

Woodlake Dam and Outlet Works Evaluation

HOA Management Info:

Woodlake HOA
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October 27, 2025

WDL-2025-10-18



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2025-10-27

Cover Sheet

Professional Notice Concerning the Limitations of a Visual Dam Inspection

Visually inspecting a dam is not easy. Many of the problems with a dam are not readily apparent, because so much within a dam occurs underground, out of site, and, in many ways, continuously. As such, it must be understood that my inspection of the Woodlake dam and outlet works is based largely on visual and tactile observations as well as a rough measurement of a few, discrete elements. It must be understood, too, that the severity (or lack thereof) opined by me concerning any element is subjective and reflective of my experience. That said, as the inspector, I've done my utmost to exercise a high standard of care in the execution of the inspection and the preparation of this report.

The inspection of this facility did not include any land surveying, geotechnical investigation, or hydrologic/hydraulic or dam breach analyses.

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Executive Summary

The Woodlake dam, outlet works, and lake has been in existence for at least three decades. On 2025-10-18, I inspected the dam and outlet works. This report is a presentation of my findings as well as my recommendations on “where to go from here.”

This report is, essentially, split into four sections:

1/Facility Location and Vitals. This is where I provide an overall look at the location, size, etc., of the device.

2/Element Measurements and Renderings. This is where I draw from both on-line GIS sources as well as rough field measurements performed by me at the inspection to create several renderings of the outlet works and dam. I’ve also attached a PDF of what looks a little like a detail sheet. Please note that it’s NOT a detail sheet. Given that GIS contouring elevations are +/- about one-foot and given that GIS distances are +/- about 10%, I had to use considerable judgement (and “fudging”) when pulling these “renderings” together. Even though I’ve provided “scaled” drawings, please note that these drawings are NOT accurate. That’s why I prefer to refer to them as renderings. It is hoped that these drawings will be useful to the HOA in the O&M of Woodlake.

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3/Element Review. This is where I walk through the entire inspection of the facility.

In my review, I highlight items using the following color-coding:

GRAY SLIDES: These slides provide only an overall, general review of a particular element.

GREEN SLIDES: These slides are intended to demonstrate that the element being reviewed appeared to be in good shape at the time of the inspection.

RED SLIDES: These slides point to areas of significant concern with a particular element. For example, corrosion of the spillway pipe and risers.

YELLOW SLIDES: These slides point to some general maintenance items that should be addressed without significant difficulty or significant expense.

BLACK SLIDES: These slides point to element conditions that should be monitored over time. They're not necessarily "problems." However, should conditions deteriorate, like say, the dam settles significantly in one area (like all of the sudden), such a conditional change is an indicator that something bad may be happening.

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ORANGE SLIDES: These slides point to issues that are “wrong” with the device but are of a lower priority than any of the other “problems” identified in the report. Additionally, these types of items may need the cooperation and involvement of other parties (such as an adjoining or downstream property owner, the City of Durham, etc.).

PURPLE SLIDES: These slides highlight items that may be helpful (kind of in a “nerdy” way) in monitoring certain conditions like settlement, phreatic flow in the dam, etc. These items are “great to have” but not required or essential at this time.

4/Priorities. This is where I indicate how I’d prioritize work items. In a way, this will just be an intuitive regurgitation of how the inspection slides are laid out. For example, **RED SLIDES** identify high priority items. **Please note that I have NOT provided order of magnitude cost estimates for the priority work. This is because such work is, in many ways, highly specialized. In addition, typical, estimating cost data from the last few years is no longer relevant. In the maintenance and construction industry, costs have doubled and, in some instances, tripled since COVID.** My recommendations about discerning what something will cost, while it may seem simplistic, are as follows (please forgive me if any of this sounds even remotely insulting, for that’s not at all my intention):

Step One: Scope out the work you need done as clearly and with as much detail as you can. Make sure to include specifics concerning timing and the grade of materials you want used. Please note A/that higher grade materials will always be more expensive; and B/that work you want completed in the short term will always cost more than work that can be scheduled out a little further in the future.

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Step Two: Solicit bids/quotes for the work from companies recommended to you by experts in the field (or, at least, recommended by those with a modicum of reasonable knowledge in the field).

Step Three: Evaluate critically the bids/quotes you receive.

And...

Step Four: Go with your gut on which bid/quote to go with.

The financial cost to have that contract implemented is the cost to you to have that work completed.

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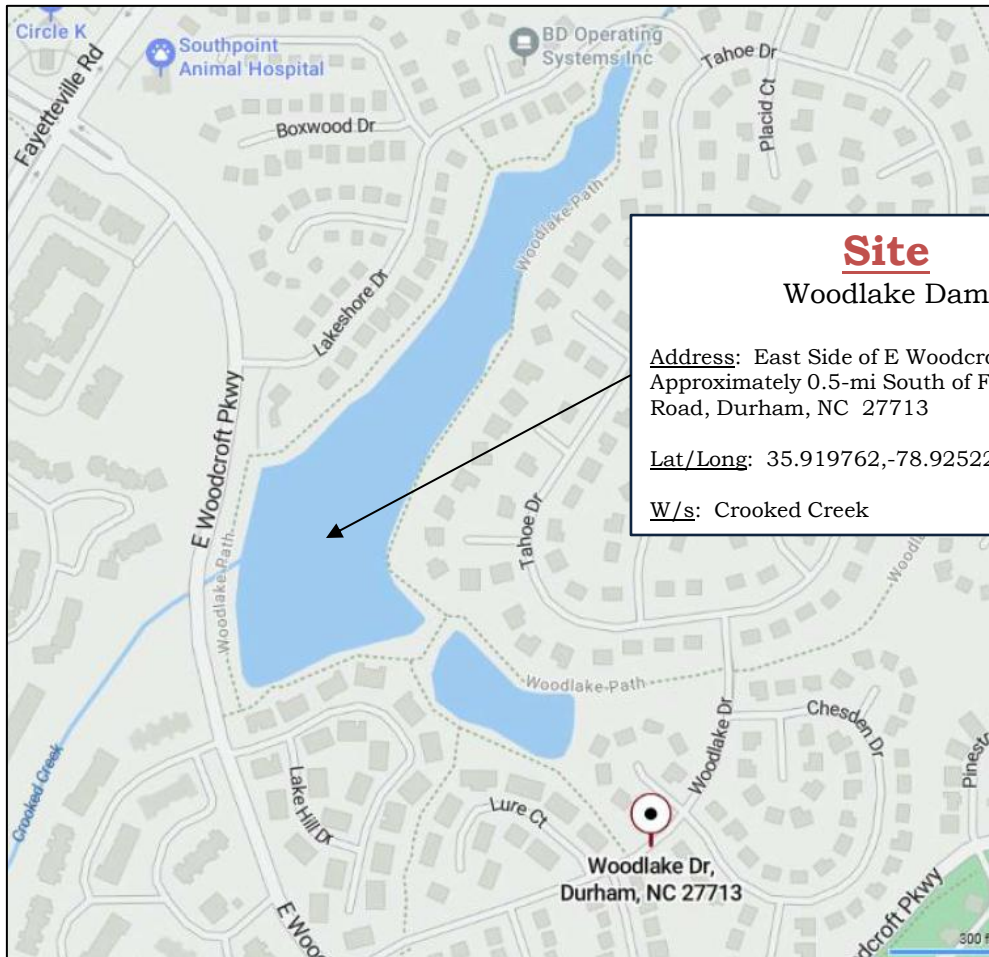


1/Facility Location and Vitals



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Site

Woodlake Dam

Address: East Side of E Woodcroft and
Approximately 0.5-mi South of Fayetteville
Road, Durham, NC 27713

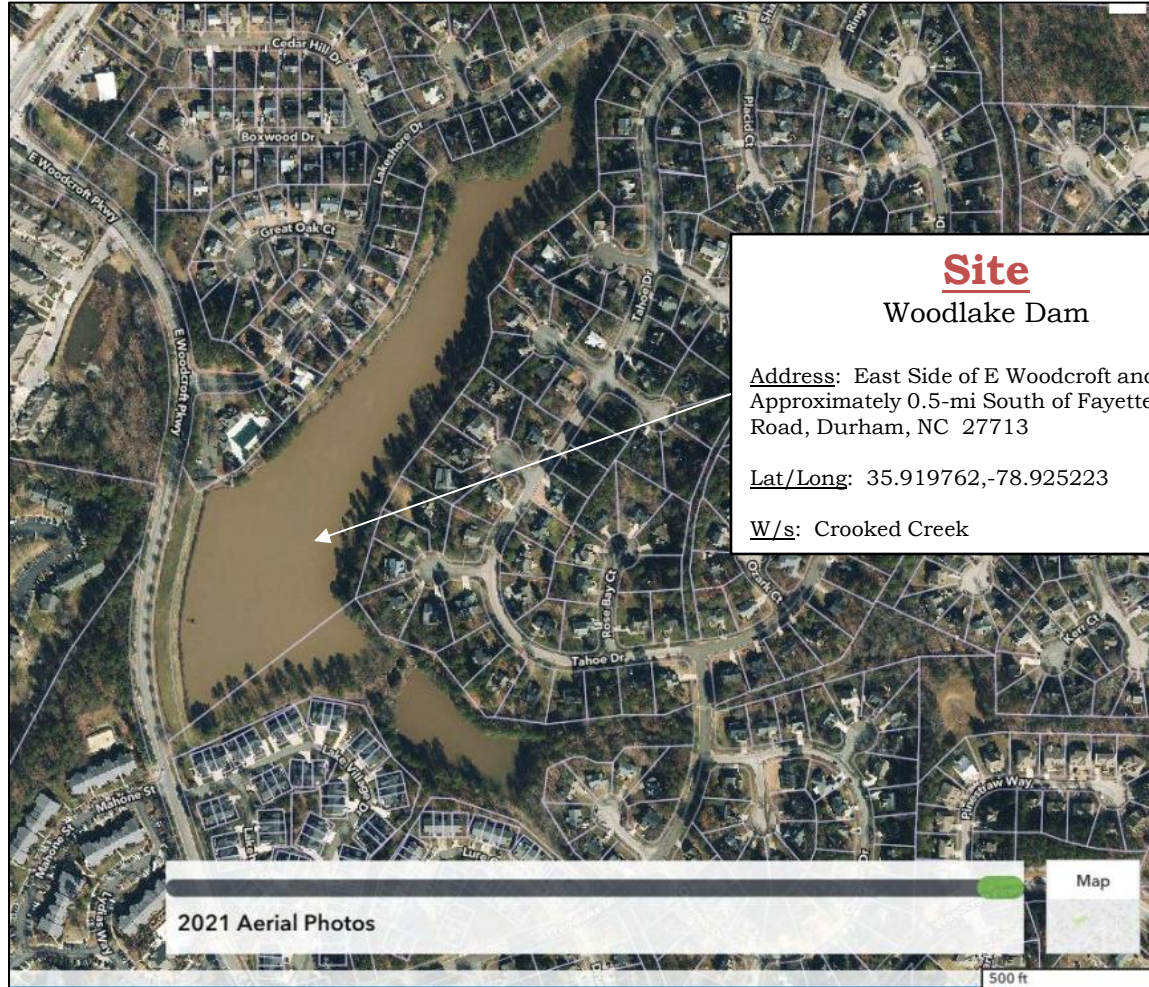
Lat/Long: 35.919762,-78.925223

W/s: Crooked Creek

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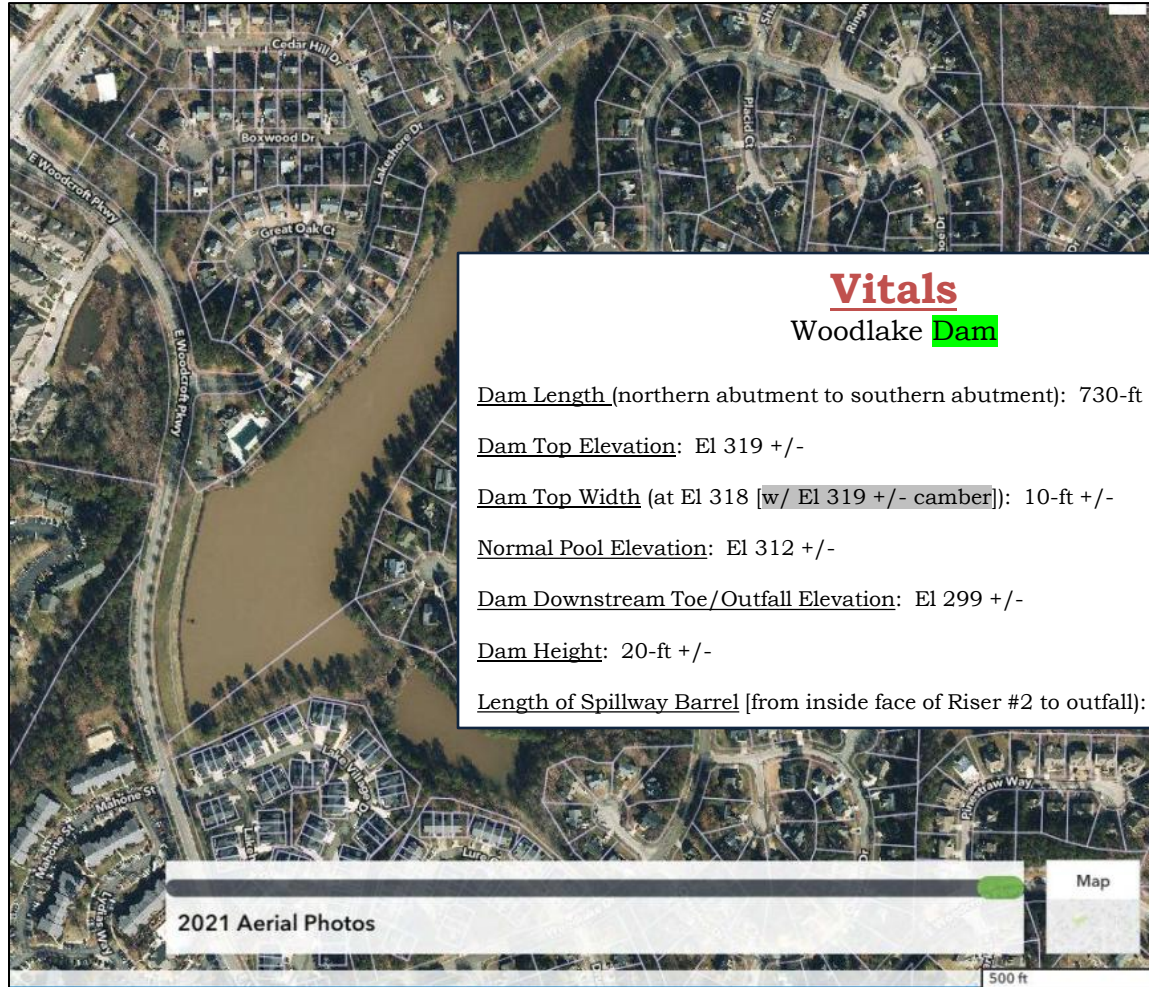




