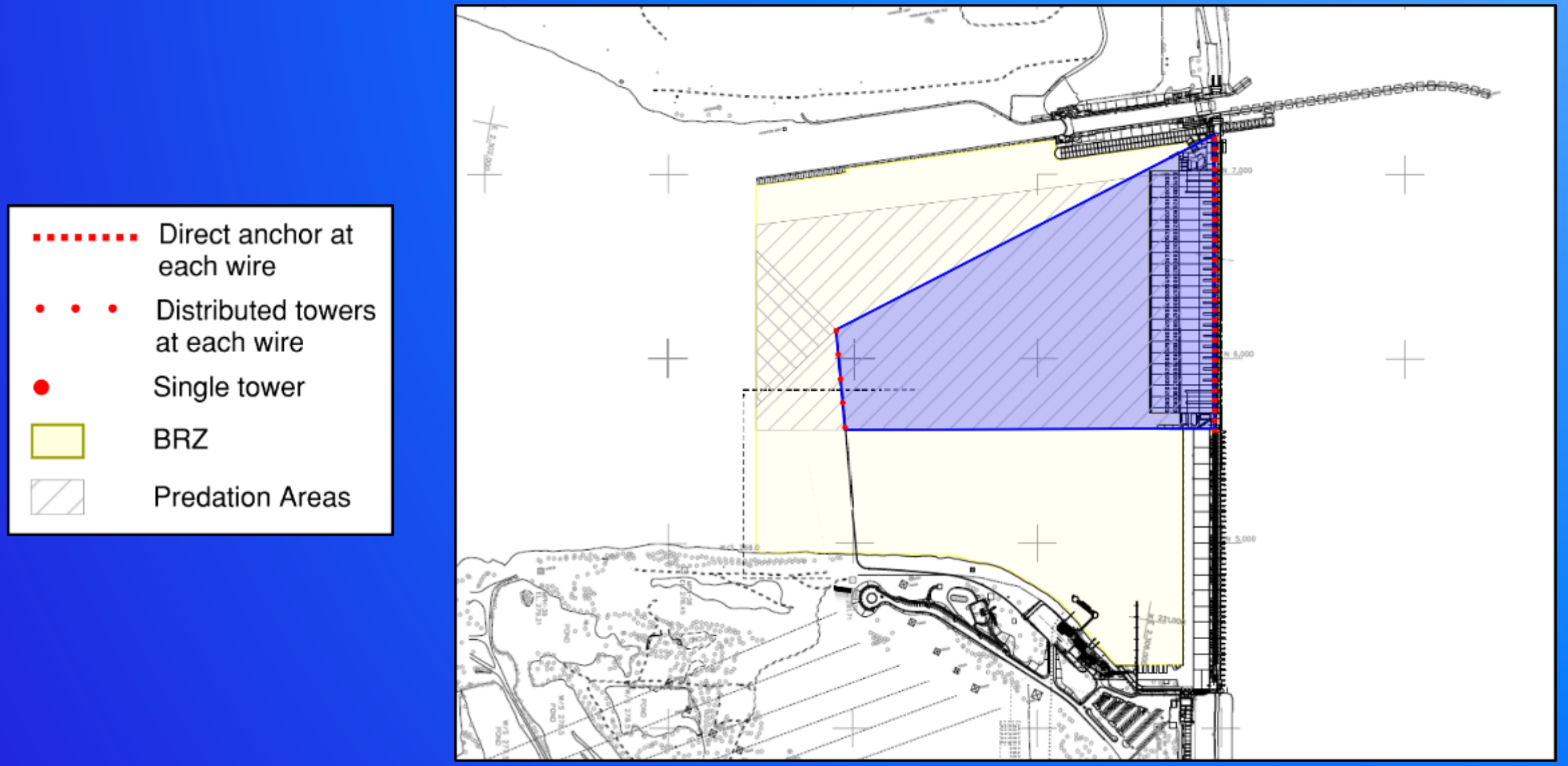
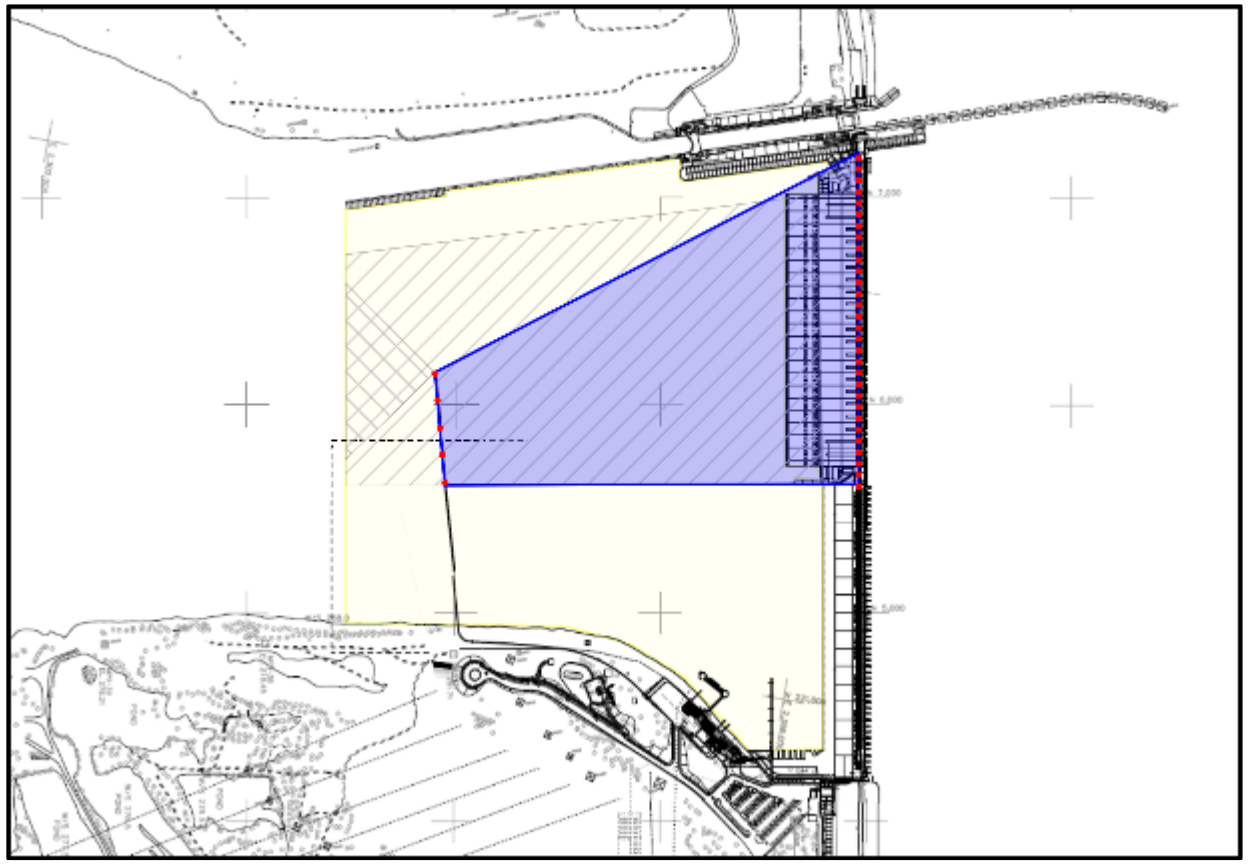
Alternative 11. JBS Outfall Pier to Spillway Array



Alternative 11. JBS Outfall Pier to Spillway Array

- Originally Screened out due to structural load on outfall pier. Considered feasible after further investigation.
- Pros
  - Coverage of spillway tailrace
  - No new structural support needed in water
- Cons
  - No coverage at JFOF
  - Distributed towers needed at outfall pier attachment points
  - Max wire span about 2,400 ft



