NORTH AMERICAN SOCIETY FOR TRENCHLESS TECHNOLOGY

WARNING – DO NOT BID ON THIS PROJECT

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BRIERLEY ASSOCIATES
Creating Space Underground

"For projects advertised and awarded through bidding, it's the responsibility of the Owner to prepare a design package which is readily constructible within standard industry practices"

"Design efforts should follow standards of the practice (at a minimum)"

"Don't think this can be built as shown"

- Bring problems to attention of owner – risk advantage
- Include budget to handle problems – too expensive
- Keep quiet – address in change orders
- ***Avoid it altogether….***

Common Trenchless Design Deficiencies

- Method Selection
- Alignment Selection
- Work Space Allocation
- Ground Characterization
- Pipe Design

May be tied to permit condition

Examples

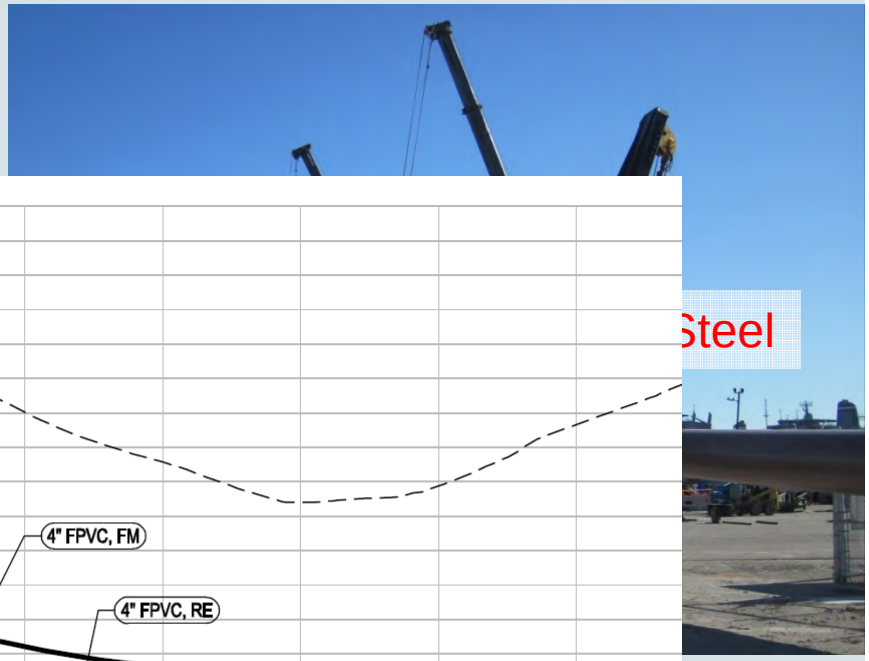
Method Selection

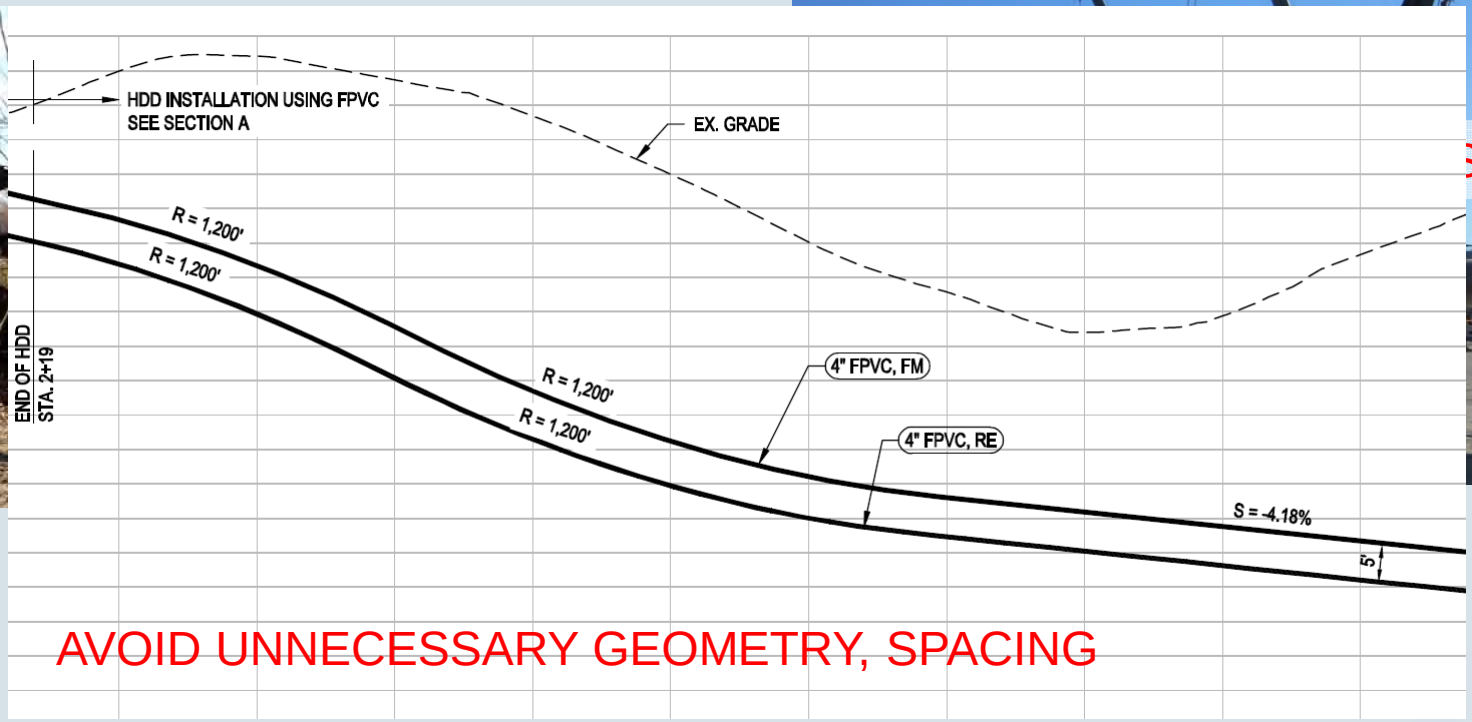
Method	Commonly Overlooked Limitations
HDD	➢ Generally not suitable for gravity installations ➢ Sensitive to shallow installations