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Vitals

Woodlake **Dam**

Dam Length (northern abutment to southern abutment): 730-ft +/-

Dam Top Elevation: El 319 +/-

Dam Top Width (at El 318 [w/ El 319 +/- camber]): 10-ft +/-

Normal Pool Elevation: El 312 +/-

Dam Downstream Toe/Outfall Elevation: El 299 +/-

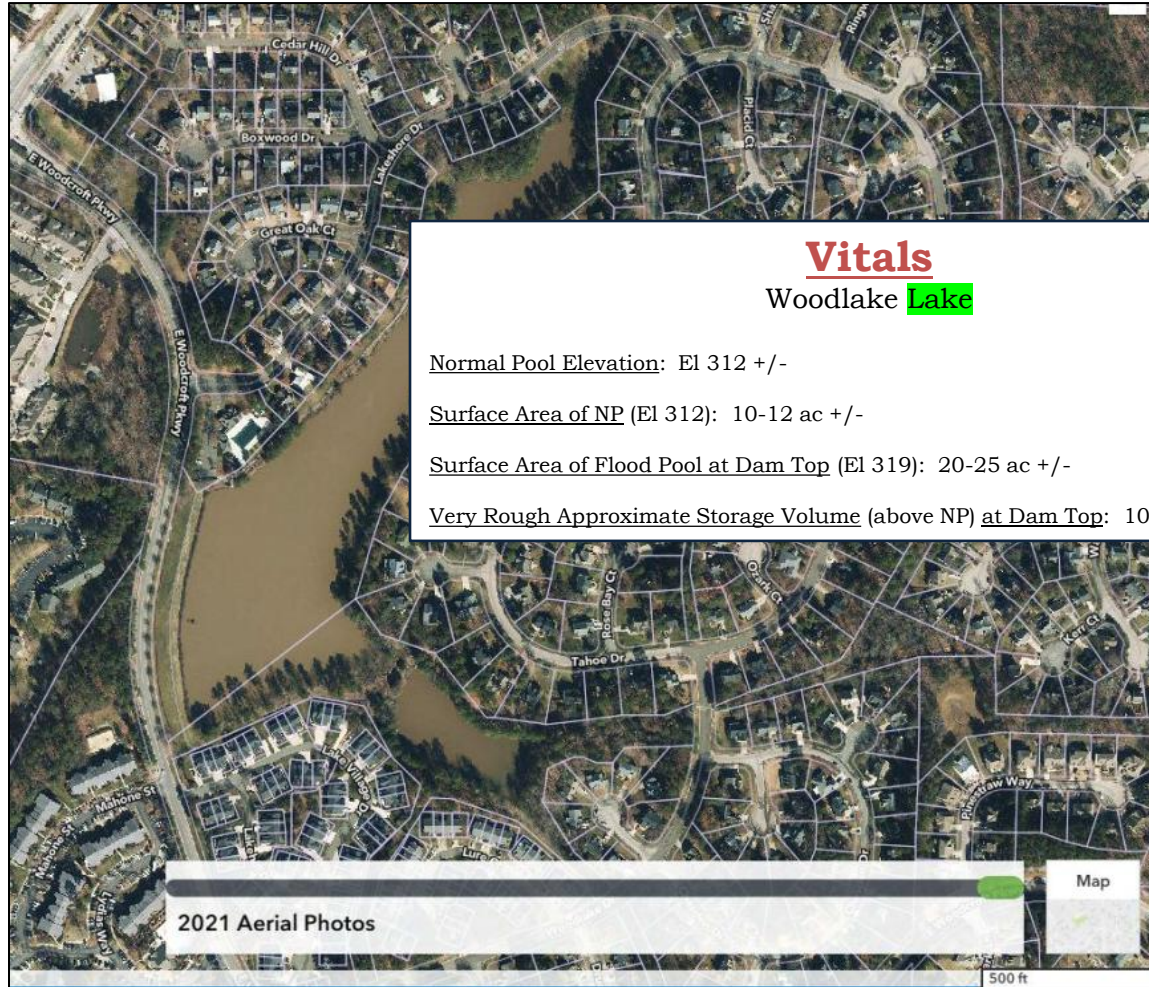
Dam Height: 20-ft +/-

Length of Spillway Barrel [from inside face of Riser #2 to outfall]: 191.5-ft +/-

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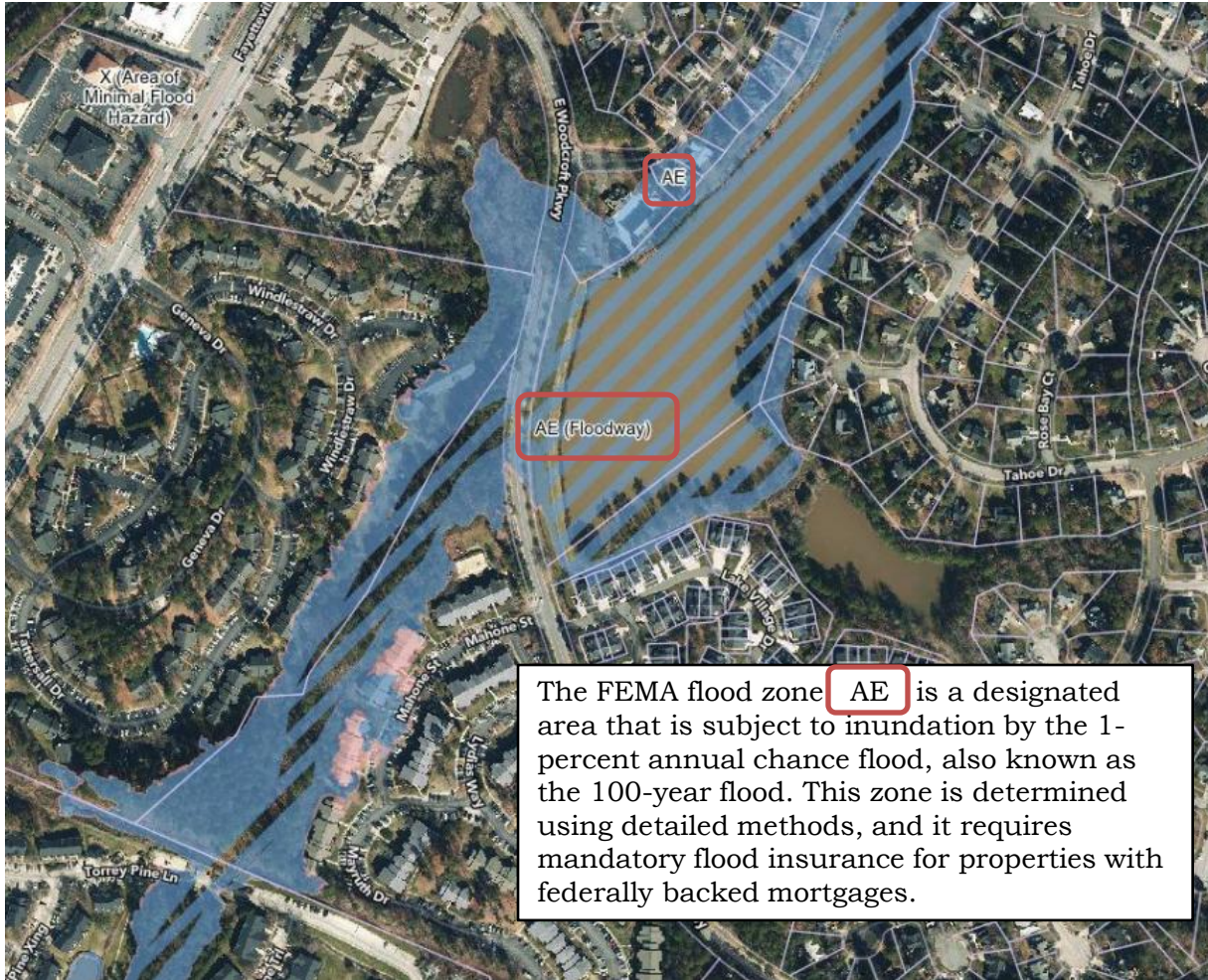




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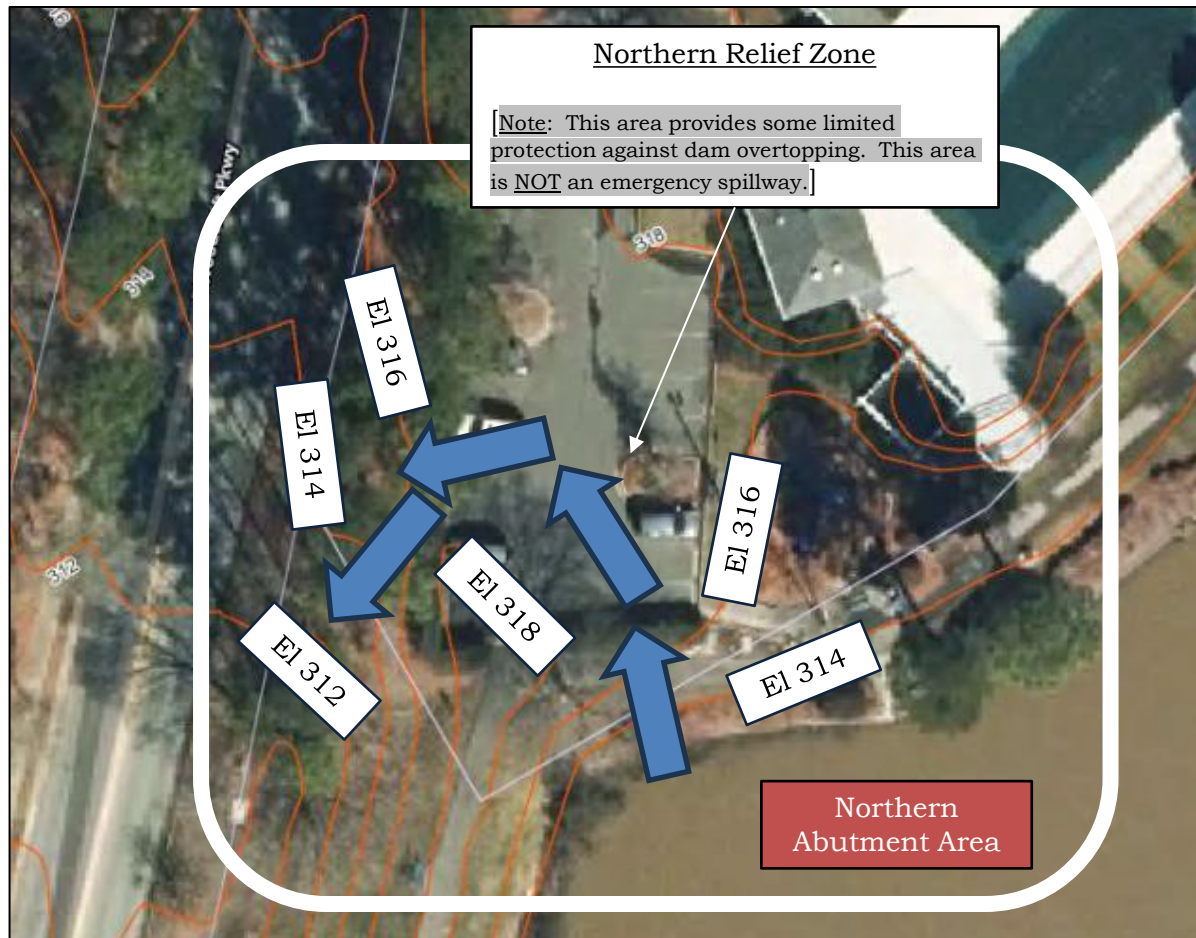




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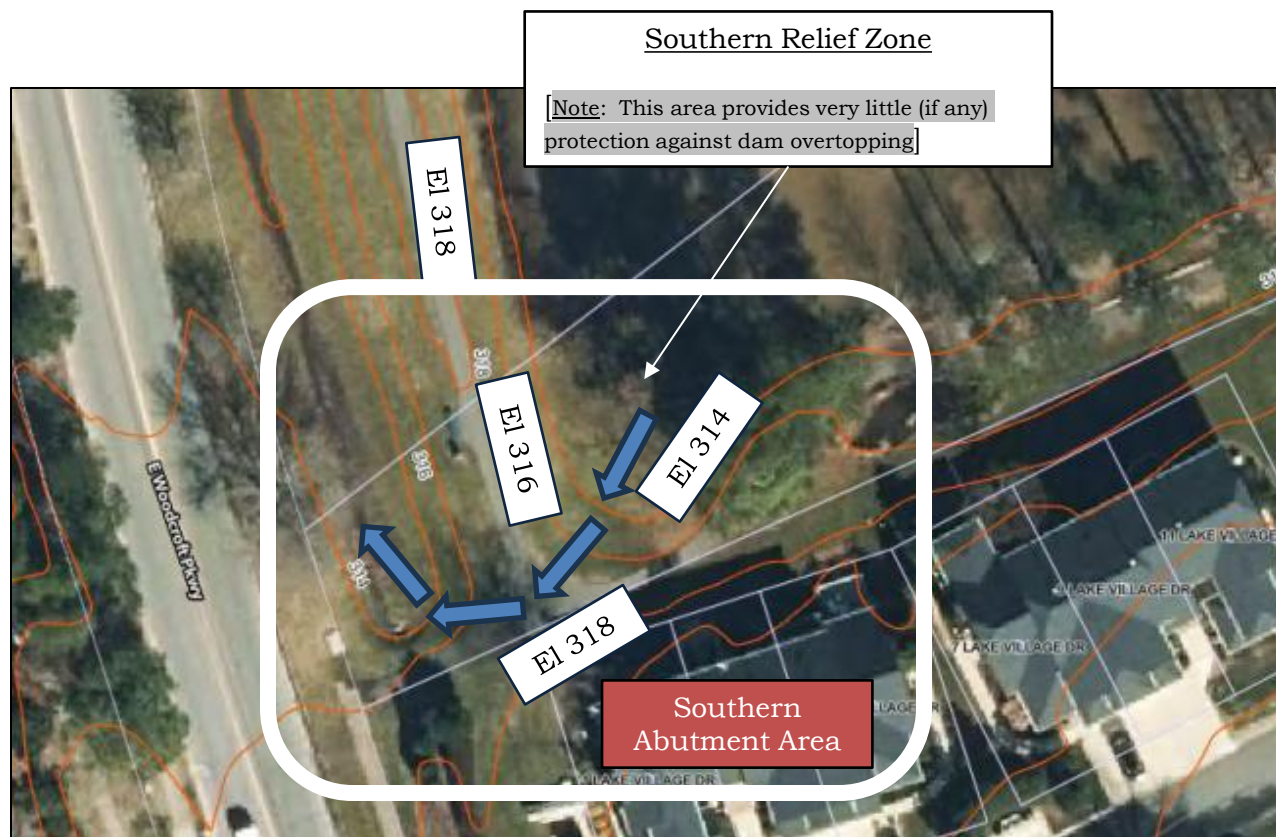