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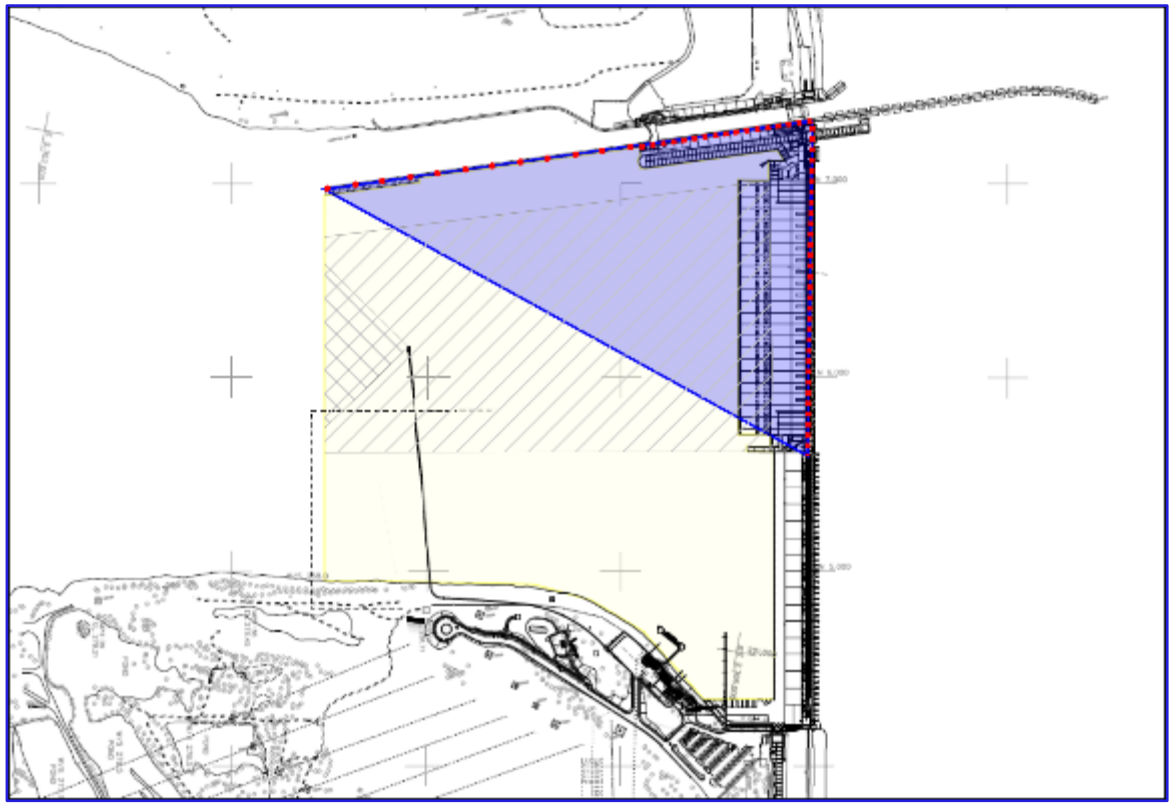
Alternative 12. Navigation Lock Guidewall to Spillway

Alternative 12. Navigation Lock Guidewall to Spillway Array

- Pros
  - Partial coverage of spillway tailrace
  - No new structural support needed in water
- Cons
  - No coverage at JFOF
  - Distributed towers needed at navigation guide wall attachment points
  - Install/maintenance would impact project operation.
  - Covers little predation area during high spill.
  - Max wire span about 2,900 ft



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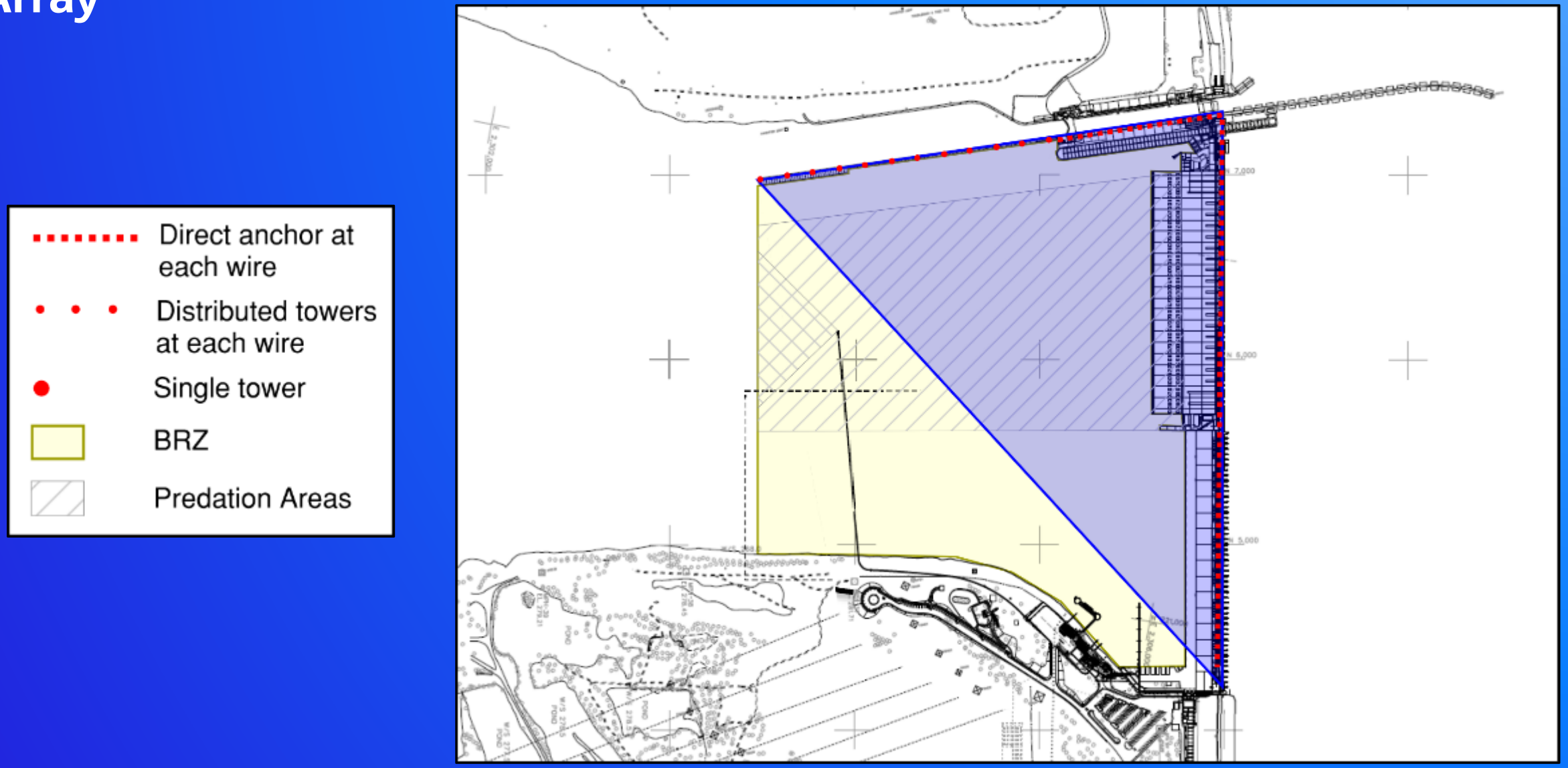
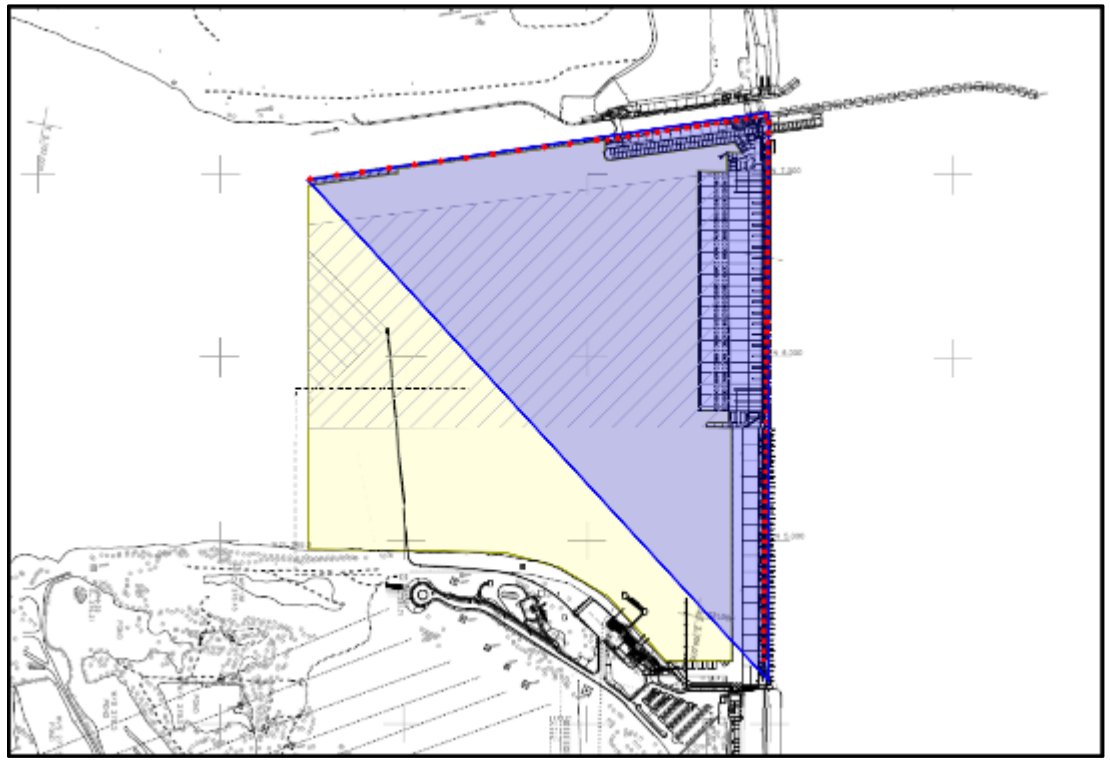
Alternative 13. Navigation Lock Guidewall to Spillway and Powerhouse Array



Alternative 13. Navigation Lock Guidewall to Spillway and Powerhouse Array

- Screened out due to installation challenges and lack of coverage at JBS outfall.
- Pros
  - Partial coverage of powerhouse tailrace and good coverage of spillway tailrace
  - No new structural support needed in water
- Cons
  - No coverage at outfall or downstream tailrace.
  - Distributed towers needed at navigation guide wall attachment points
  - Max wire span about 3,800 ft