Microtunnel	➢ Expensive, may require significant shafts
Pipe Ramming	➢ No primary groundwater control ➢ Accuracy ➢ Vibrations
Auger Boring	➢ No primary groundwater control ➢ Accuracy
Pilot Tube	➢ Requires displaceable soils ➢ No primary groundwater control
Pipe Jacking	➢ No primary groundwater control ➢ Requires face control

- Don’t Be Overly Prescription On Method
- Consider Bidding Multiple Methods

Alignment Selection - HDD

- Borehole needs to consider bending capabilities of pipe
- Don’t design to minimum radius





Steel

AVOID UNNECESSARY GEOMETRY, SPACING

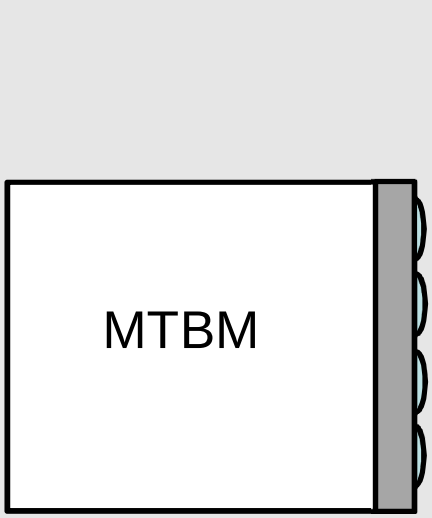
Alignment Selection - HDD

- Depth of bore needs to consider geometry AND geology AND hole size.
- Depth assignment should NOT be arbitrary

- Rock drilling costs $$
- Soft soils present steering issues

Alignment Selection - Microtunneling

- Avoid nested cobbles and boulders
- Avoid mixed face conditions
- Depth assignment should NOT be arbitrary
- Depth of MT needs to consider slurry pressure, face stability, groundwater pressures.