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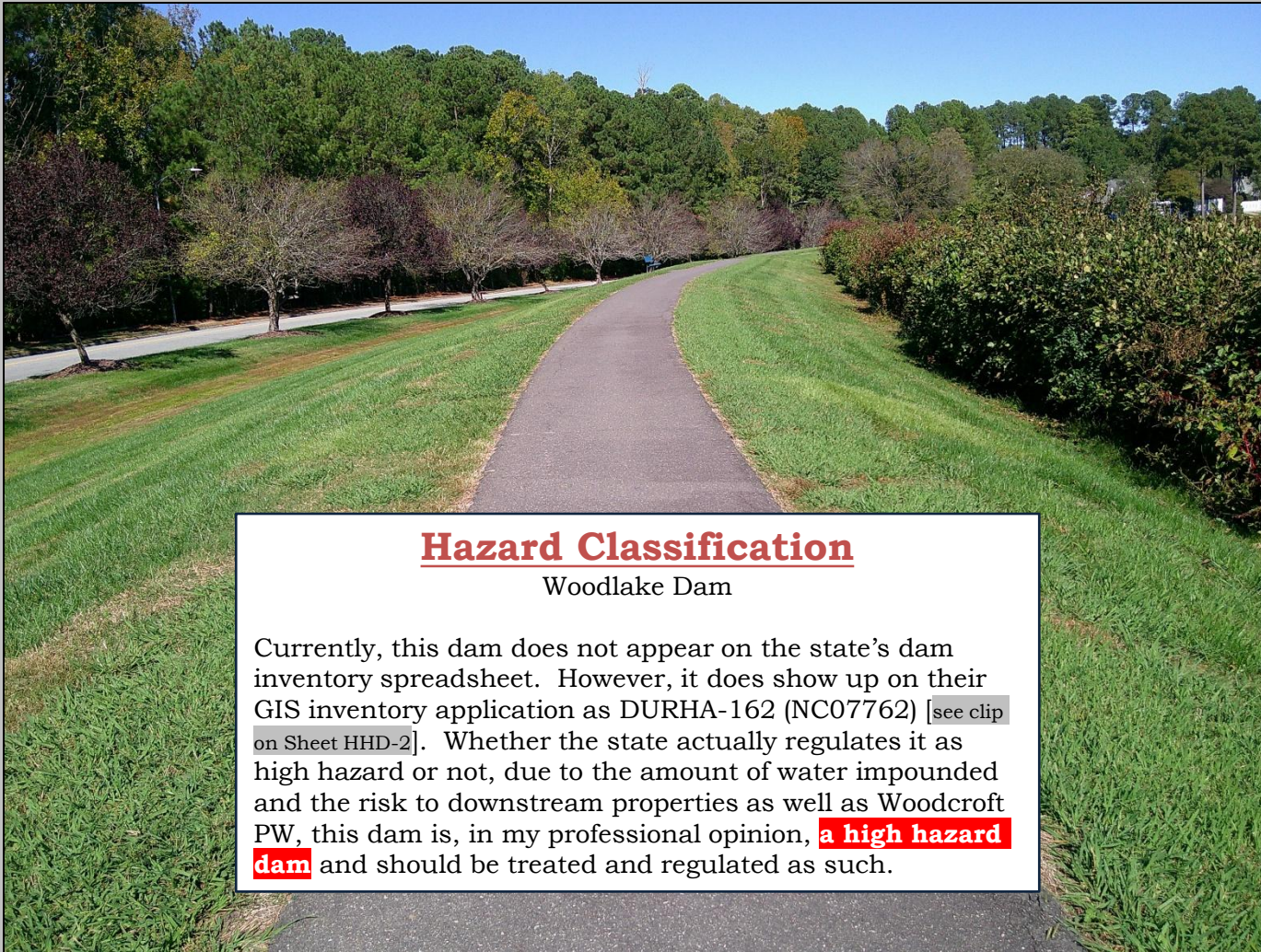




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Hazard Classification

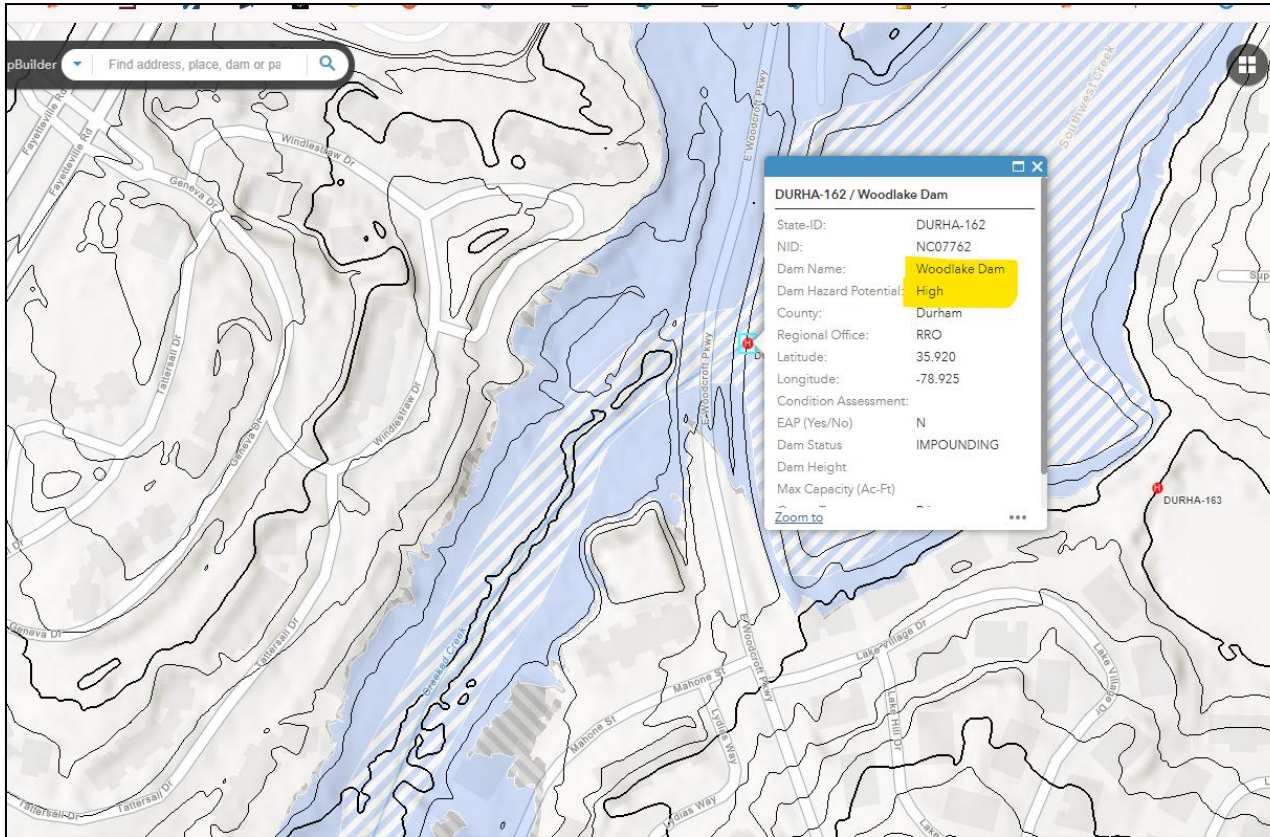
Woodlake Dam

Currently, this dam does not appear on the state's dam inventory spreadsheet. However, it does show up on their GIS inventory application as DURHA-162 (NC07762) [see clip on Sheet HHD-2]. Whether the state actually regulates it as high hazard or not, due to the amount of water impounded and the risk to downstream properties as well as Woodcroft PW, this dam is, in my professional opinion, **a high hazard dam** and should be treated and regulated as such.

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Reference: <https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=9ac80a9a8dda4c168cf9798819064292>

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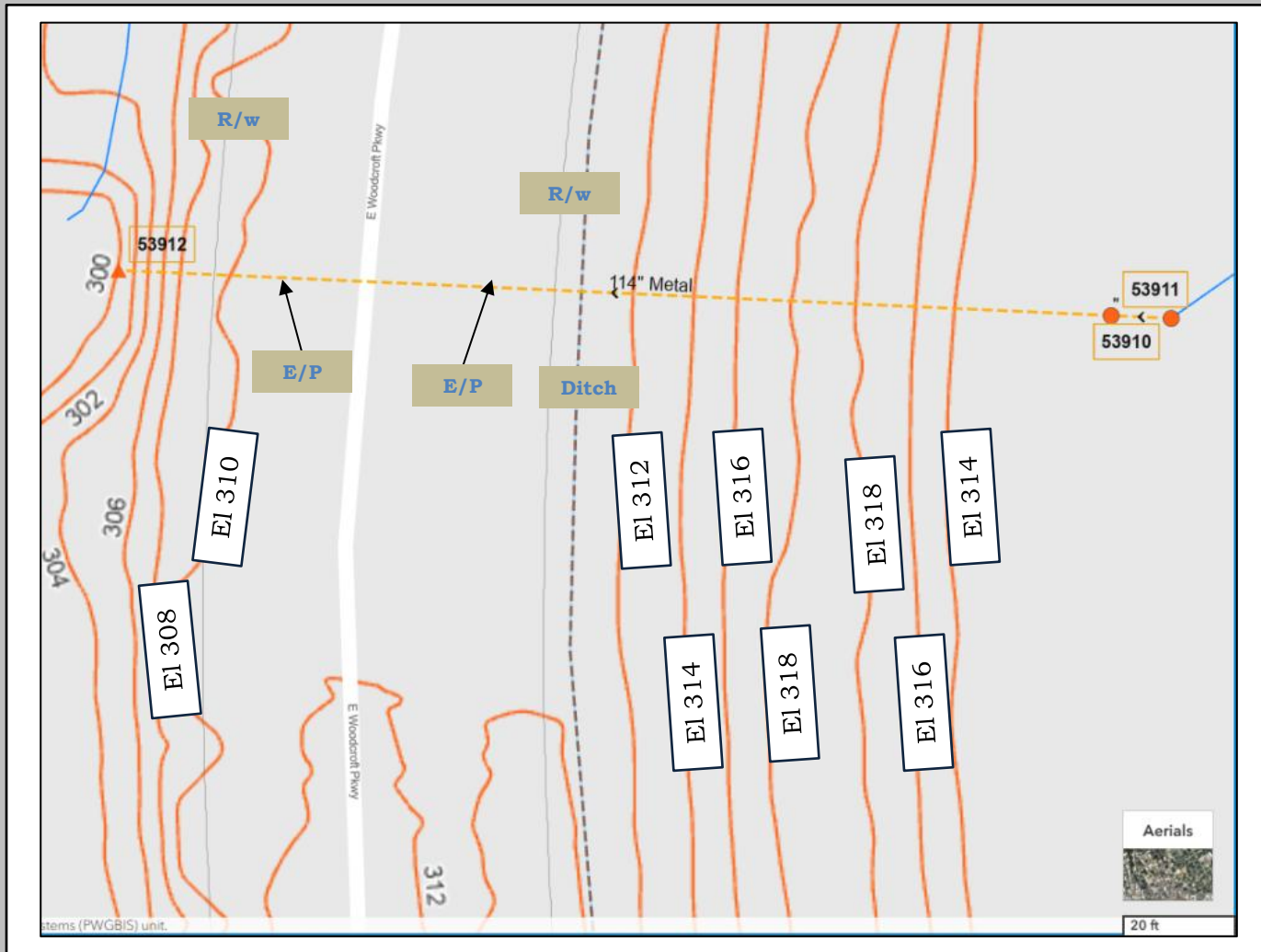


2/Element Measurements



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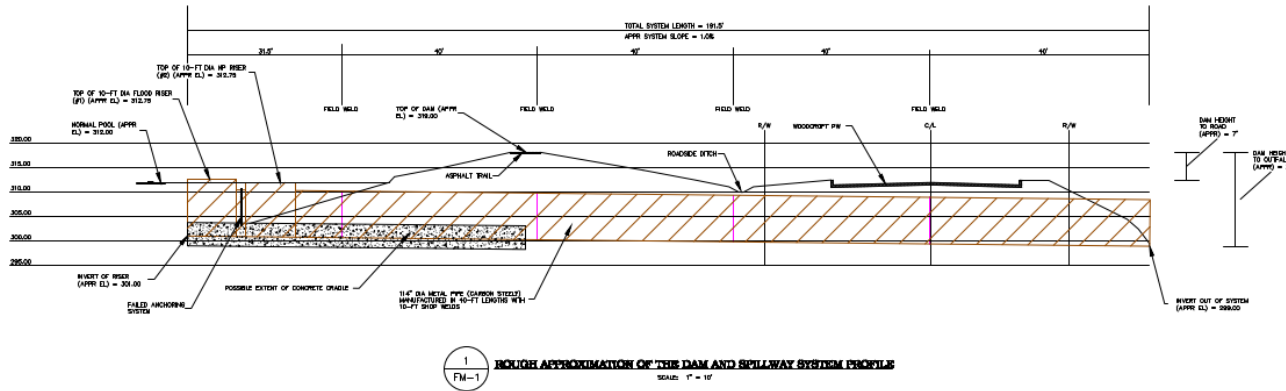


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NOTE: THIS DRAWING IS NOT BASED ON A LAND SURVEY. THIS DRAWING WAS PREPARED FROM ROUGH FIELD MEASUREMENTS TAKEN ON 2025-10-18, FROM ONLINE GIS DATA, AND FROM ASSUMPTIONS OF FIELD CONDITIONS. IT SHOULD BE UNDERSTOOD THAT ALL ELEVATION DATA IS +/- 2-FT AT BEST.



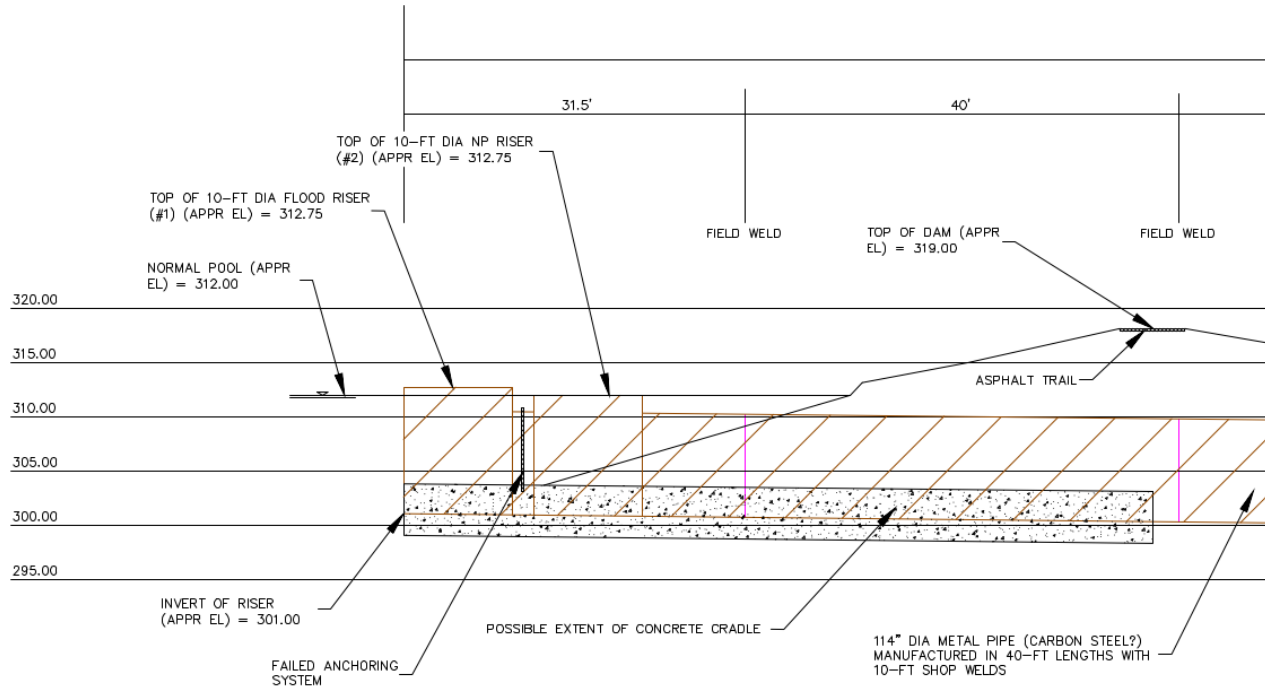
Note: There appear to be no available plans for the dam and outlet works.