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Alternative In-water Deterrent System

- Aerial arrays are ineffective against pelicans (surface foraging) and cormorants (diving birds)
- Alternative Deterrents
  - Use cables with floats arranged parallel to the riverbank, utilizing the river's current
  - Cables rise and fall with water levels, extending over the boat restrictive zone (BRZ)
  - Rudders attached to cables create undulating motion, deterring birds and preventing debris accumulation
  - Floating balls made from durable, weather-resistant materials cover large areas, reducing predation risk

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Other Potential Disadvantages

- Debris Accumulation
  - Potential for Clogging - risk that floating balls could become clogged with debris, requiring regular cleaning
  - Environmental Debris - natural events like storms could increase debris load, challenging the effectiveness of the array
- Effectiveness Variability
  - Species Adaptation - birds may eventually adapt to the deterrents, reducing their effectiveness over time
  - Behavioral Changes - some bird species might find ways to navigate around or through the deterrents, diminishing their effect
- Aesthetic and Recreational Impact
  - Visual Impact - floating balls or cables may be considered unsightly, affecting the aesthetic value of the river
  - Recreational Use – potentially impacts recreational activities such as boating, fishing, or swimming

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Example of Floating In-water Array

- **Debris-Free Design**
  - The floating balls will be arranged in parallel lines with the riverbank, without perpendicular attachments
- **Durable Materials**
  - The floating balls used will be made from durable, weather-resistant materials
- **Self-Cleaning Motion**
  - The use of the river's current to spread the floating balls downstream creates a natural, self-cleaning motion

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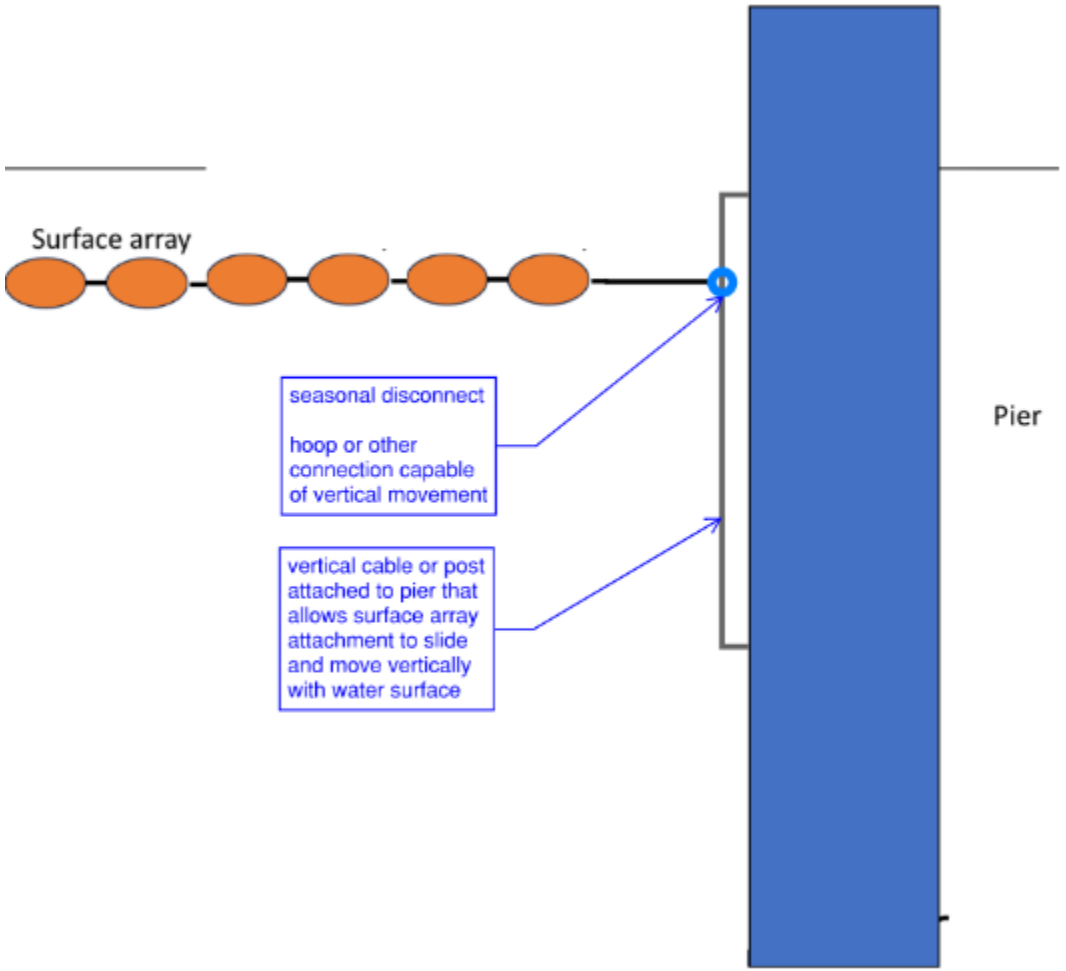
Cables with Floats – Advantages

- Deters diving birds like cormorants and pelicans
- Simple Tethering System
  - Cables tethered to a vertical bar attached to permanent structures like the outfall piers or dam, which are stable, require minimal adjustments, and adapts to changing water levels
  - Less prone to wear and tear, minimizing the need for ongoing maintenance
- Potential to be removed seasonally



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Cables with Floats – Disadvantages

- Installation Complexity
  - Installing cables with floats and rudders may be technically challenging, requiring specialized equipment and skilled labor
- Maintenance Requirements
  - Wear and tear of cables, floats, and attachment points requiring regular inspections and maintenance
  - Ensuring the rudders remain functional and effective in creating undulating motion
- Added Structural Load to Outfall Piers
- Environmental Impact
  - Installation and presence of cables may disrupt local aquatic habitats and affect other wildlife
  - Cables could potentially alter water flow patterns, affecting sediment transport and aquatic vegetation

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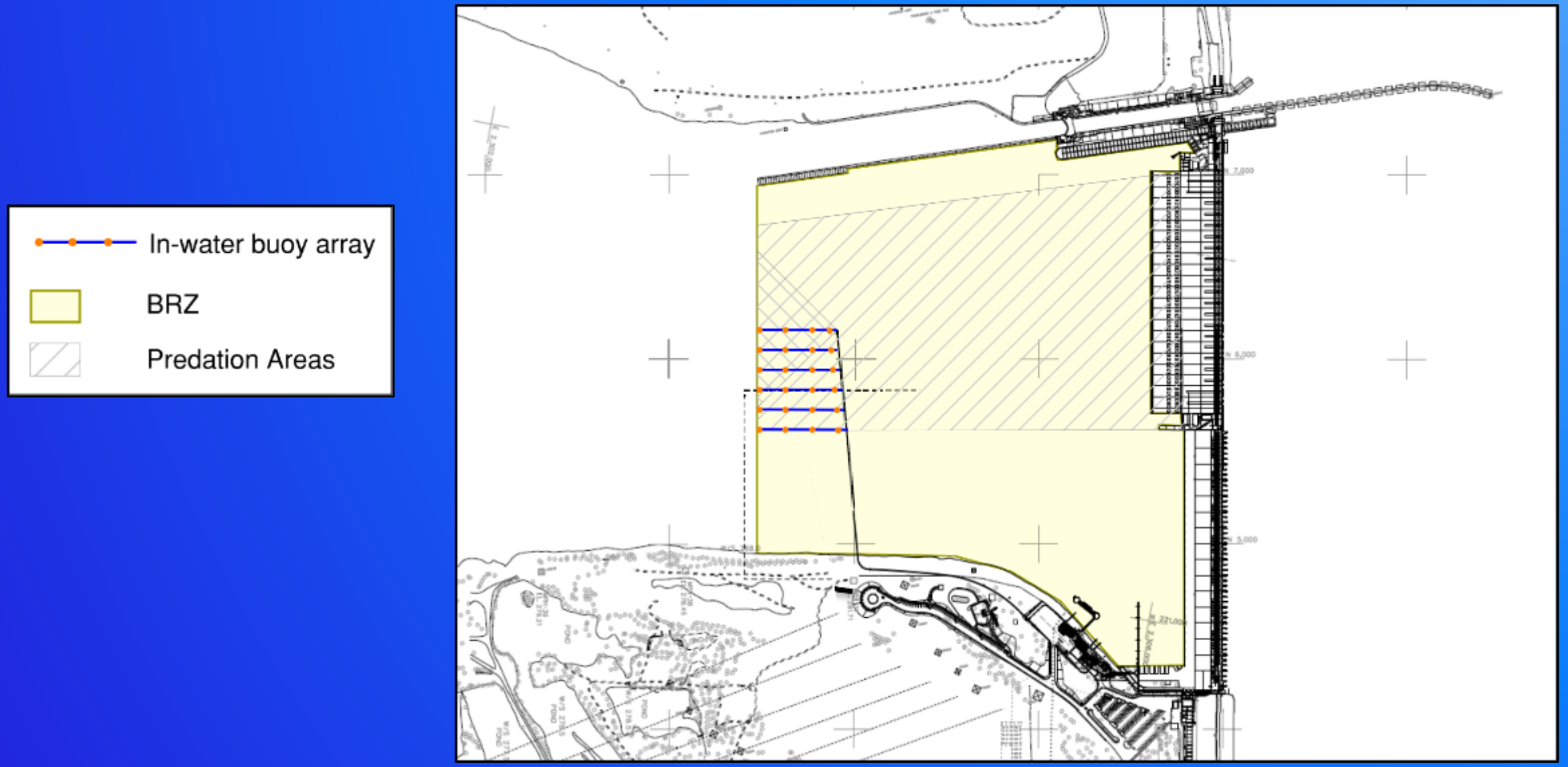
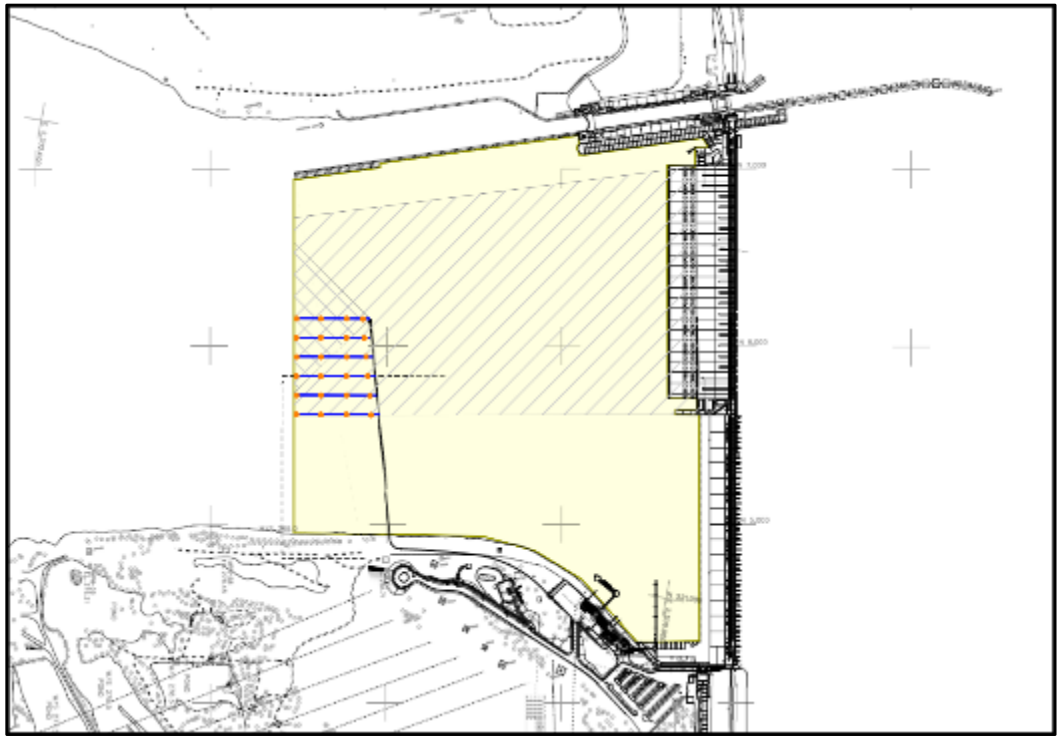
Alternative 14. In-Water Floating Array