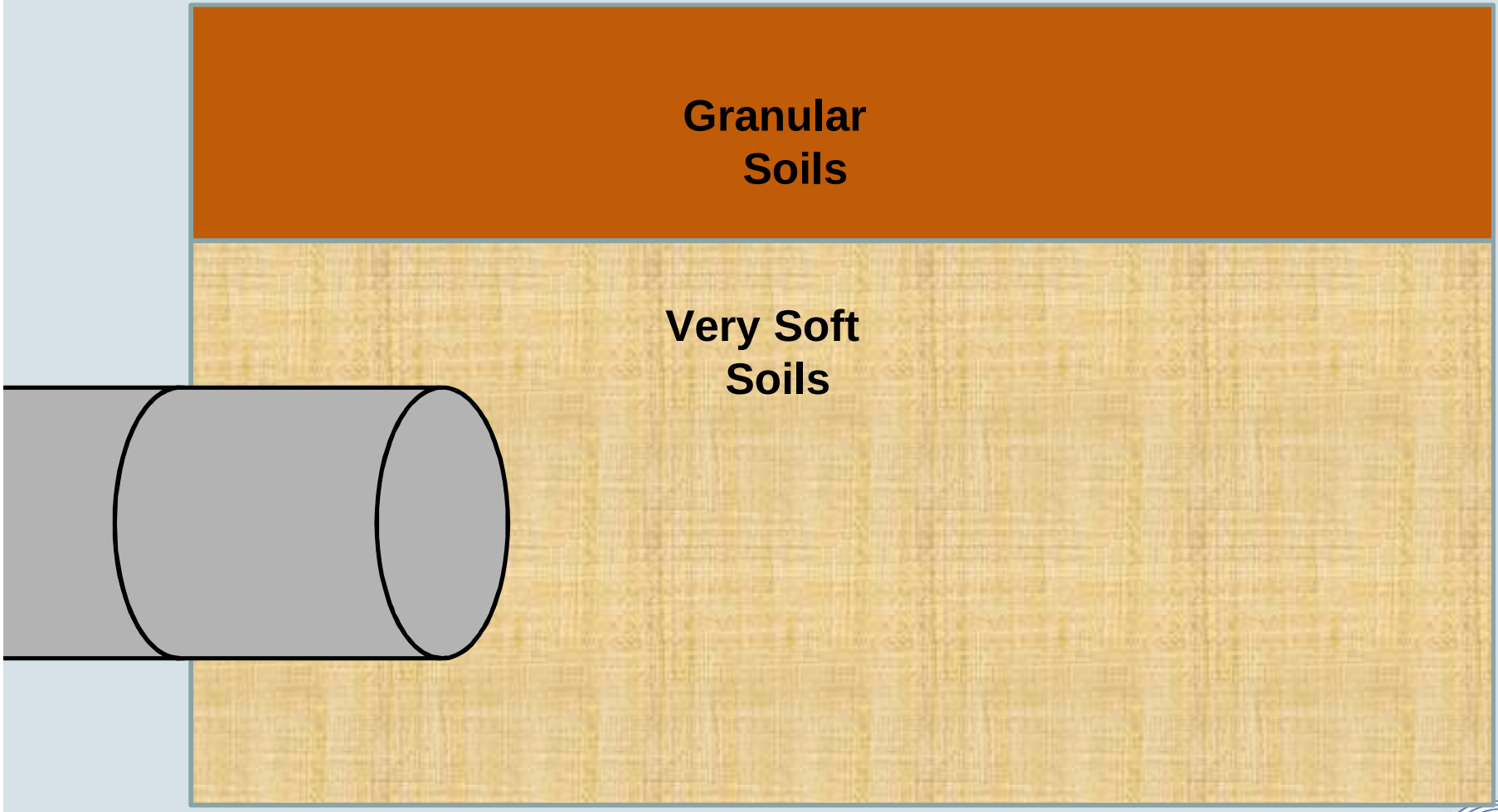


SILT

SAND AND GRAVEL

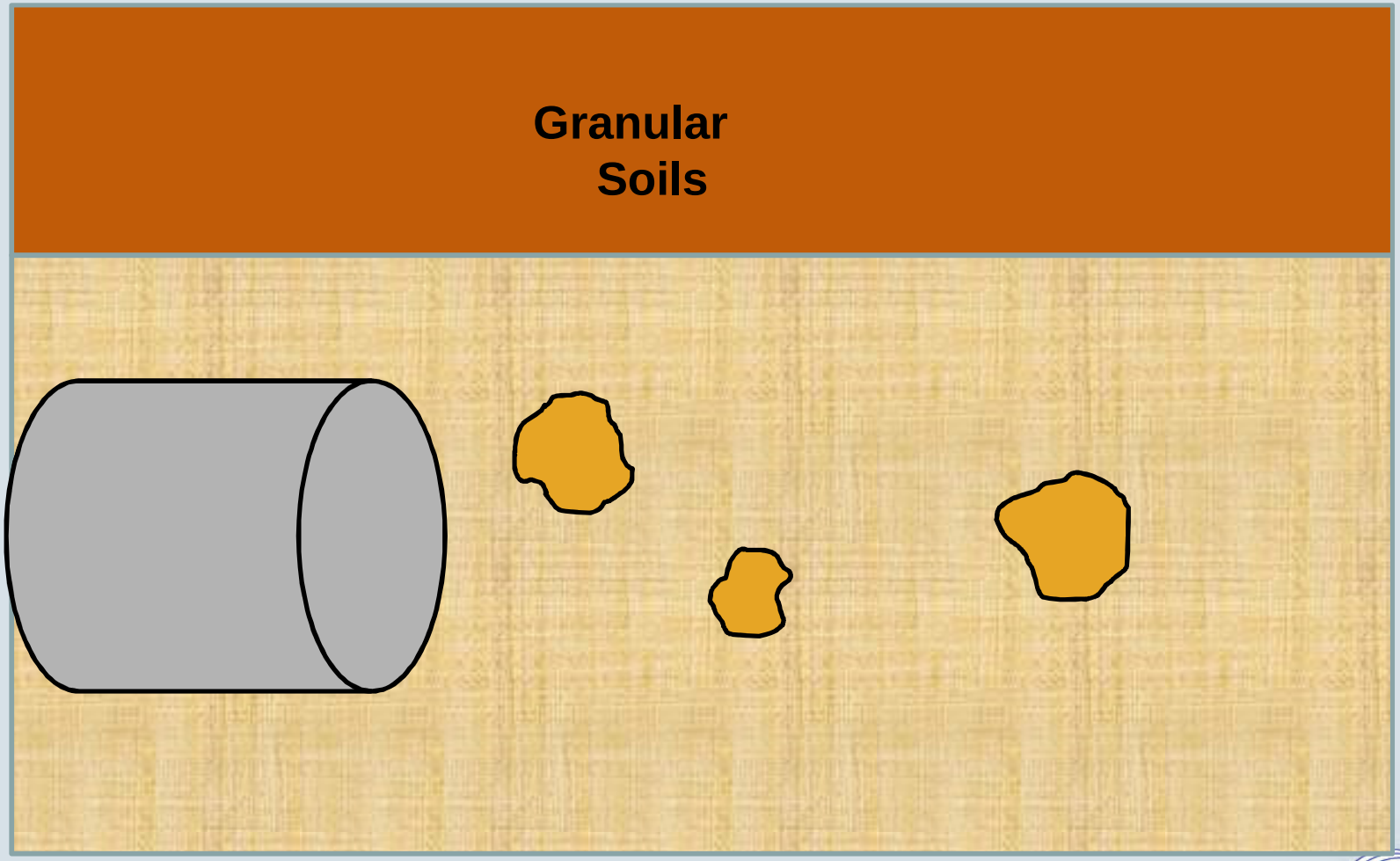
Alignment Selection

- Will equipment be stable?
- Pipe buoyancy?