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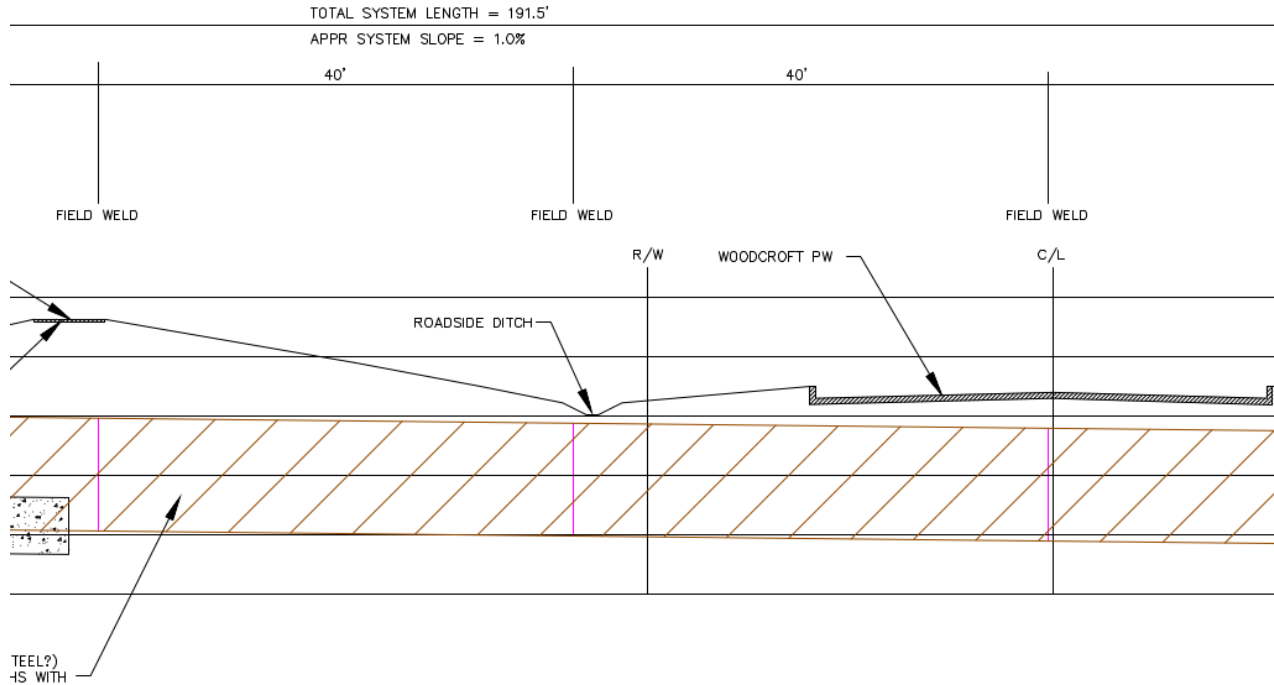
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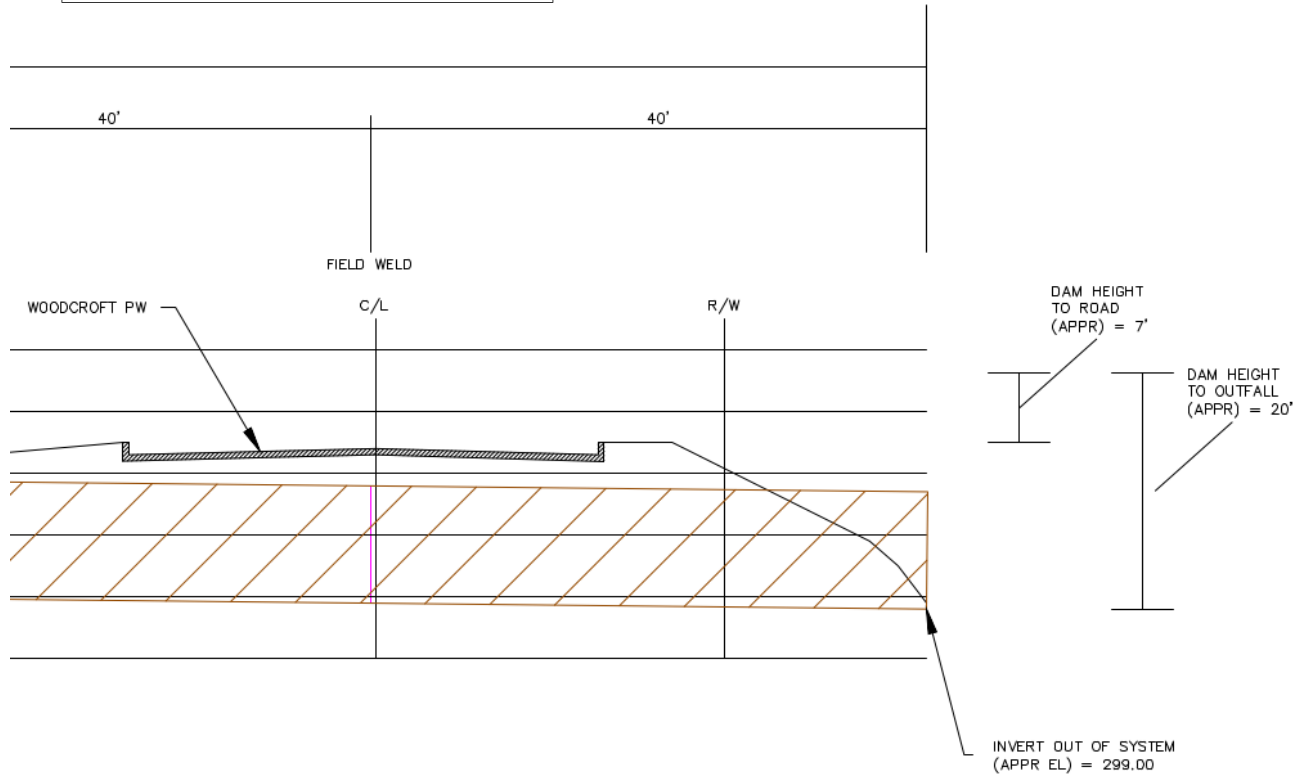
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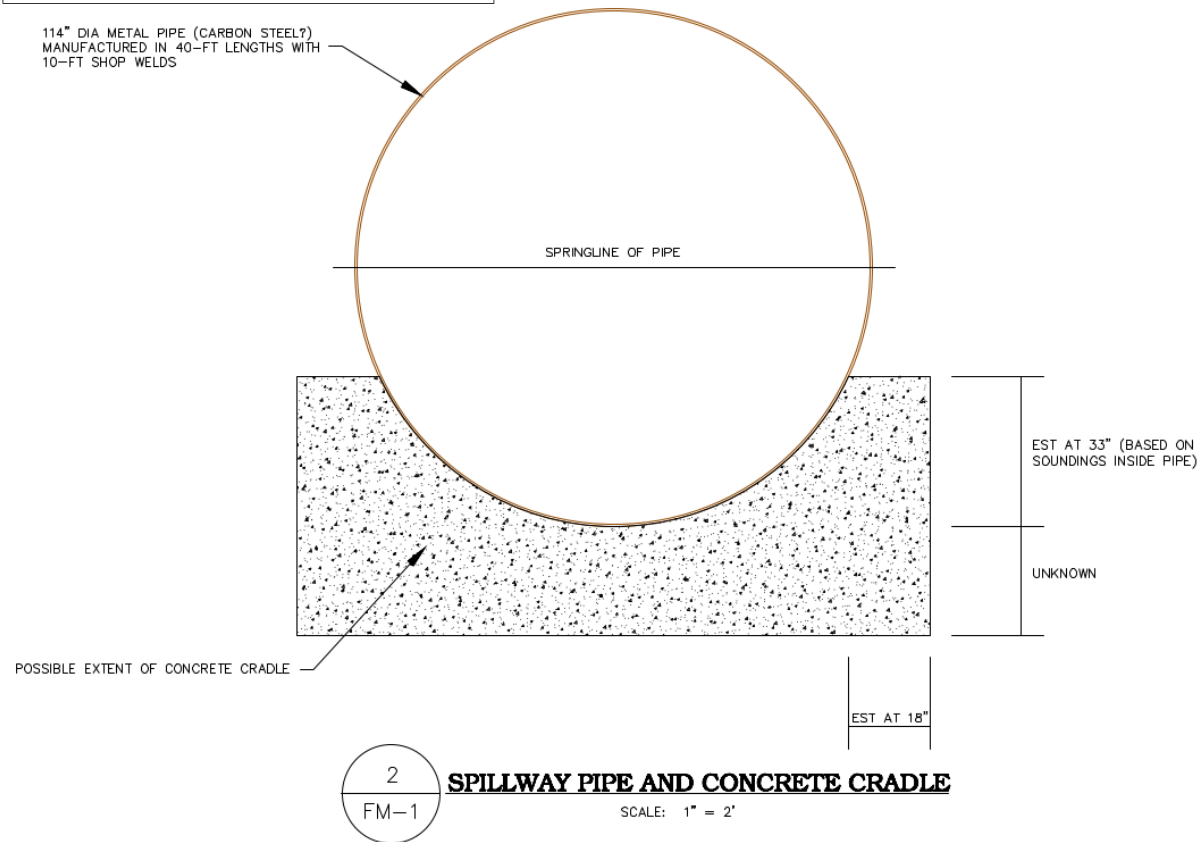
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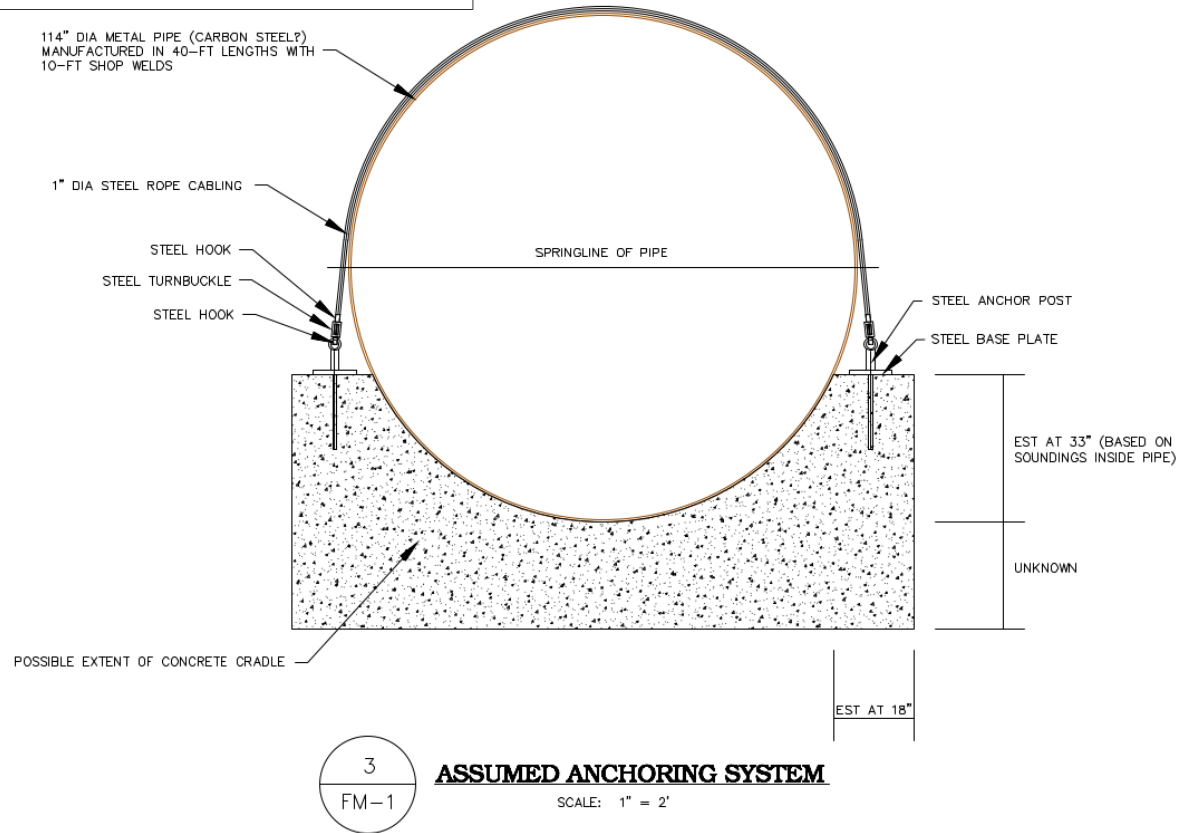
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Element Review



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Outfall Overall Comments: The riprap lined stilling basin outfall appeared to be in really good condition. There did not appear to be any new (or significant) plumes of sediment in the stilling basin.



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Pipe Overall Comments: Overall, the inside of 114" dia carbon steel spillway pipe [Note: I'm not a metal pipe expert, but this pipe looks like a carbon steel (i.e., a carbon-iron composite) pipe.] appeared to be in reasonable condition. This pipe appeared to be manufactured in 40-ft sections, where each 40-ft section appeared to be comprised of four ten-foot long segments, which were plant-welded on the inside and outside. Some undermining under the last two-feet of pipe was apparent due to hollowness under the pipe. This undermining issue should be addressed [see Sheets ER-3f and ER-3g]. There was no evidence of leakage into the pipe. Nor was there any indications that seepage was occurring around (and outside) the pipe. Overall, the pipe appeared to be in reasonable condition.



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Pipe Material Condition Comments: At installation, the 40-ft pipe sections appeared to have been field-welded inside (and, presumably) outside. Given that these field welds are probably the weakest connection points, obvious rusting/corrosion at those connections was noted [see Sheet ER-2c]. It should be noted that there were many instances where the coating on the pipe was gone or had begun to peel away. Corrosion was noted at multiple locations in the flowline [see Sheet ER-2d] (and elsewhere). The pipe is ½" thick; at it's worst, the corrosion in the flowline appeared to have eaten away approximately 1/16" (6%) of the steel. Scraping, chemical cleaning, and recoating of the entire inside of the pipe (and the two risers) is recommended to be performed within the next few years (perhaps, even, the next two- to three-years). This work will be a time-consuming and expensive process. It's recommended that, within the next twelve-months, the HOA consult with a carbon steel pipe manufacturer concerning the methods required and timing for this crucial work. Concurrent with this, it's recommended, too, that the HOA consult with a metal pipe expert to look at the pipe itself and even make recommendations on a good contractor to perform any required maintenance work (i.e., scraping, chemical cleaning, coating, etc.).