Alternative 14. In-Water Floating Array

- Pros
  - Partial coverage of JBS outfall
    - No new structural support needed in water
    - No aerial wires and towers
    - Could be a cost-effective proof of concept
- Cons
  - No coverage at tailrace
  - Waterborne debris may impact floating array



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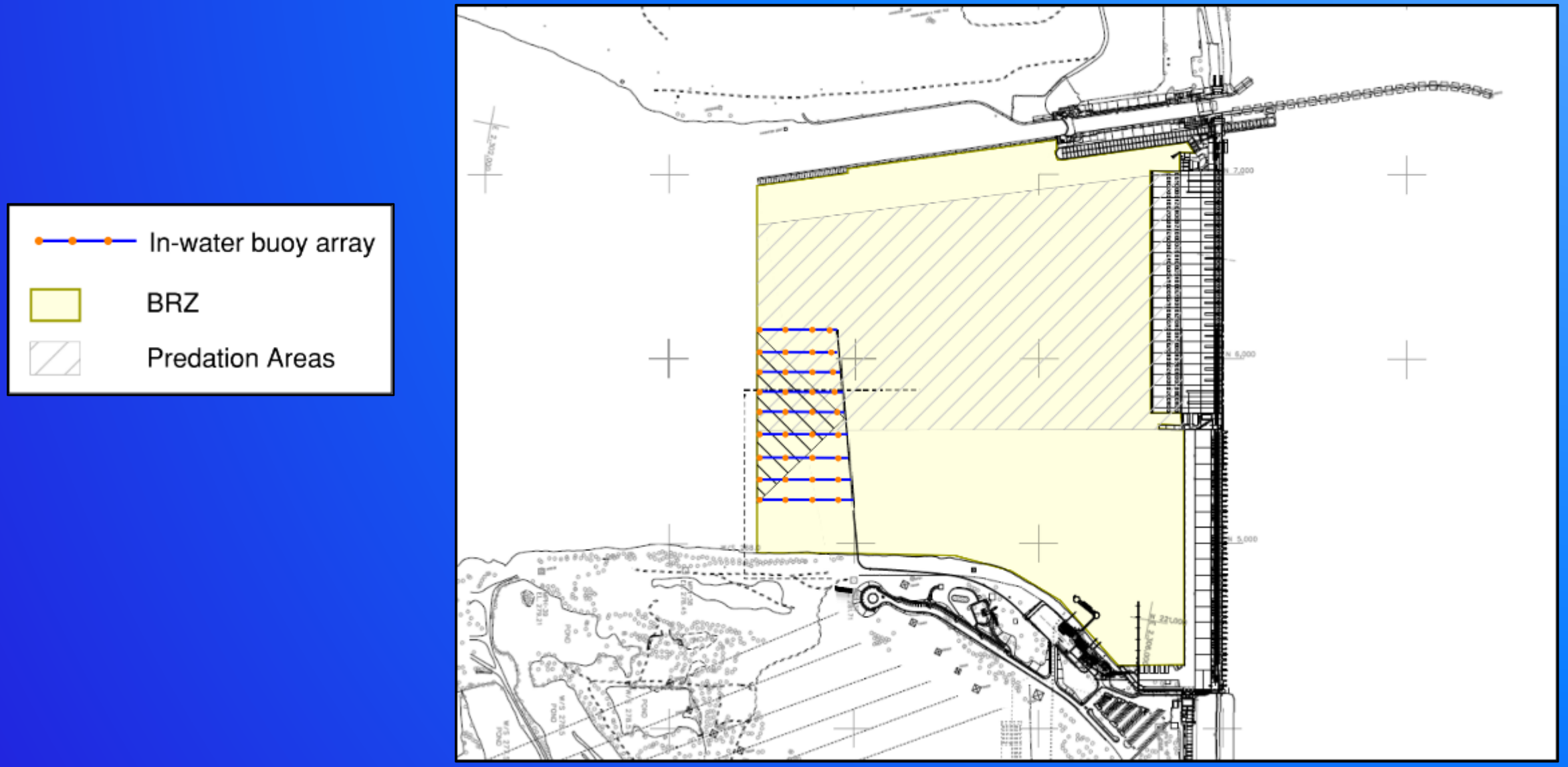
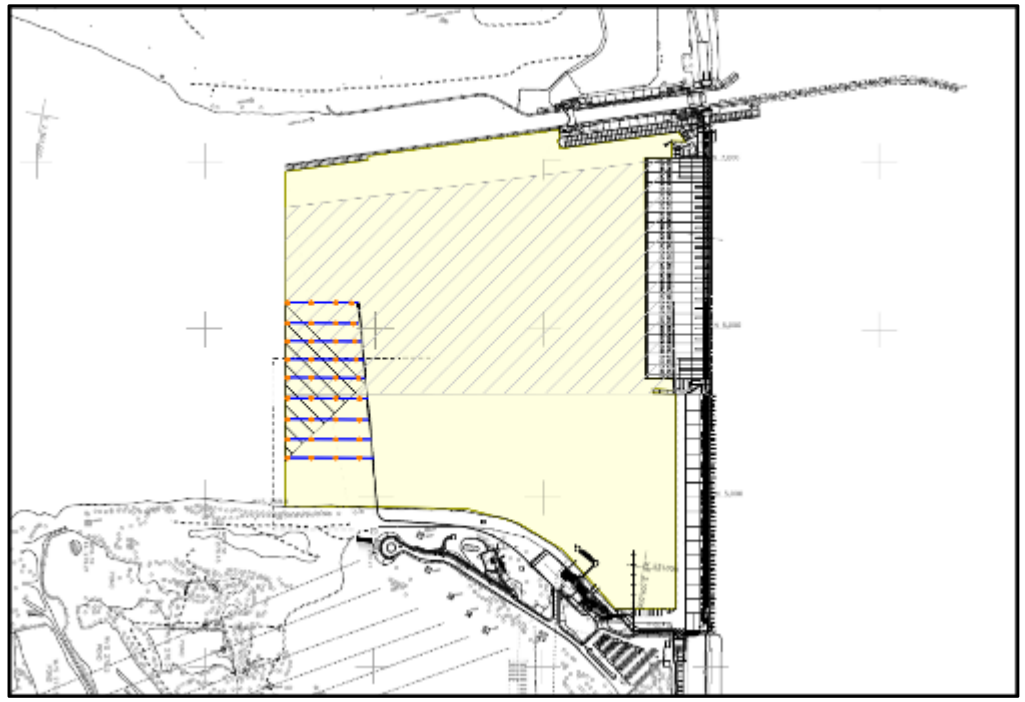
Alternative 15. In-Water Floating Array with Modified Outfall Location