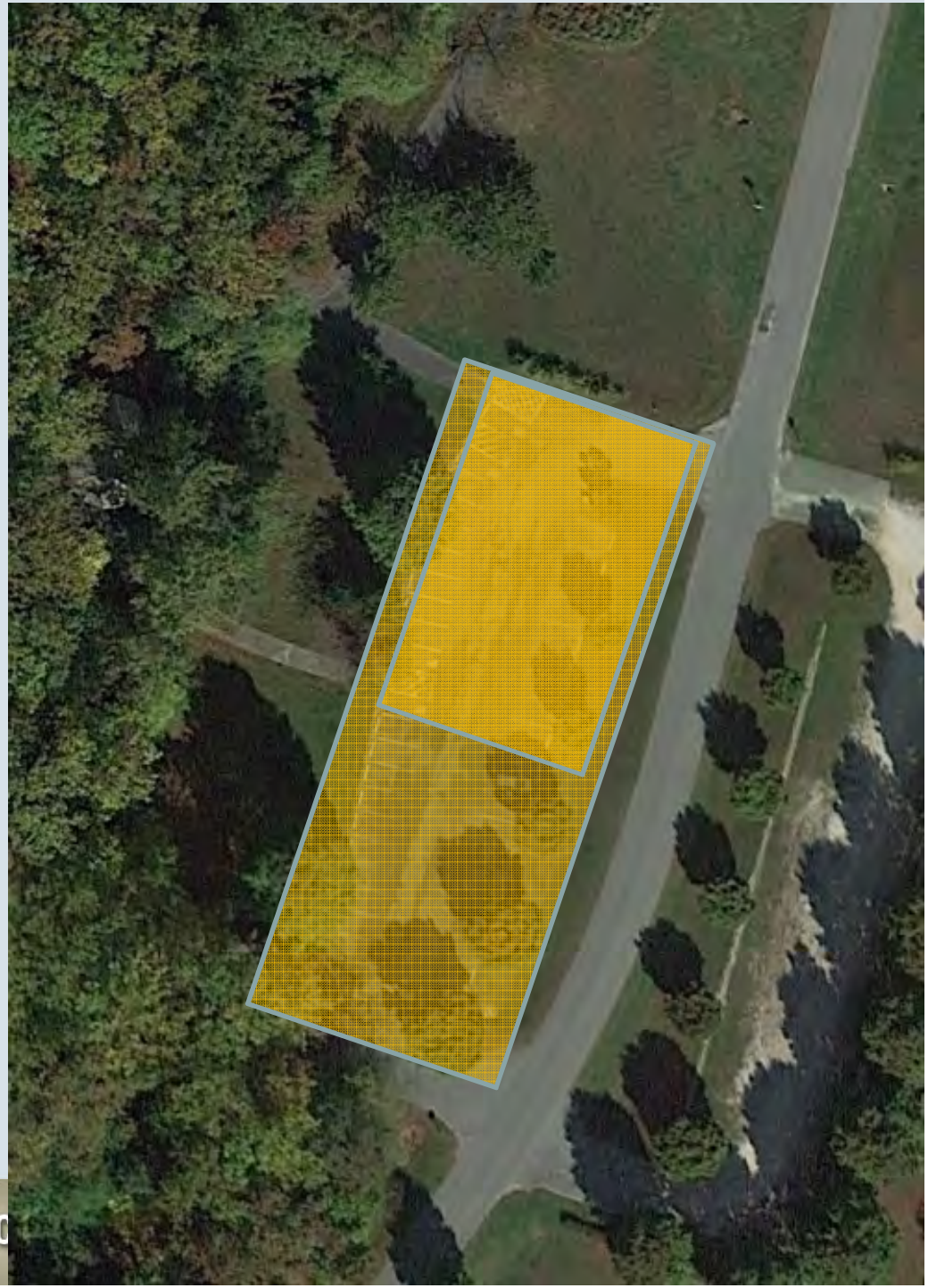
Alignment Selection

- How will obstructions be handled?
- Define “obstruction” in spec



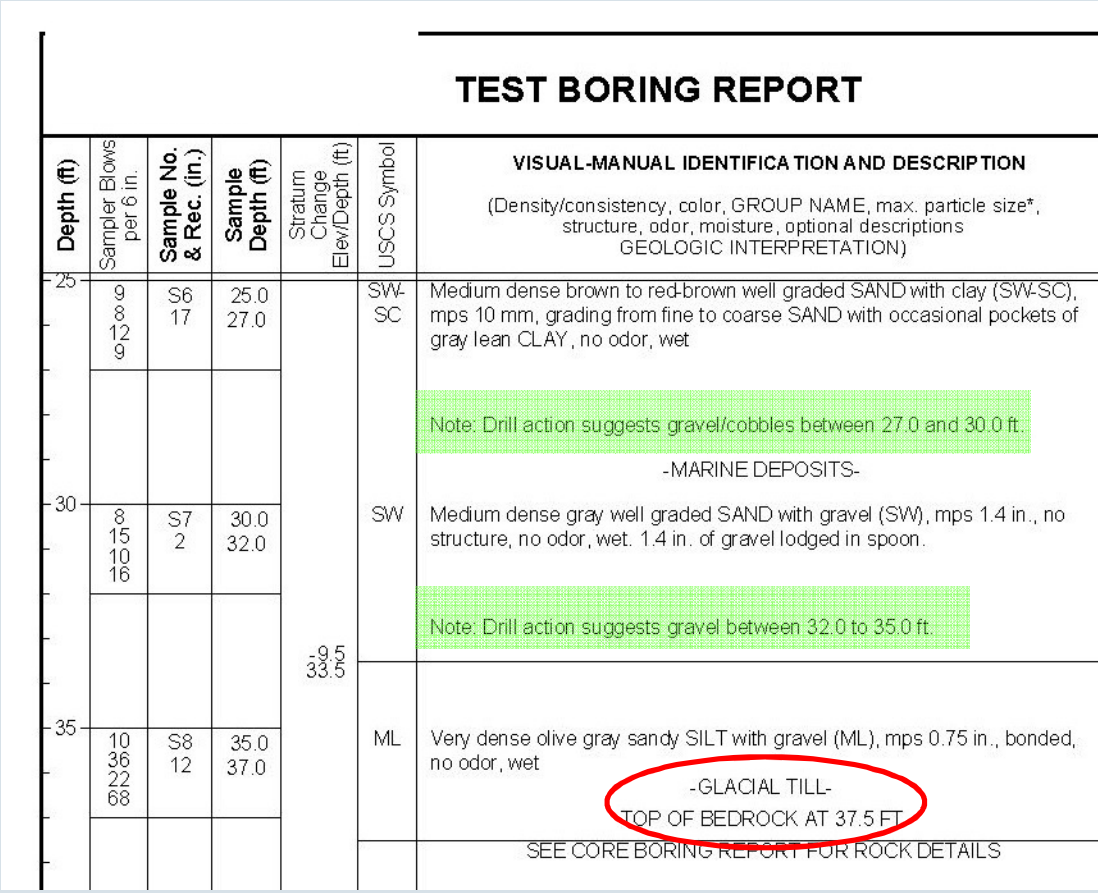
Work Space Allocation

- Need room for all construction equipment, construction activities, trucking routes.
- Complete a mockup in advance
- Show limits on drawings
- Include pipe storage and laydown



Ground Characterization

- Too few explorations (if any)
- Explorations too shallow
- No definition of shallow refusal
- No rock coring
- Poor sample characterization
- No emphasis on critical points (e.g. obstructions)



TEST BORING REPORT

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
25	9 8 12 9	S6 17	25.0 27.0		SW-SC	Medium dense brown to red-brown well graded SAND with clay (SW-SC), mps 10 mm, grading from fine to coarse SAND with occasional pockets of gray lean CLAY, no odor, wet
						Note: Drill action suggests gravel/cobbles between 27.0 and 30.0 ft.
						-MARINE DEPOSITS-
30	8 15 10 16	S7 2	30.0 32.0		SW	Medium dense gray well graded SAND with gravel (SW), mps 1.4 in., no structure, no odor, wet. 1.4 in. of gravel lodged in spoon.
						Note: Drill action suggests gravel between 32.0 to 35.0 ft.
				-9.5 33.5		
35	10 36 22 68	S8 12	35.0 37.0		ML	Very dense olive gray sandy SILT with gravel (ML), mps 0.75 in., bonded, no odor, wet
						-GLACIAL TILL-
						TOP OF BEDROCK AT 37.5 FT
						SEE CORE BORING REPORT FOR ROCK DETAILS

"The Contractor shall perform additional test borings to determine geotechnical and groundwater conditions, as he considers necessary to complete the installation at no additional cost to the Owner."