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Examples of plant-welded joints

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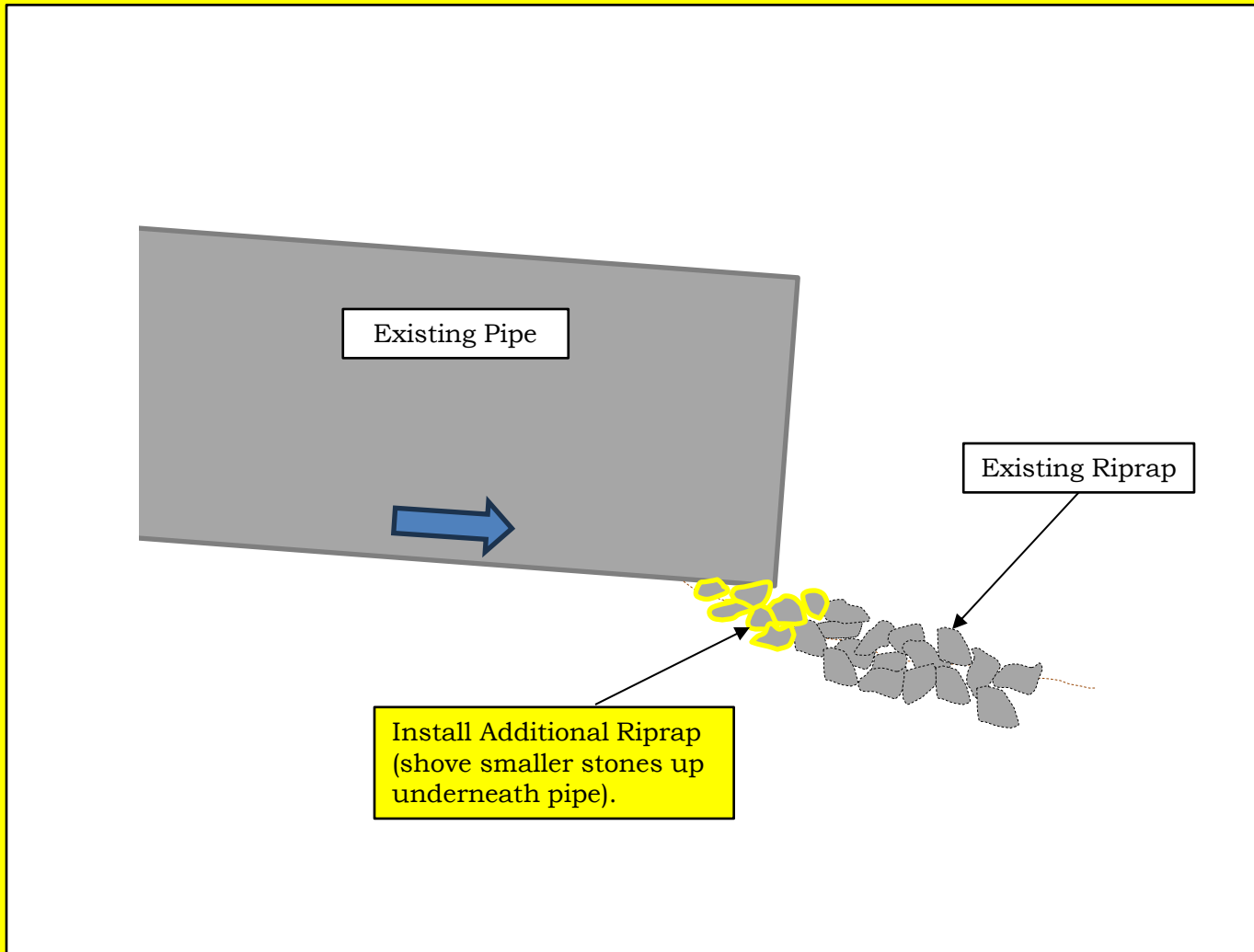




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Side View

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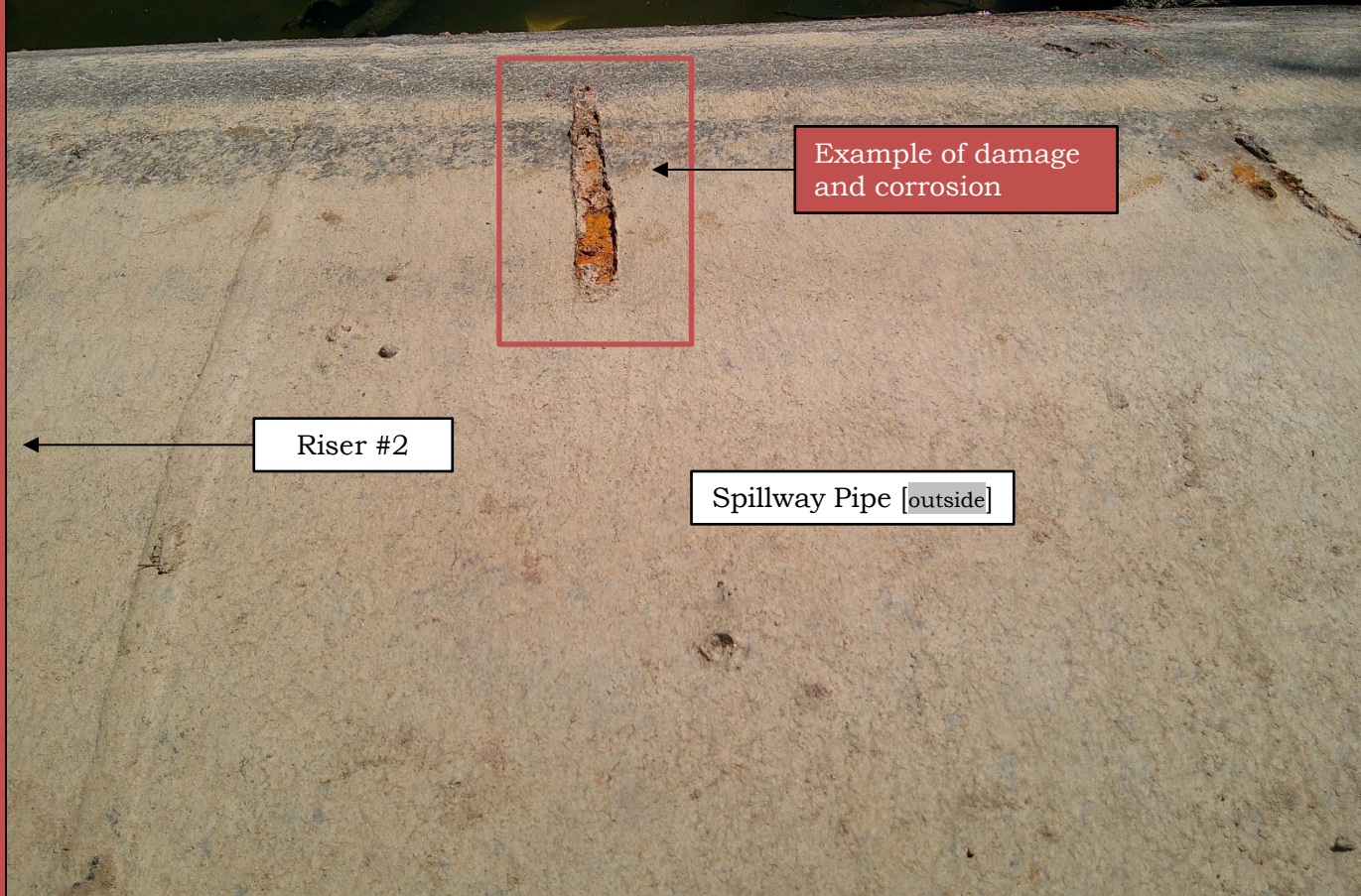
Spillway Pipe

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Pipe Material Condition Comments: The outside of the spillway pipe should, along with the inside, be evaluated [see comments on Sheet ER-2b].



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NP Riser (#2)

[This riser sets normal pool
and drains most storms]

Drawn-down Water
Level on 2025-10-18:
Appr 4'-7" below NP (at
El = 307.42 +/-)

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Dual Siphon System

It should be noted that Riser #1 included a bottom drain, which went malfunctional many years ago. This malfunctioning bottom drain does not appear to be leaking.

Flood Riser (#1)

[This riser kicks in during major storms. The top elevation of Riser #1 is 9" above the top elevation of Riser #1]

NP Riser (#2)

[This riser sets normal pool and drains most storms]

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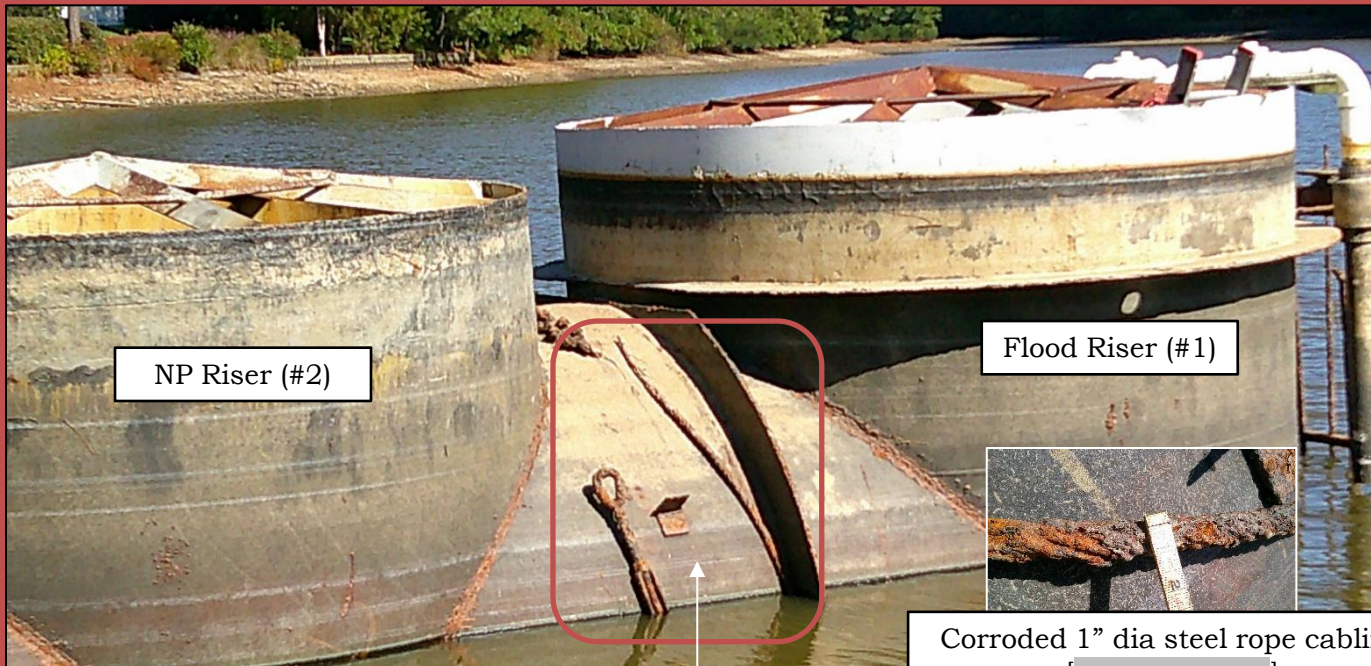
Pipe Material Condition Comments: The riser pipes, like the spillway pipe, are ½” thick. When measuring the thickness of Riser #2, the thickness had been corroded/eroded/worn down to ¼”, which is 50% of the pipe material. To me, this material condition feels worse than the inside (and, perhaps, the outside) of the pipe. Like with the spillway pipe, it’s recommended that, within the next twelve-months, the HOA consult with a carbon steel pipe manufacturer concerning the condition of the two riser structures. Concurrent with this, it’s recommended, too, that the HOA consult with a metal pipe expert to look at the pipe itself and even make recommendations on a good contractor to perform any required maintenance work (i.e., scraping, chemical cleaning, coating, etc.).



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Replace the failed outlet works anchoring system.

The purpose of this anchoring system is to anchor the spillway to the concrete cradle to keep the spillway from floating during large events.

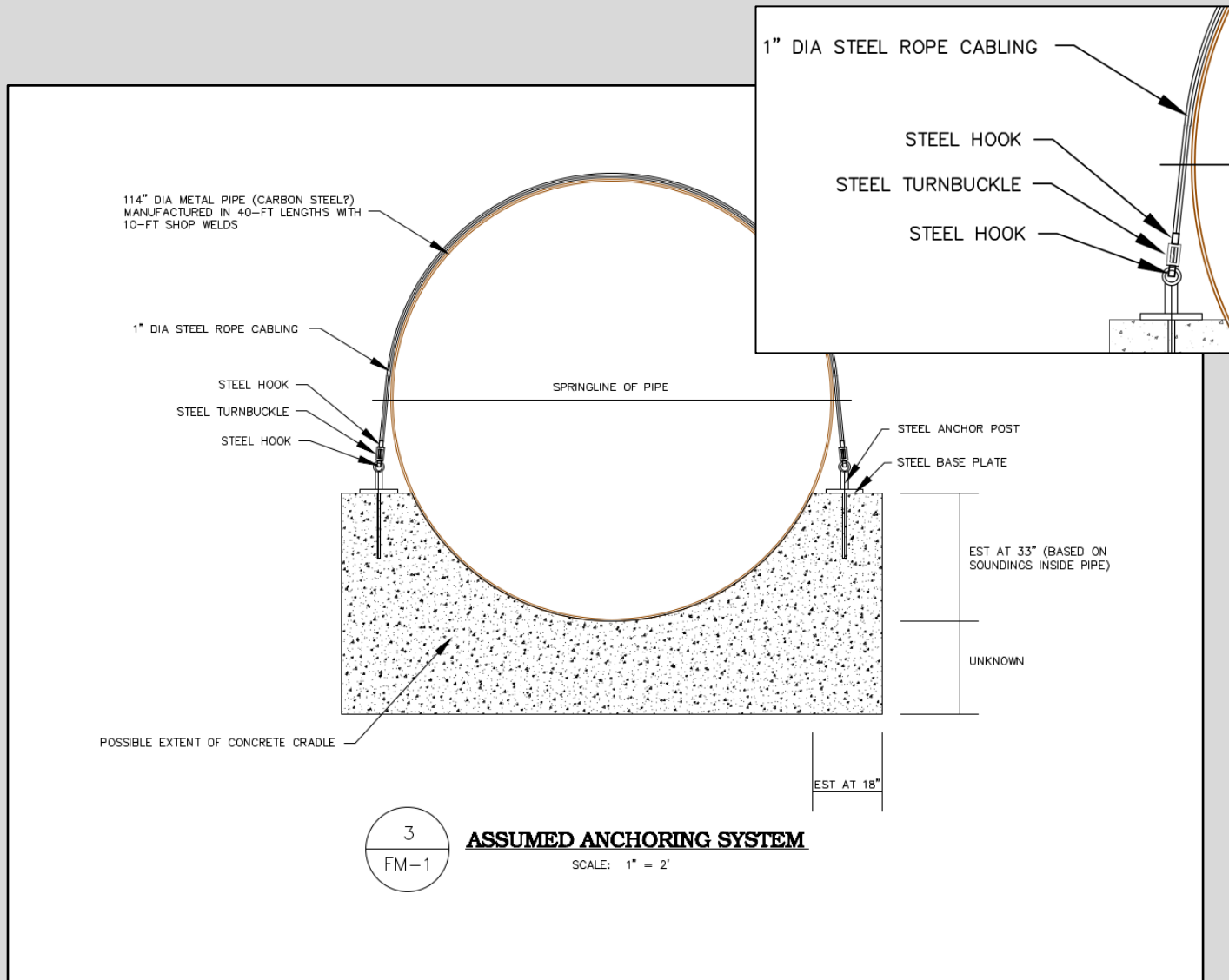
The previous anchoring system [see “assumed” configuration on Sheet ER-4b] was comprised of steel items, which failed due to corrosion. Of course, what was installed previously could be implemented again. Doing so, however, will, eventually, result in a similar failure. It’s recommended that alternate materials, which are less subject to corrosion, should be explored. An example would be the use of *Amsteel Blue* [see Sheet ER-4c], which is a synthetic rope that’s used in many marine applications and that boasts much greater strength than steel cabling. For other possible alternatives, see Sheets ER-4d – ER-4f.

Note: Before any replacement system is explored, the lake will need to be drained down approximately 4-ft more than what’s shown in the photo above so that the concrete cradle and structural connection (e.g., base plates, anchor posts, etc.) can be examined and evaluated. Additional work to this connection may be required.