Alternative 15. In-Water Floating Array with Modified Outfall Location

- Screened out. Would require moving the outfall.
- Pros
  - Good coverage of JBS outfall
  - No new structural support needed in water
  - No wires and towers
- Cons
  - No coverage at tailrace
  - Waterborne debris may impact floating array
  - Modification of outfall location



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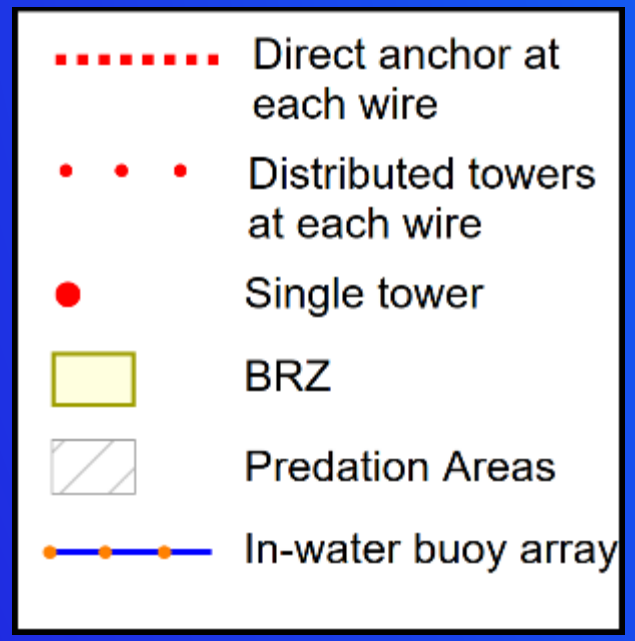
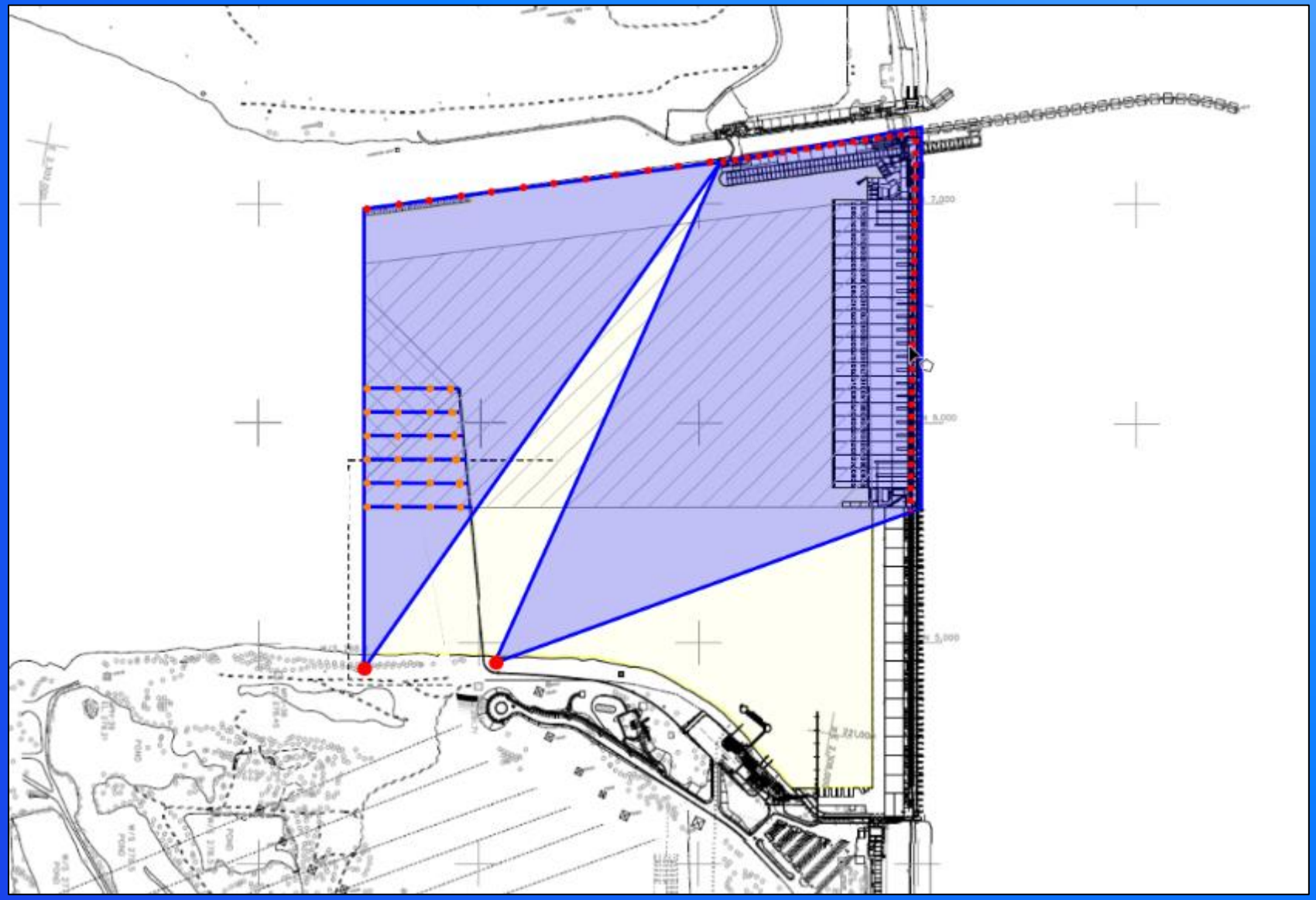
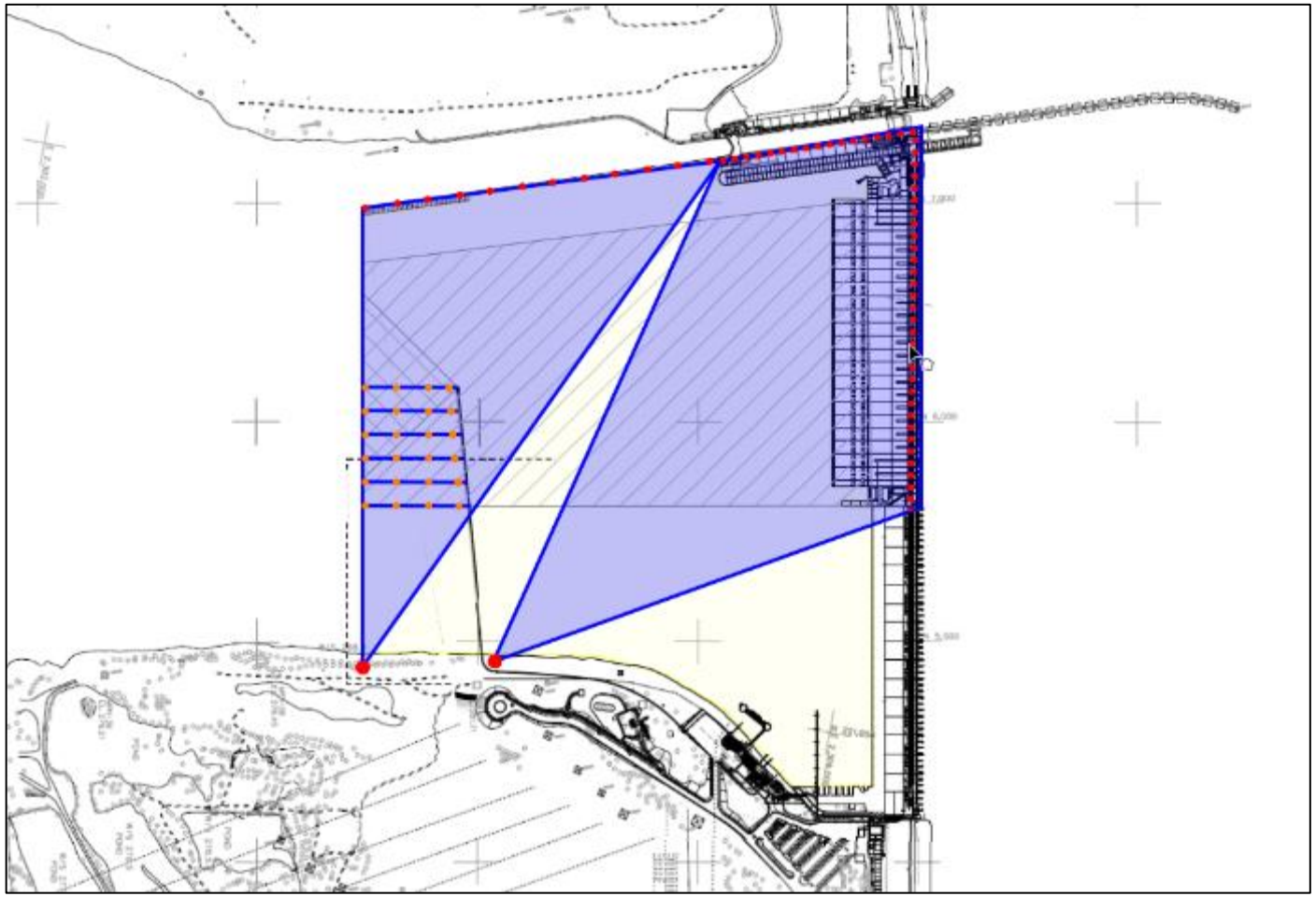
Alternate 16. Wire Arrays "Oregon Shoreline to Guidewall" and "Oregon Shoreline to NavLock to Spillway Decks" and In-water Array