Pipe Design - HDD

- Pipe selection is designer's responsibility
- Vast majority of small to medium sized HDD project have not considered pipe pull strength
- Most plastic pipe designs have not considered buckling of pipe
- Metallic pipe needs validation, too. Metallic; 100' per 1" diameter, BUT what is real min radius?

Pipe Design – Jacking Forces

- Jacking installations require jacking pipe
- Jacking forces should be evaluated, and jacking pipe selected accordingly
- Different pipe materials have different strengths
- Estimated jacking forces also help contractor select equipment, and design jacking pit/reaction system

Example #1

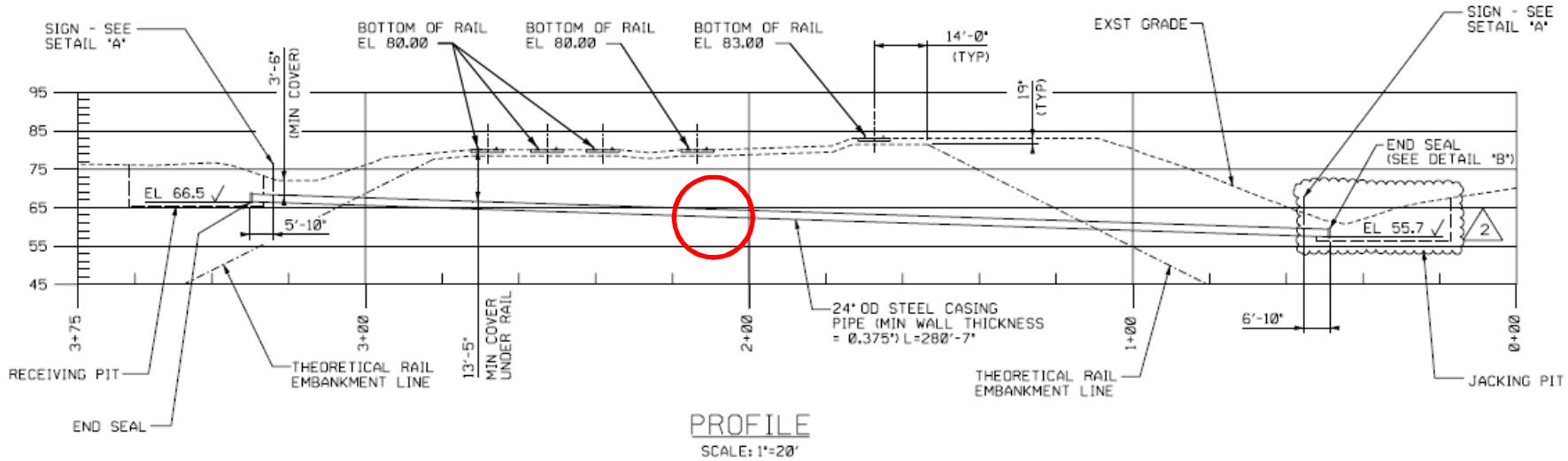
Installation of 24-in casing by auger boring