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Current System

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AmSteel-Blue is a high-performance, 12-strand single braid made from 100% Dyneema fiber, offering exceptional strength and durability. Notably, it boasts a superior strength-to-weight ratio and very low stretch, making it stronger than comparable wire rope while remaining lightweight enough to float. With its low stretch, high flex fatigue resistance, and excellent wear durability, AmSteel-Blue is ideal for demanding tasks and heavy-duty applications. Its Samthane coating further enhances its abrasion and cut resistance. Recommended for split-drum winch applications, AmSteel-Blue should not be used on H-bitts, capstans, or cleats where surging or rendering the rope is necessary. It has been verified by ABS according to MEG4 standards and is type-approved by ABS, BV, DNV, Lloyd's, and RMRS. With options for sustainable, bio-sourced fibers, AmSteel-Blue allows you to reduce your environmental impact without compromising quality or strength. For heavy-duty tasks requiring a strong, lightweight alternative to nylon rope, AmSteel-Blue is a top choice.

Note: Watch the *YouTube* clip to learn how to splice *AmSteel Blue* Rope and make hooks, etc. This is an amazing product.

<https://www.youtube.com/watch?v=wMCxbEyF274>

Possible Replacement “Synthetic Rope” - RECOMMENDED

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Size

Material

Color

Brand

Vehicle Service

Type

2" x 20'-4PCS

polyester,steel

YELLOW

JOYANALL

ALL

Click to see full view

Ask Rufus

Can it be used for securing furniture?

What material are the straps?

Is it weather resistant?

Ask something else

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STORMWATER
MANAGEMENT ENGINEERING

About this item

- **【Ratchet Strap Heavy Duty】** The 2 inch x 20ft ratchet tie down straps heavy duty is made of premium materials and reinforced with stitching, which can maintain unbreakable tensile strength even in strong winds. Each ratchet has an powerful load capacity of 3333 lbs and a breaking strength of up to 10000 lbs.
- **【Double J hooks】** The heavy duty ratchet strap with double J hooks are made of aluminum, not easy to corrode and rust, and can work well in bad weather and cold conditions. The easy-grip ratchet mechanism provides superior performance and is ideal for handling bulky loads.
- **【Quick Fastening】** The ratchet mechanism offers excellent control, comfort, and strong grip strength. The ergonomic spring-loaded handle allows for smooth and rapid release.
- **【Durable and Sturdy】** Ratchet tie down straps heavy duty are coated to withstand the elements and made of sturdy steel, ensuring long-lasting durability and reusability.
- **【Versatile Application】** JOYANALL ratchet straps provide durable and reliable security for transporting various small and large objects, including motorcycles, canoes, kayaks, ATVs, boxes, boats, furniture, lawn equipment, heavy machinery, and other cargo via truck beds, trailers, or roof racks.

Possible Replacement System

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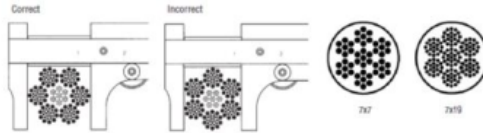
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Measuring Wire Rope

The diameter of a wire rope is the diameter of the circle which encloses all the wires.

When measuring wire rope, it is important to take the greatest distance of the outer limits of the 'crowns' of the two opposite strands. A measurement across the valleys will result in incorrect (lower) readings.



Part Number	Wire Size	Coated to: Size	Construction	Working Load	Break Strength	Reel Length	Weight per Reel
VGAC062-093-250	1/16"	3/32"	7x7	96 Lbs	480 Lbs	250	2.5 Lbs
VGAC062-093-500	1/16"	3/32"	7x7	96 Lbs	480 Lbs	500	5 Lbs
VGAC062-093-1000	1/16"	3/32"	7x7	96 Lbs	480 Lbs	1000	10 Lbs
VGAC093-125-250	3/32"	1/8"	7x7	184 Lbs	920 Lbs	250	5 Lbs
VGAC093-125-500	3/32"	1/8"	7x7	184 Lbs	920 Lbs	500	9 Lbs
VGAC093-125-1000	3/32"	1/8"	7x7	184 Lbs	920 Lbs	1000	19 Lbs
VGAC125-187-250	1/8"	3/16"	7x7	340 Lbs	1,700 Lbs	250	9 Lbs
VGAC125-187-500	1/8"	3/16"	7x7	340 Lbs	1,700 Lbs	500	18 Lbs
VGAC125-187-1000	1/8"	3/16"	7x7	340 Lbs	1,700 Lbs	1000	35 Lbs
VGAC187-250-250	3/16"	1/4"	7x19	840 Lbs	4,200 Lbs	250	19 Lbs
VGAC187-250-500	3/16"	1/4"	7x19	840 Lbs	4,200 Lbs	500	38 Lbs
VGAC187-250-1000	3/16"	1/4"	7x19	840 Lbs	4,200 Lbs	1000	77 Lbs
VGAC250-312-250	1/4"	5/16"	7x19	1,400 Lbs	7,000 Lbs	250	31 Lbs
VGAC250-312-500	1/4"	5/16"	7x19	1,400 Lbs	7,000 Lbs	500	62 Lbs
VGAC250-312-1000	1/4"	5/16"	7x19	1,400 Lbs	7,000 Lbs	1000	123 Lbs
VGAC312-375-250	5/16"	3/8"	7x19	1,960 Lbs	9,800 Lbs	250	49 Lbs
VGAC312-375-500	5/16"	3/8"	7x19	1,960 Lbs	9,800 Lbs	500	98 Lbs
VGAC312-375-1000	5/16"	3/8"	7x19	1,960 Lbs	9,800 Lbs	1000	197 Lbs
VGAC375-437-250	3/8"	7/16"	7x19	2,880 Lbs	14,400 Lbs	250	67 Lbs
VGAC375-437-500	3/8"	7/16"	7x19	2,880 Lbs	14,400 Lbs	500	134 Lbs
VGAC375-437-1000	3/8"	7/16"	7x19	2,880 Lbs	14,400 Lbs	1000	270 Lbs

Note: It appears that the mode of failure of the previous anchoring system was the corroding of the 1" dia steel cable. It appears that that size cabling is not readily available with vinyl coating. However, 5/16" dia vinyl coated galvanized wire rope is available, with a breaking strength of 9,800 lbs. I lean, though, to using *Amsteel Blue* synthetic rope or implementing a rachet of some kind.

Possible Replacement Cabling

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Northern Side (looking southward)

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Southern Side (looking northward)

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General Comments: The area near the shoreline (that's typically several feet below normal pool) looked pretty good in terms of stability. At the spillway pipe, there were no evidences of piping (as seen by settlement or cave-ins). To watch an animated video that shows what happens when piping failure in a dam occurs, click or paste the following link [Piping Failure at Dams]: <https://www.youtube.com/watch?v=PC58mGG55io>.



At the Spillway Pipe

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Comments: Beaching is occurring at the shoreline (the place where the normal pool interacts with the shoreline, creating a small sluffing of the dam at that interface. Also, the shrubs (which have been in-place for probably close to 25-yrs, are not recommended on the dam. Furthermore, the small timber walls, which were installed in select locations to mitigate against “beaching” appear to be undermining.

Alternative Repair Option One: I recommend [see Sheet ER-5h] that the shrubs be cut back significantly and that all areas of erosion be revetted with additional riprap stone.

Alternative Repair Option Two: If Alternative One measures don’t achieve the desired results, I recommend [see Sheets ER-5i and ER-5j] that the shrubs and timbers be removed, that the beaching and the dam surface where the shrubs were be repaired, and that additional shoreline riprap be placed from approximately three-feet below normal pool to approximately three-ft above normal pool. It should be understood that implementing

Alternative Two could cost **\$250K**+/-.



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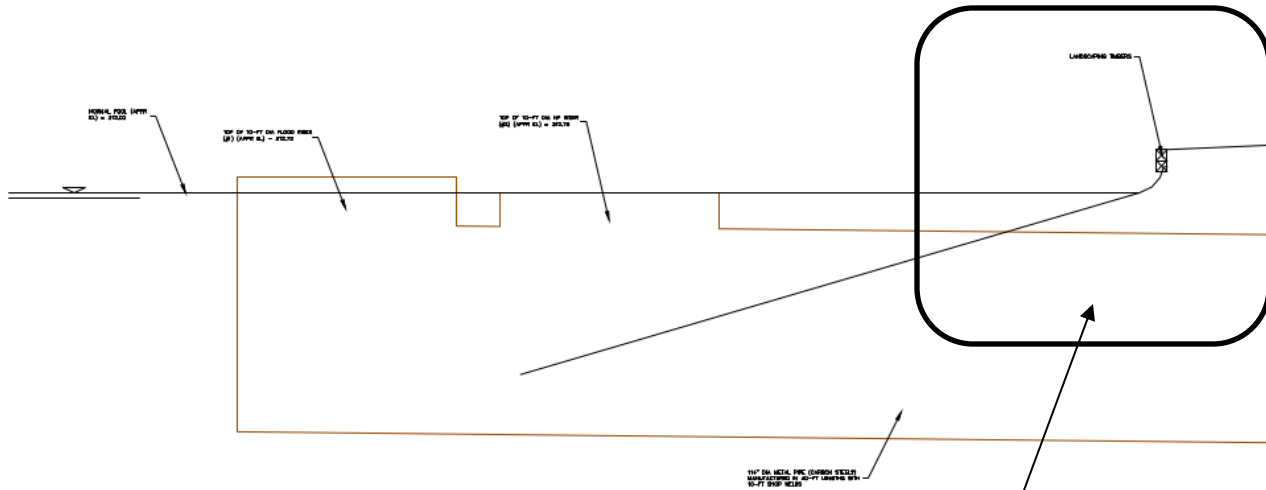


Example of undermining of timbers.

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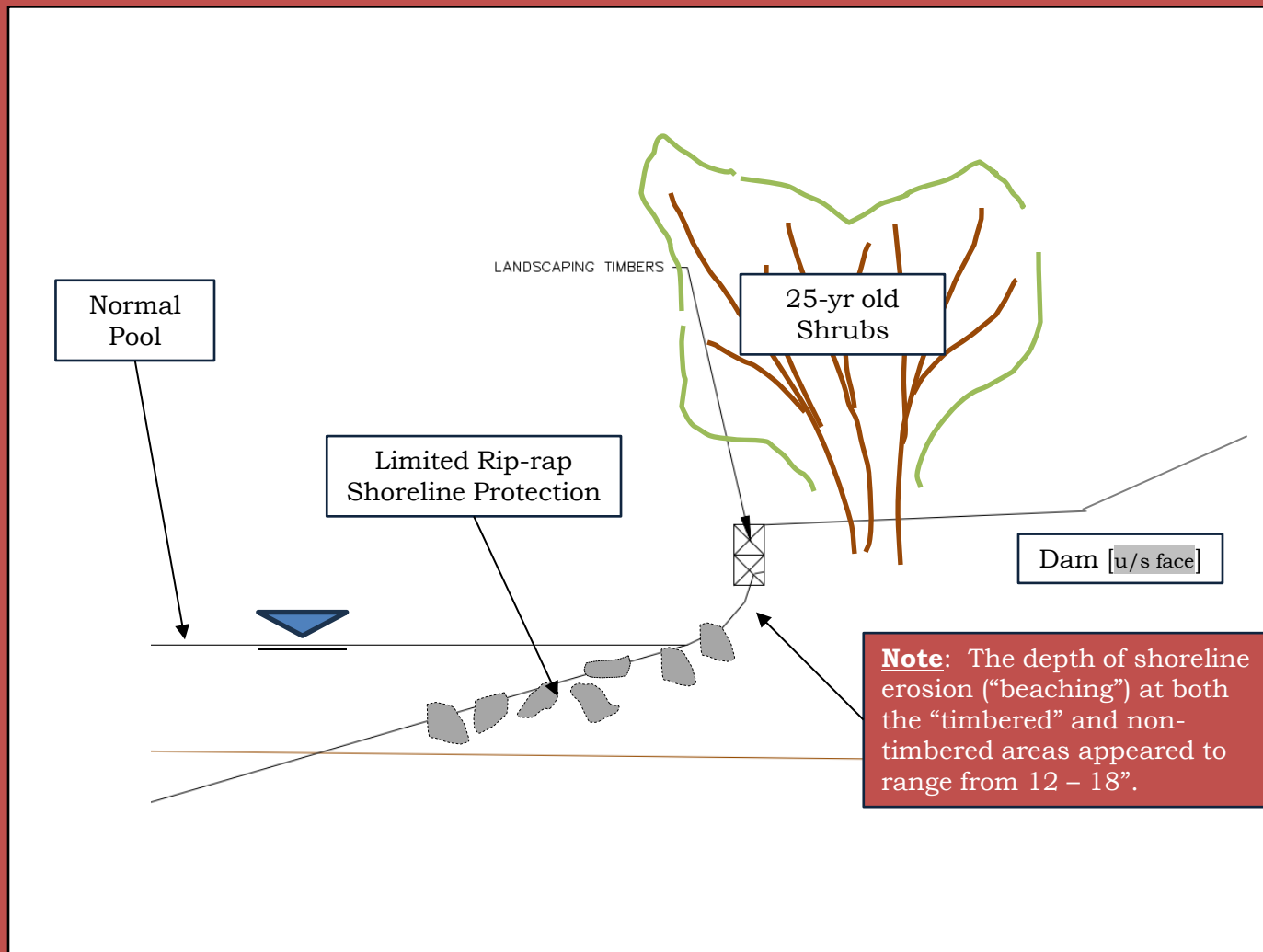


Existing Condition

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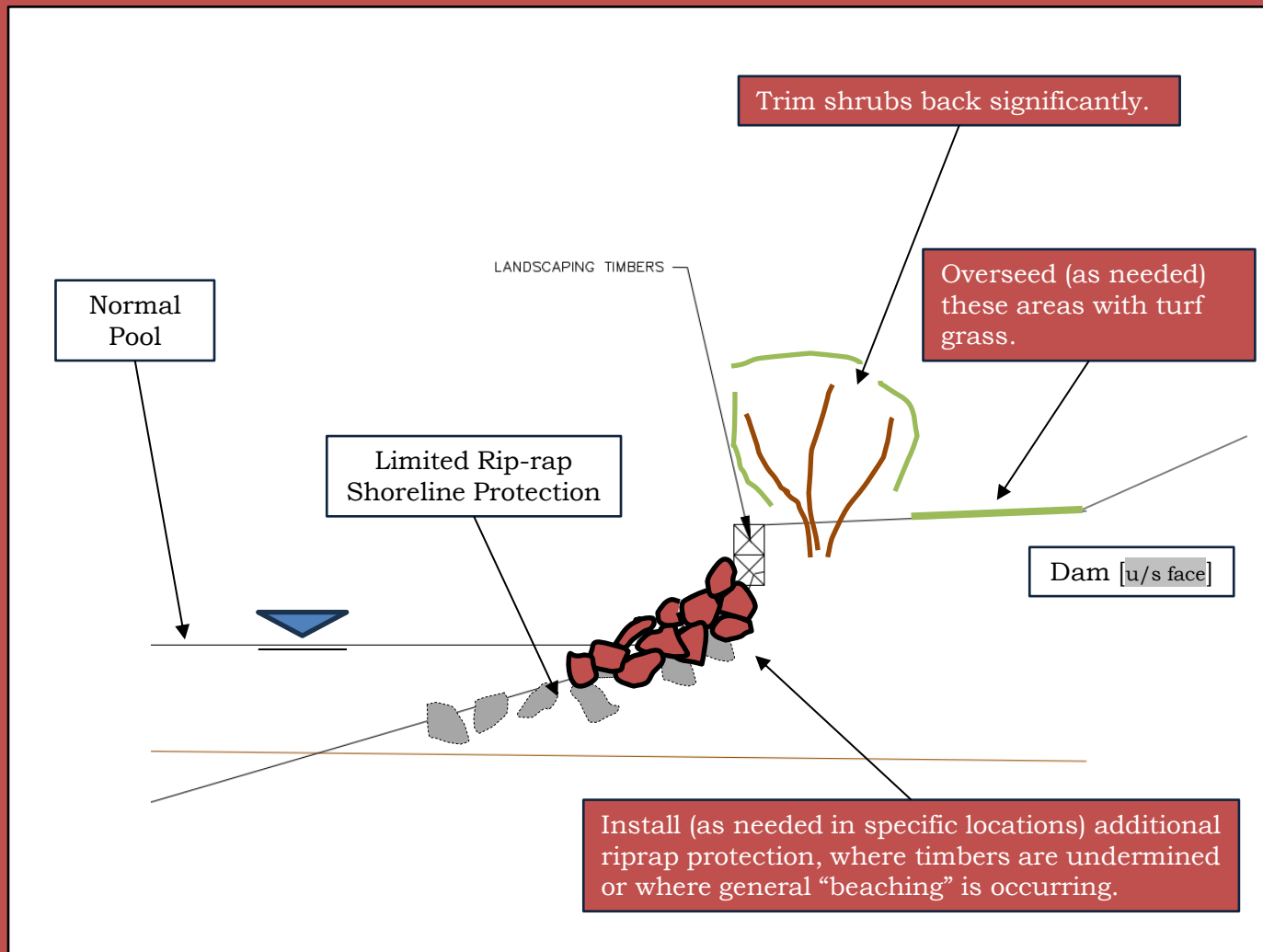


Existing Condition **Note:** This is a little of what things look like.]