Alternate 16. Wire Arrays "Oregon Shoreline to Guidewall" and "Oregon Shoreline to NavLock to Spillway Decks" and In-water Array

- Pros
  - Excellent coverage of full Predation Priority Area
  - Structural towers on shore
  - Provides protection against gulls, pelicans and cormorants
- Cons
  - Install/maintenance would impact project operation.
  - In-water array untested
  - Routine maintenance due to waterborne debris



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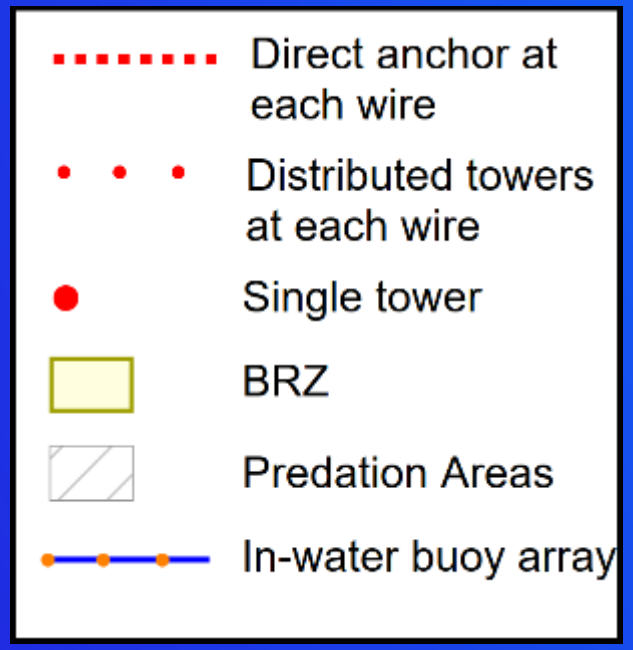
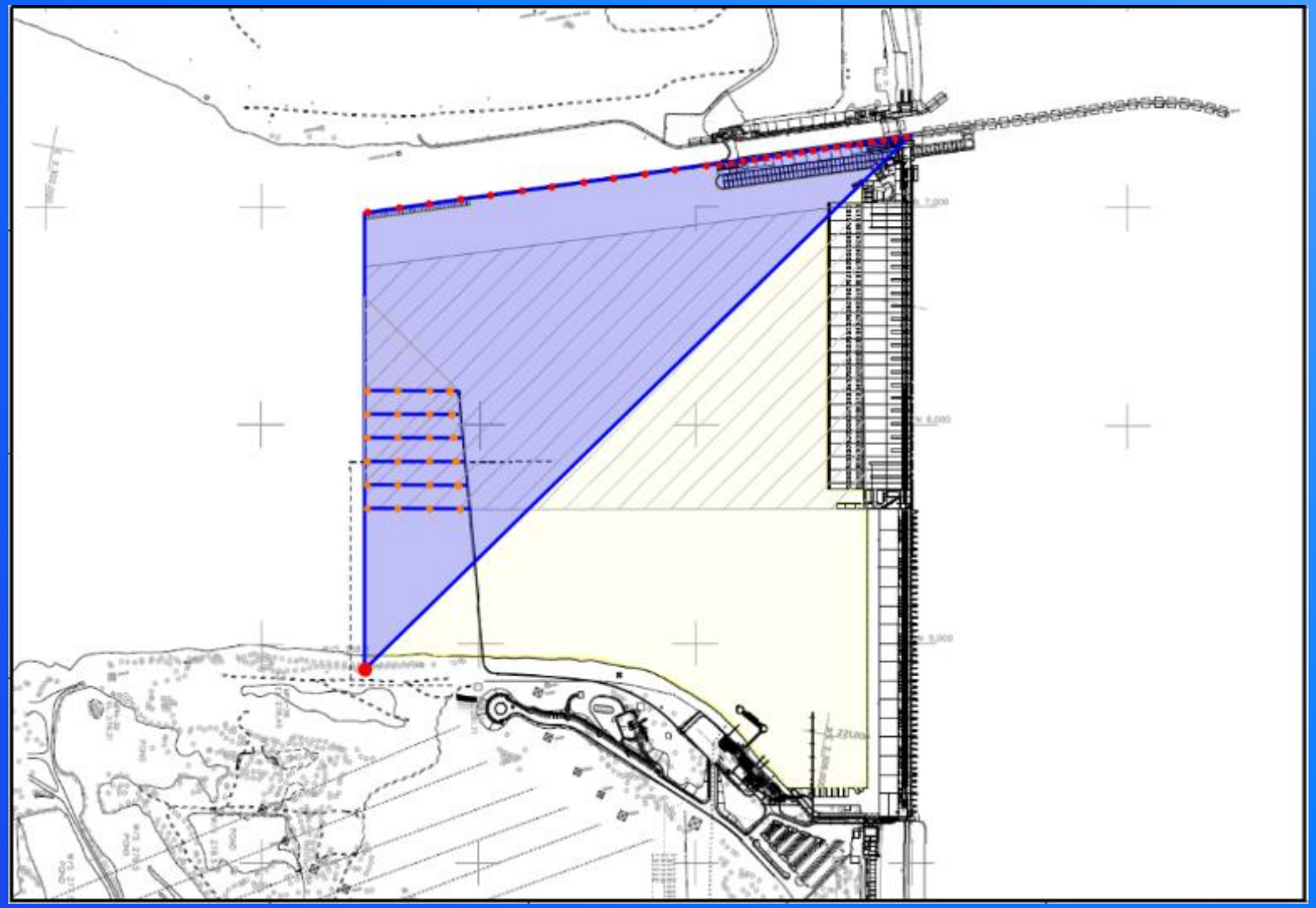
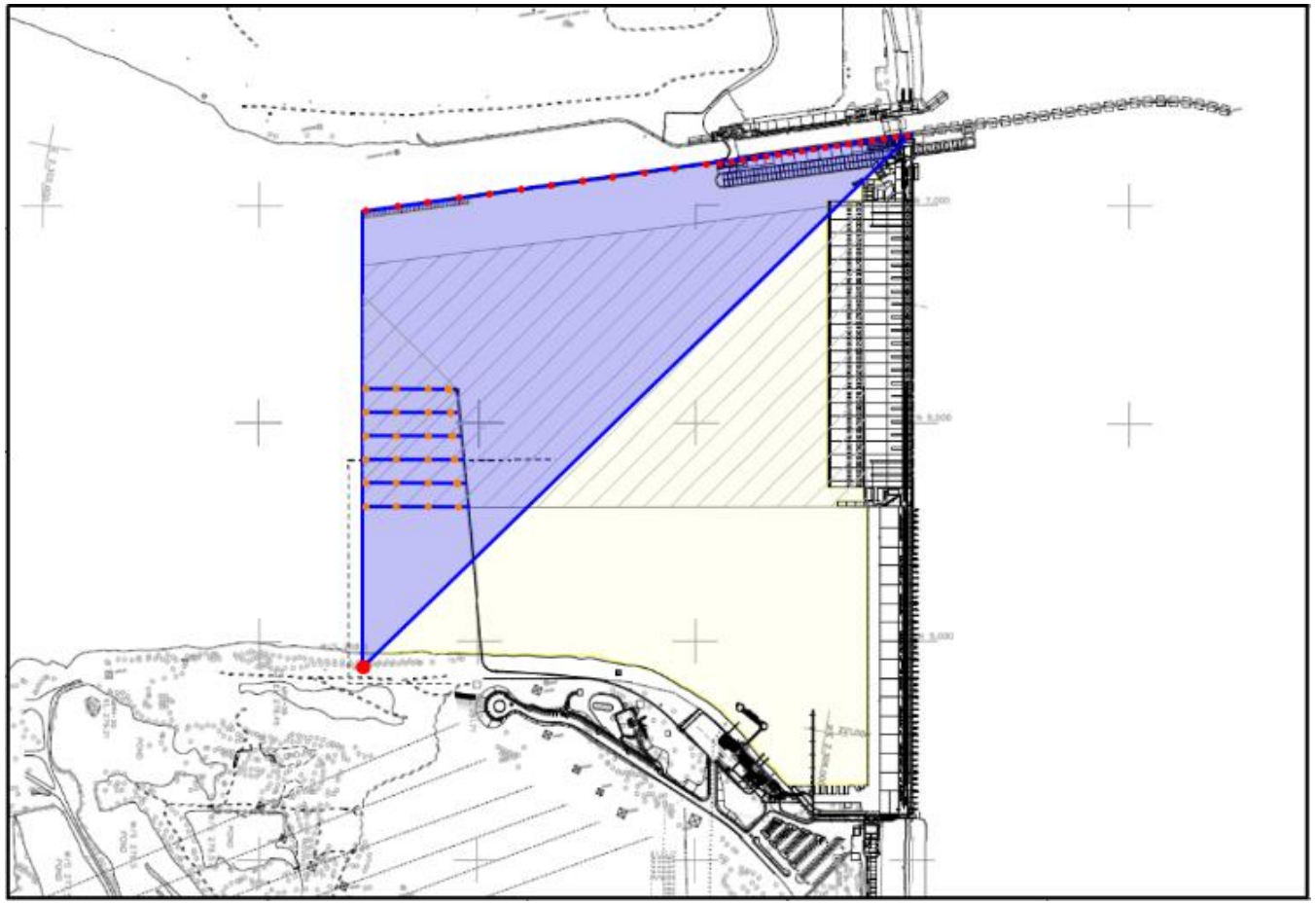
Alternate 17. Wire Array "Oregon Shoreline to Guidewall Expanded to NavLock Deck" and In-water Array