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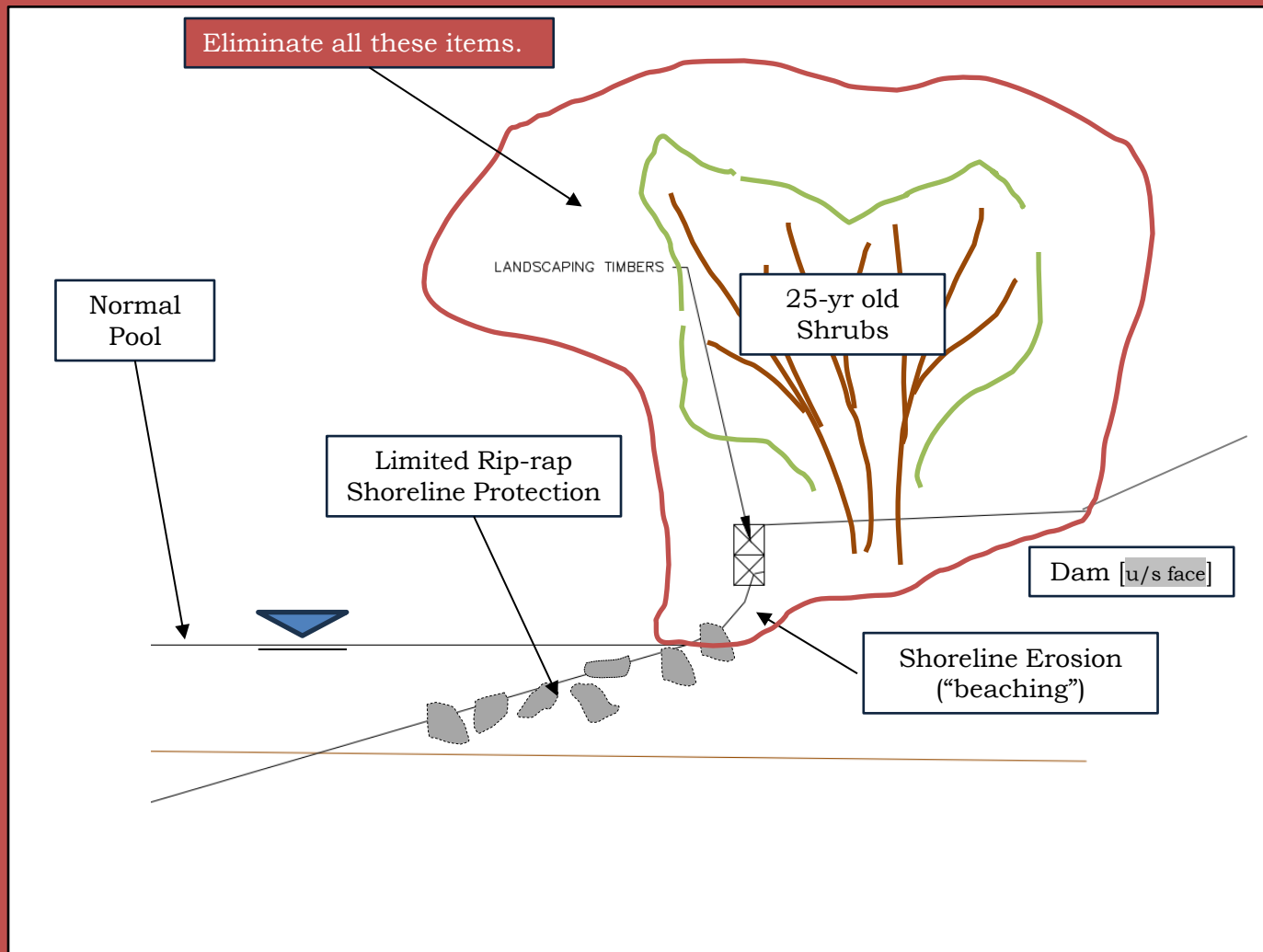


Recommended Maintenance – **Alternative One**

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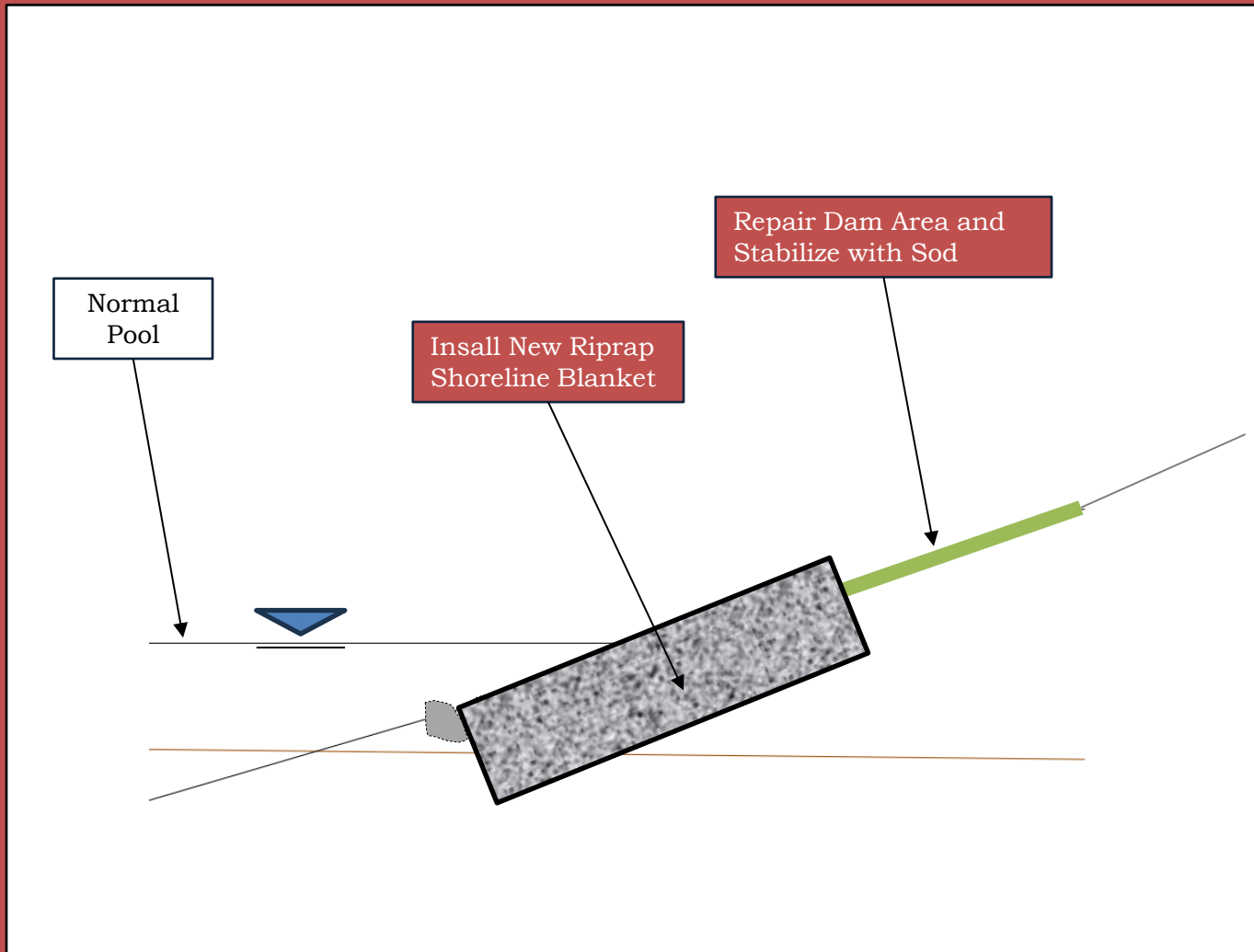


Recommended Demolitions – **Alternative Two**

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Installations – **Alternative Two**

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Riprap Shoreline Example

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Riprap Shoreline Example [Lake Royal, Fairfax County, VA (More than two decades ago, I had operational control over this dam and lake)]

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General Comments: The portion of the dam that sits above Woodcroft PW is generally in good shape and well-vegetated. Manual probings with a 48" utility probe rod found that the dam appeared to be very tight and well-compacted. There's an area on the d/s face near the northern abutment that needs some attention (in terms of the establishing of turf grass). In addition, the ditch on the downstream side is experiencing some distress due to marginal original construction and marginal stabilization attempts (probably by the City of Durham). As with all dams, settlement occurs as the dam consolidates. In walking the whole dam, I noted areas of settlement. To monitor such "settlement" and to make sure it's not indicative of something "bad" happening below the surface, I recommend setting two rows of survey monument pins (at 100-ft increments) along the top of the dam approximately two feet west of the trail edge and on the u/s face approximately 10-ft east of the trail edge. In addition, since this device doesn't appear to include seepage control measures, it would be prudent to consider establishing some piezometers near the top of the dam and about halfway down the downstream slope. I'd place them approximately 30-ft on each side of the spillway pipe [see Sheet ER-5n]. Piezometers can be helpful in monitoring the migration of seepage through the dam. All dams seep; in the industry, we call it "phreatic flow." In many ways, the phreatic surface in a dam is like an artificial water table.

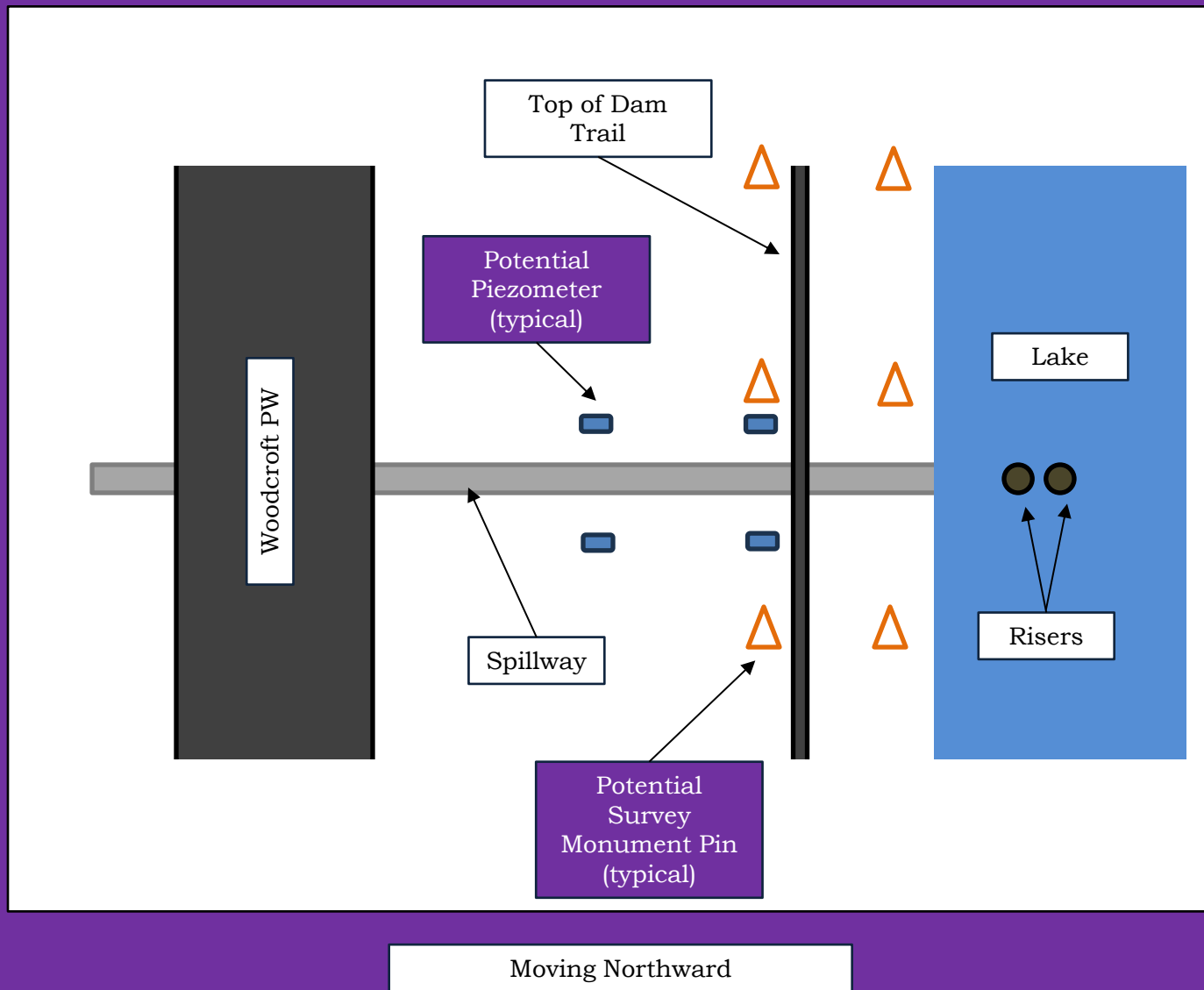


Moving Northward

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Piezometer Example

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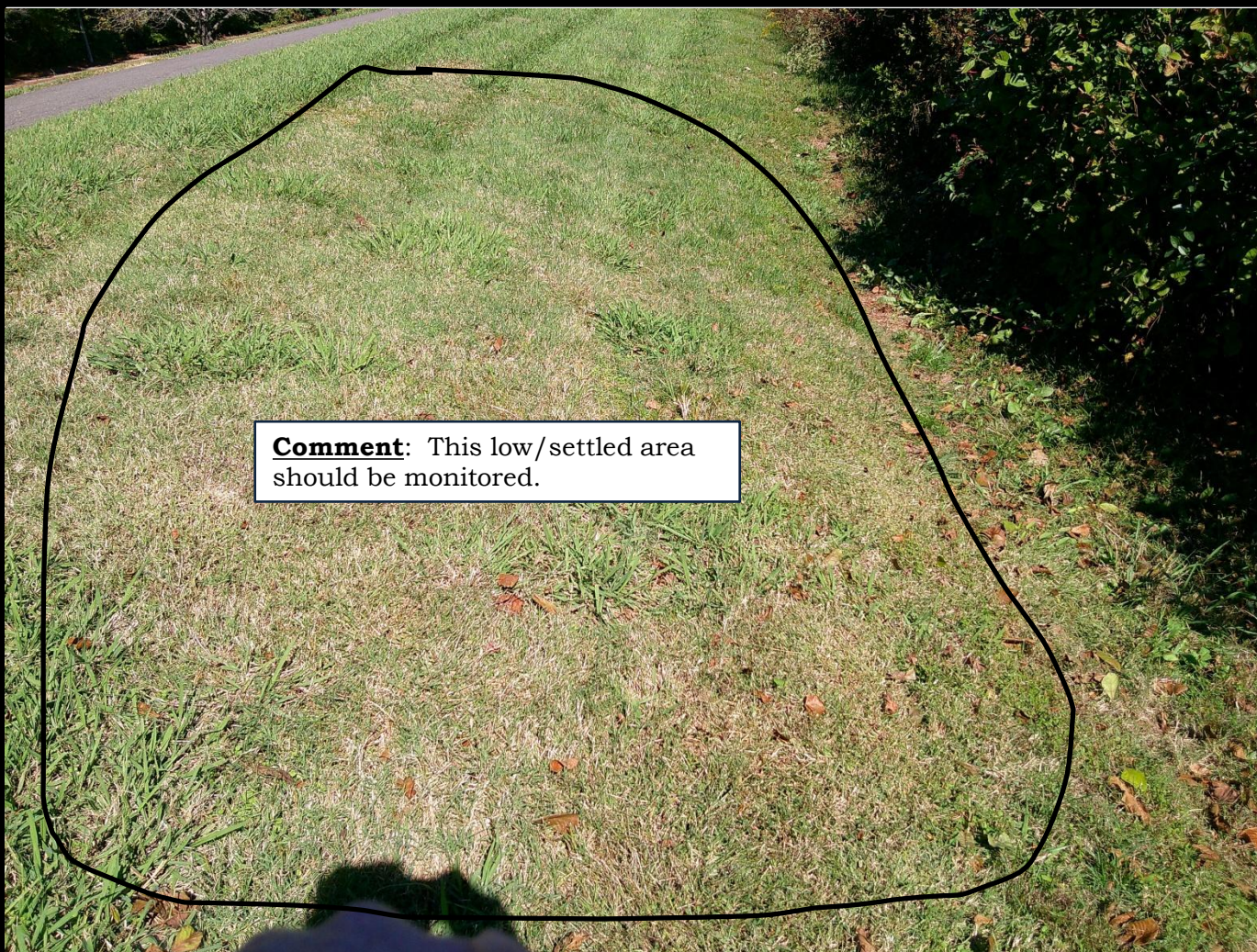


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Comment: This low/settled area should be monitored.

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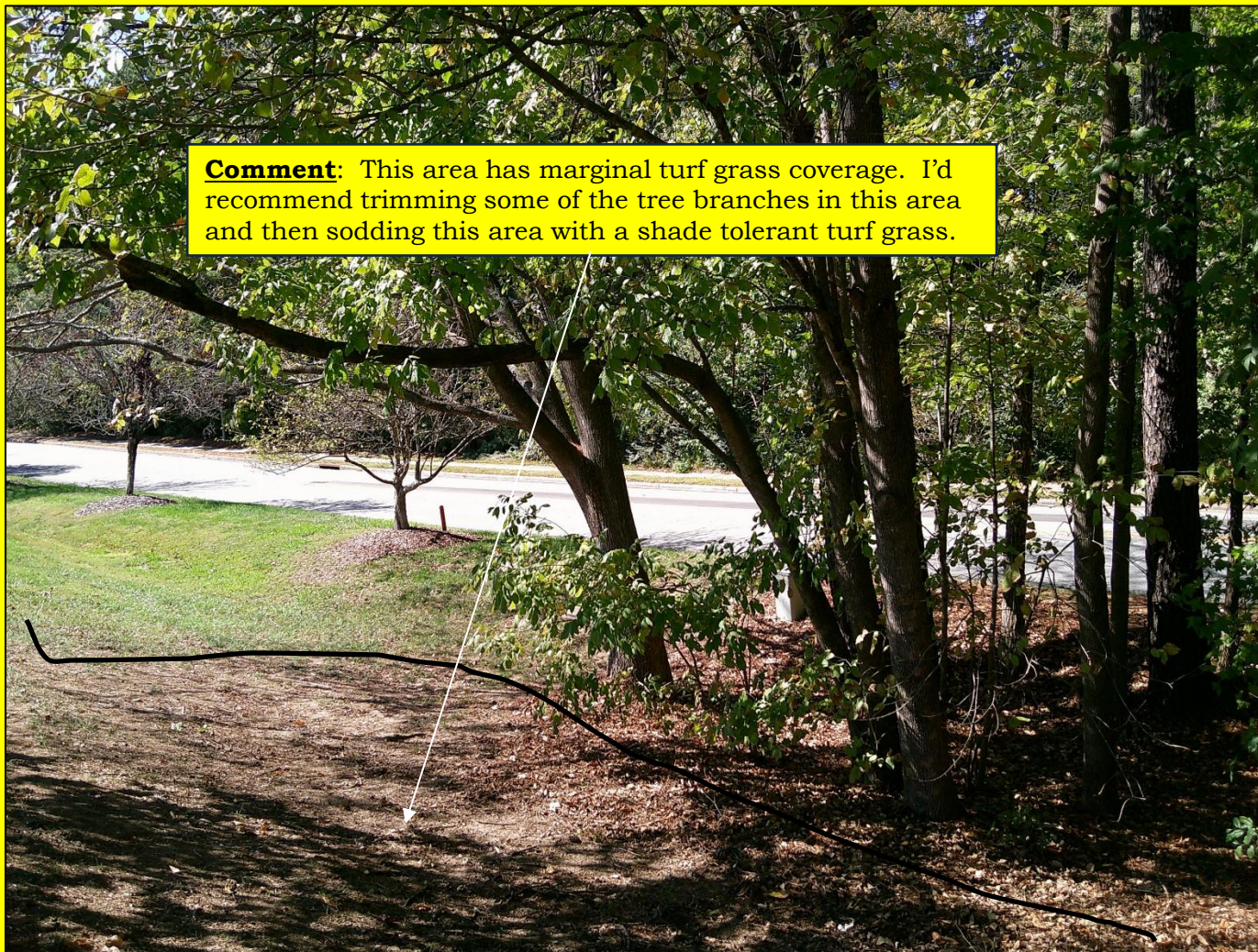
Comment: This area has marginal turf grass coverage. I'd recommend trimming some of the tree branches in this area and then sodding this area with a shade tolerant turf grass.

Moving Southward

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Comment: This area has marginal turf grass coverage. I'd recommend trimming some of the tree branches in this area and then sodding this area with a shade tolerant turf grass.

Moving Southward (facing northward)

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Comment: The riprap armoring in this area is only providing marginal protection. I don't think fabric or filter stone was installed under this riprap. That's probably one of the reasons why the ground appears to be sinking a little in this area. At some point, I'd recommend taking the riprap up, reshaping the channel)perhaps all the way up to the outfall fro the culvert under Lake Village Drive.

Moving Southward

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Moving Southward

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Comment: This is an area where erosion (head-cutting) is occurring.

Moving Southward (facing northward)

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Note: This is area of significant cracking in the trail (from about 50-ft on each side of the spillway pipe) should be monitored.

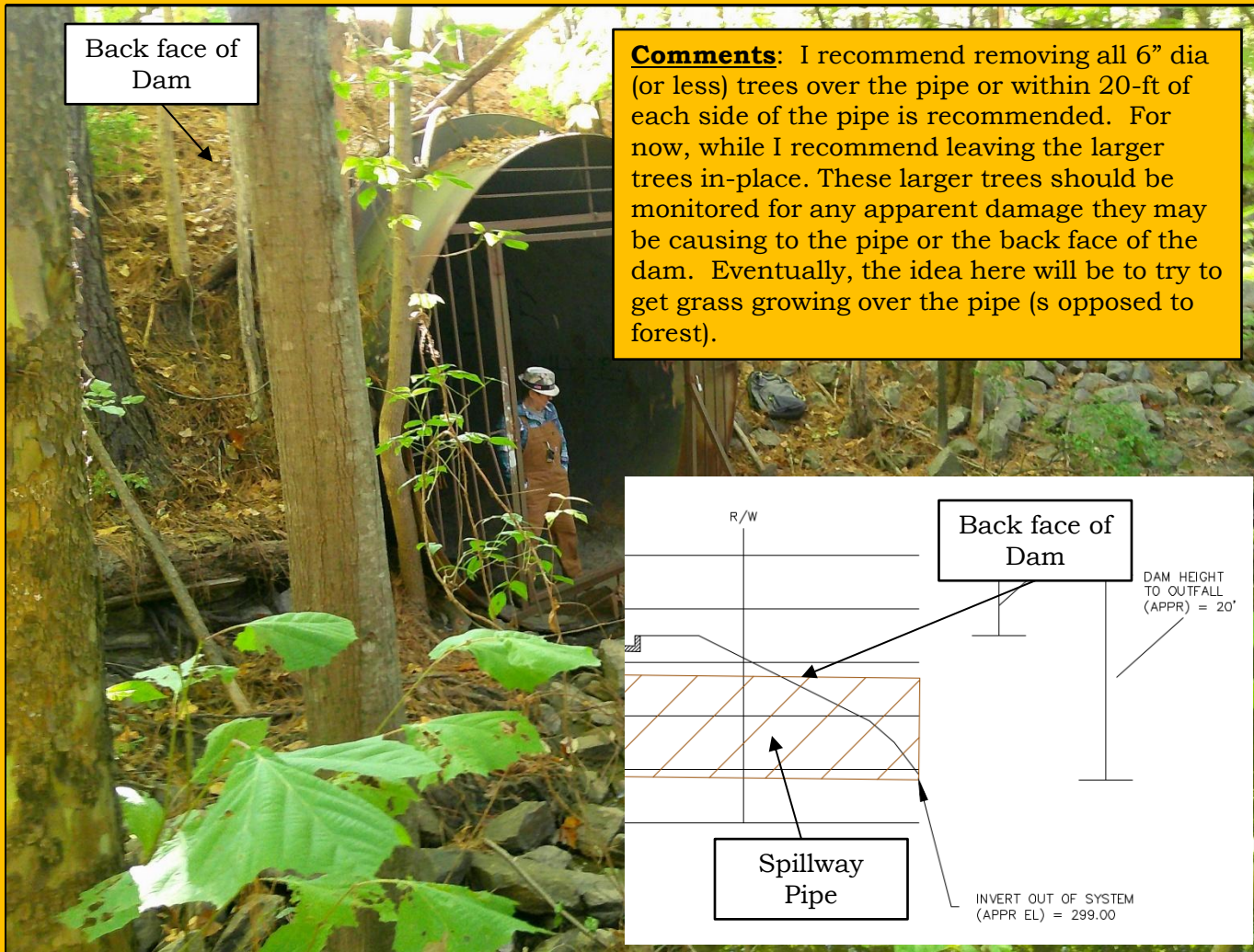
Centerline of Spillway Pipe

Moving Southward (looking northward)

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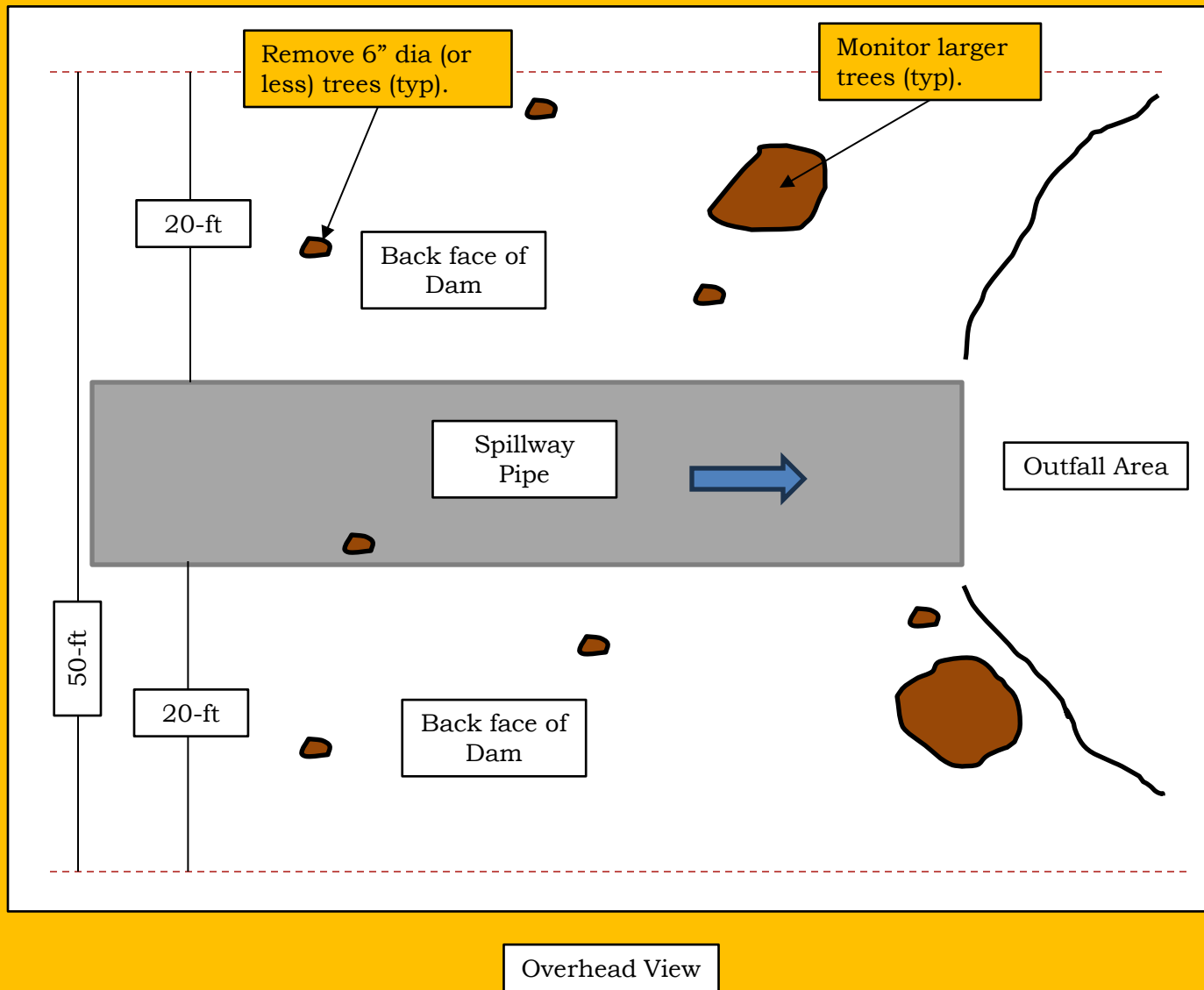




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4/Priorities



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Priorities

For planning purposes, I recommend proceeding with the following priorities:

RED ITEMS: The undertaking of these items should be pursued in the next year or so. Of note, the RED ITEMS concern the spillway pipe and risers and the “beaching” issue on the upstream face of the dam at the shoreline.

YELLOW ITEMS: The undertaking of these items should be pursued within the next five years.

BLACK ITEMS: These items should be monitored.

ORANGE ITEMS: These are not priorities. However, if conditions change, these may become priority items at sometime in the future.

PURPLE ITEMS: These are items that can aid with the O&M of the dam and outlet works. While they’re not “required,” having them can be quite beneficial.

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