Alternate 17. Wire Array "Oregon Shoreline to Guidewall Expanded to NavLock Deck" and In-water Array

- Pros
  - Sizable coverage of full Predation Priority Area
  - Structural tower on shore
  - Provides protection against gulls, pelicans and cormorants
  - Install/maintenance would have little impact on project operation.
- Cons
  - Wire array does not cover approx 1/3 of Predation Priority Area
  - In-water array untested
  - Routine maintenance due to waterborne debris



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Other Alternatives

- **The Guardian Soundscape Technology**
  - Claims to be proven effective on nearly all species of songbirds, gulls, wading birds, waterfowl, raptors, and birds of prey. As well as on mammals like deer, raccoon, possum and others
  - System can be mounted on poles, rafters, trailers, or walls
  - Speaker array options- 360°, 140°, Directional
  - Power input 120VAC only; or 120VAC / 12VDC selectable
  - Single 360° array covers approximately 8-20+ acres depending on topography of site
  - Constant undulating sound that the manufacturer claims disrupts wildlife's ability to communicate
  - Wildlife does not habituate to the sounds

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Potential Drawbacks to "Soundscape"

- Relies on constant sound
  - Constant disruptive sound may be unsettling or annoying to the project employees and the public. Some potential risks of human exposure include:
    - Cognitive impairment due to exposure to low frequency sound
    - Physiological, neurological, and biochemical changes
    - Elevated blood pressure, loss of sleep, increased heart rate, cardiovascular constriction, labored breathing, and changes in brain chemistry
    - Increased risk of mental health problems
  - Excessive volume may need to be used at the dam, or it may not be effective near the spillways when they are in operation
  - If it is effective, it would likely drive away all or most wildlife

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Discussion about Selection of Preferred Alternatives

- APDA objectives
  - Biological effectiveness
  - Device reliability
  - Ease of routine maintenance
  - Does not adversely impact dam operations
- Design Considerations which includes constraints and criteria (biological and operational criteria from Feasibility Report)
- Review and consider FFDRWG comments from Feasibility Report
- Jump to Ranking Matrix using
  - Biological effectiveness (predation priorities coverage)
  - Installation and routine maintenance
  - Devise reliability
  - FFDRWG input
  - Other important factor(s)?

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Backup Slides

McNary Dam Observation Zones with seasonal mean daily bird counts (circa 2013)

- FB1 – Forebay
- SWT1 – Spillway Tailrace
- PHT1 – Powerhouse Tailrace
- JFOF – Juvenile Fish Bypass Outfall
- BRZ – Boat Restriction Zone

Common Name	FB1
American White Pelican	0.3
Bald Eagle	0.0
Caspian Tern	0.1
Common Merganser	0.0
Double-crested Cormorant	0.1
Great Blue Heron	0.0
Grebe spp.	6.2
Gull spp.	1.6
Osprey	0.1

Common Name	SWT1
American White Pelican	3.7
Bald Eagle	0.0
Caspian Tern	6.6
Common Merganser	0.2
Double-crested Cormorant	1.1
Great Blue Heron	<0.0
Grebe spp.	0.0
Gull spp.	17.7
Osprey	0.0

Common Name	PHT1
American White Pelican	0.1
Bald Eagle	0.0
Caspian Tern	0.1
Common Merganser	0.0
Double-crested Cormorant	<0.1
Great Blue Heron	0.0
Grebe spp.	0.0
Gull spp.	0.1
Osprey	<0.1

Common Name	JFOF
American White Pelican	1.4
Bald Eagle	0.0
Caspian Tern	1.1
Common Merganser	0.0
Double-crested Cormorant	0.1
Great Blue Heron	0.0
Grebe spp.	0.1
Gull spp.	4.9
Osprey	0.0

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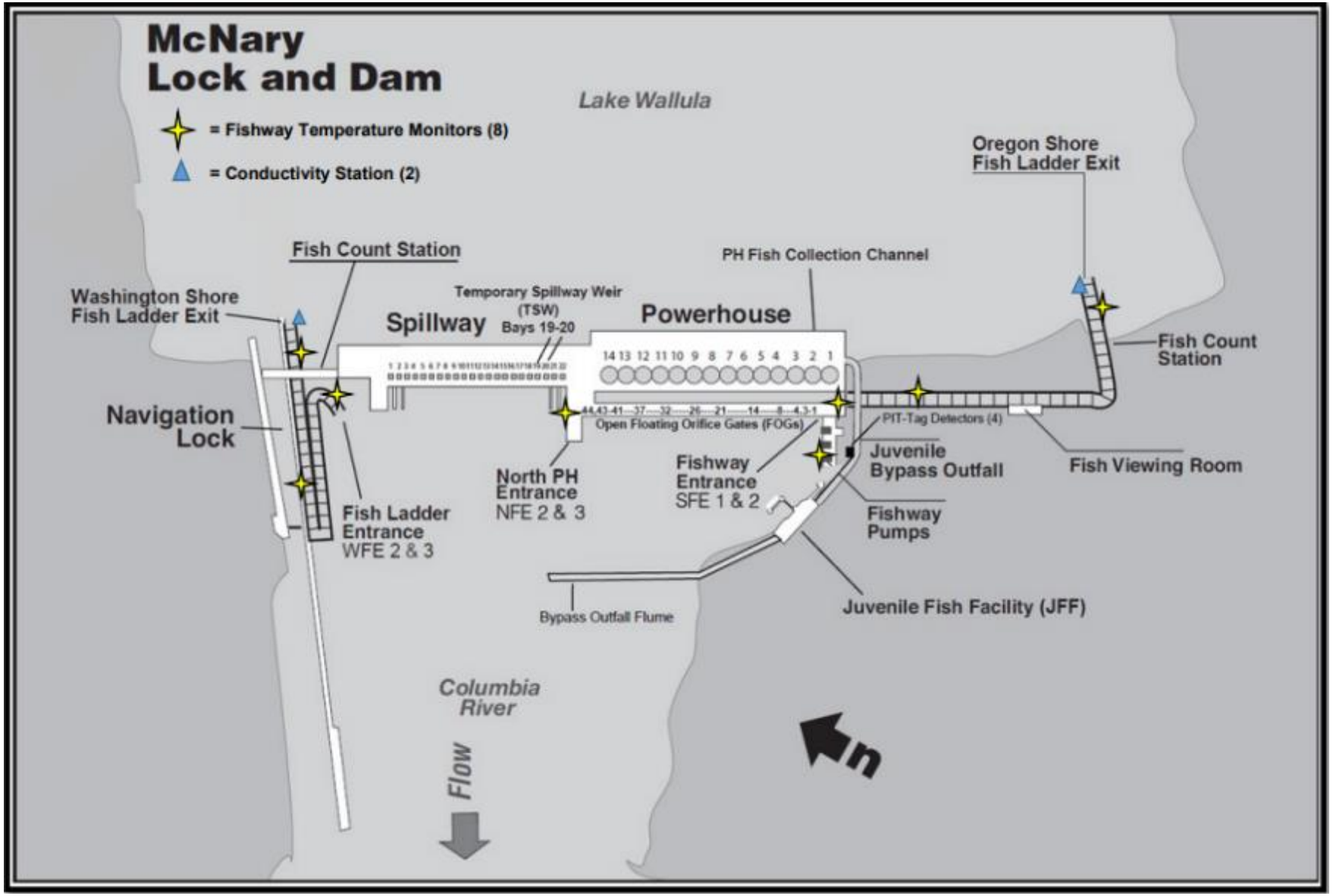

Source: From 2024 Fish Passage Plan

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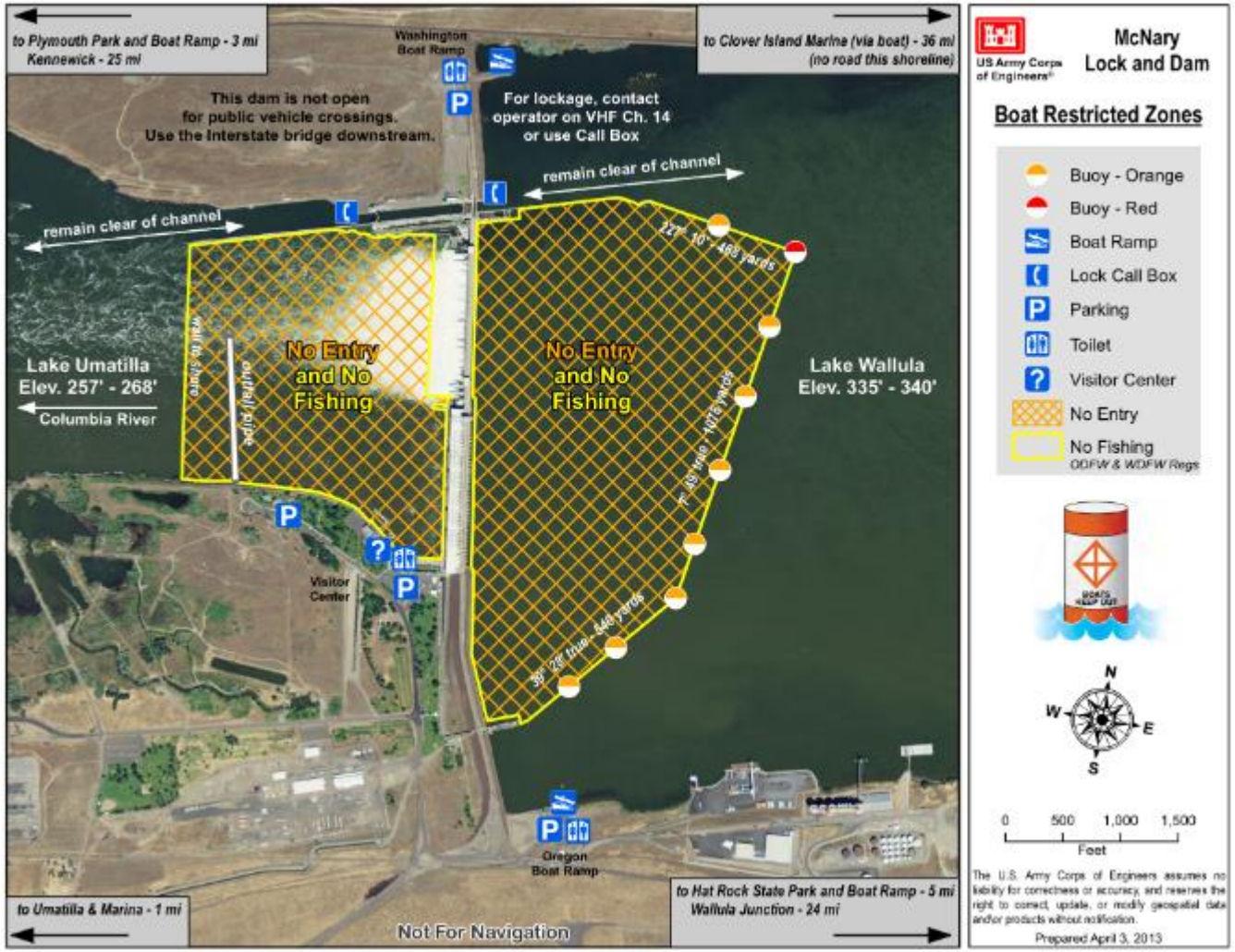
Boat Restricted Zone (BRZ)



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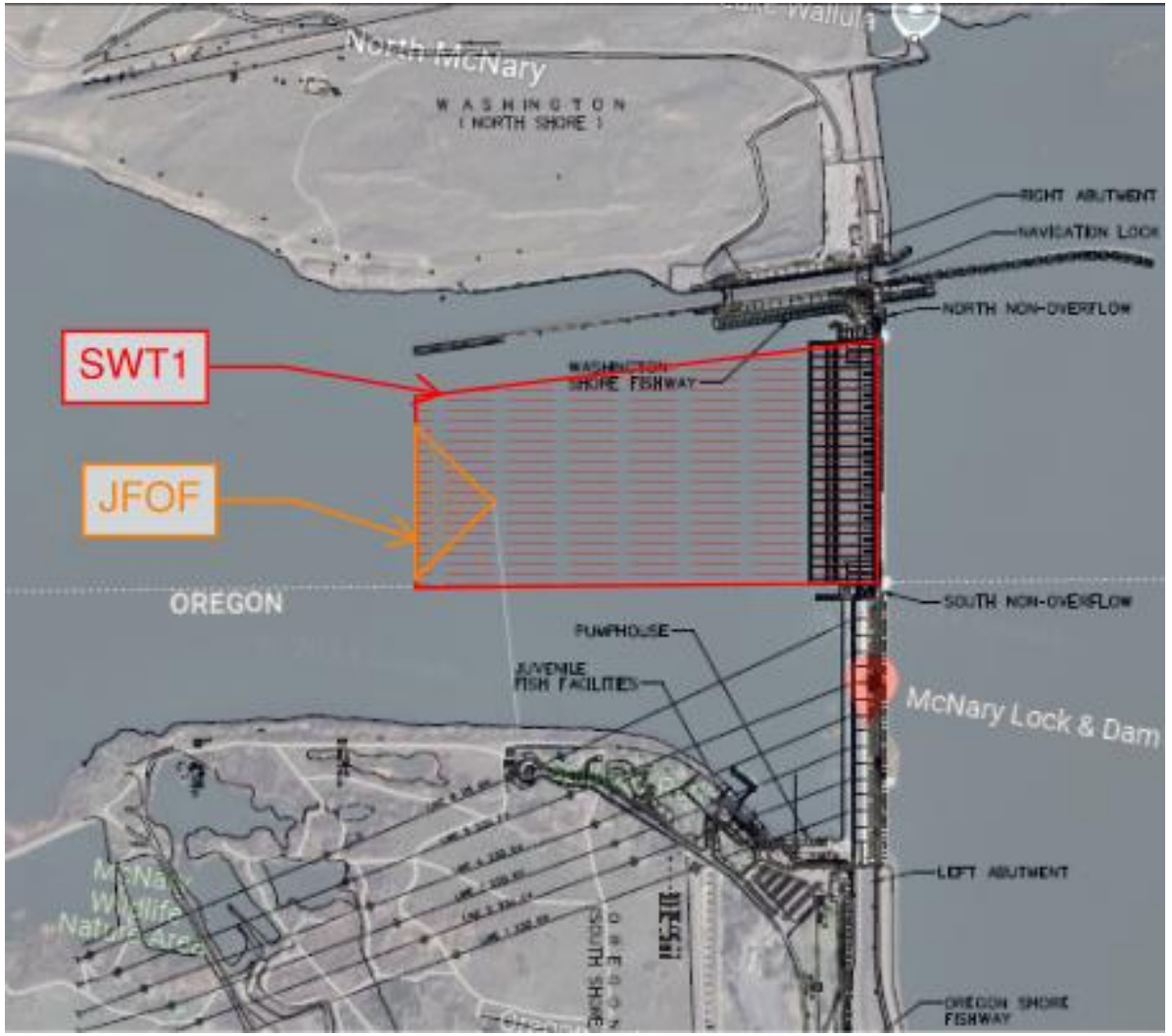
Primary Avian Predation Zones

- Spillway Tailrace (SWT1)
- Juvenile Fish Outfall (JFOF)



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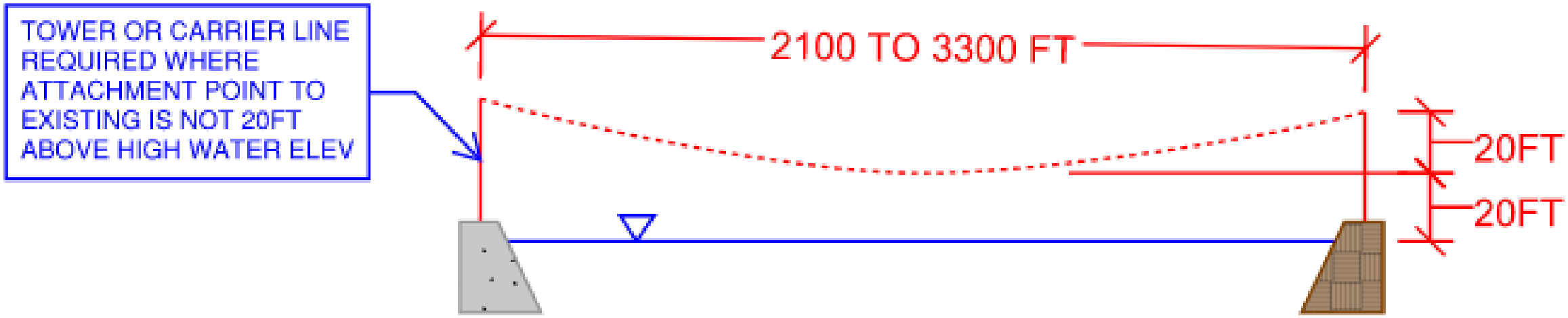
Array Wire Profile

- 20ft minimum cable height above high water elevaton
- 20ft maximum cable sag
- 40ft minimum cable attachment height above high water elevaton



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