280-ft Auger Bore

Closest test borings

Example #1

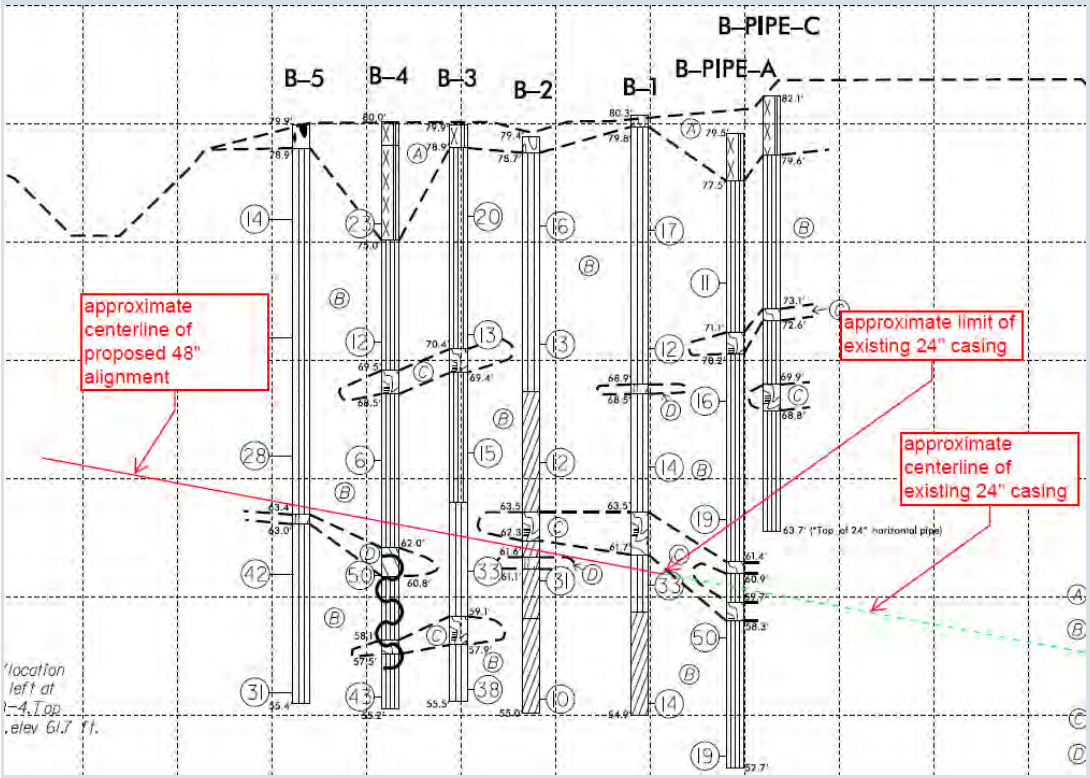
Installation of 24-in casing by auger boring



- 24” Casing did not permit obstruction removal from within casing
- Could not excavate from above

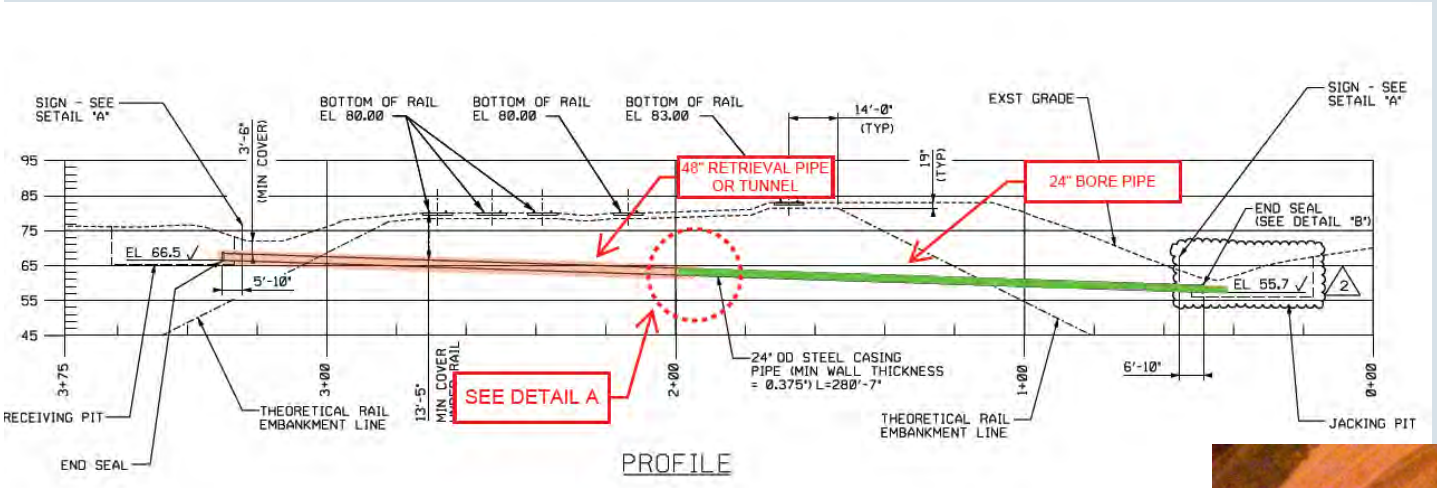
Example #1

Installation of 24-in casing by auger boring



Example #1

Installation of 24-in casing by auger boring

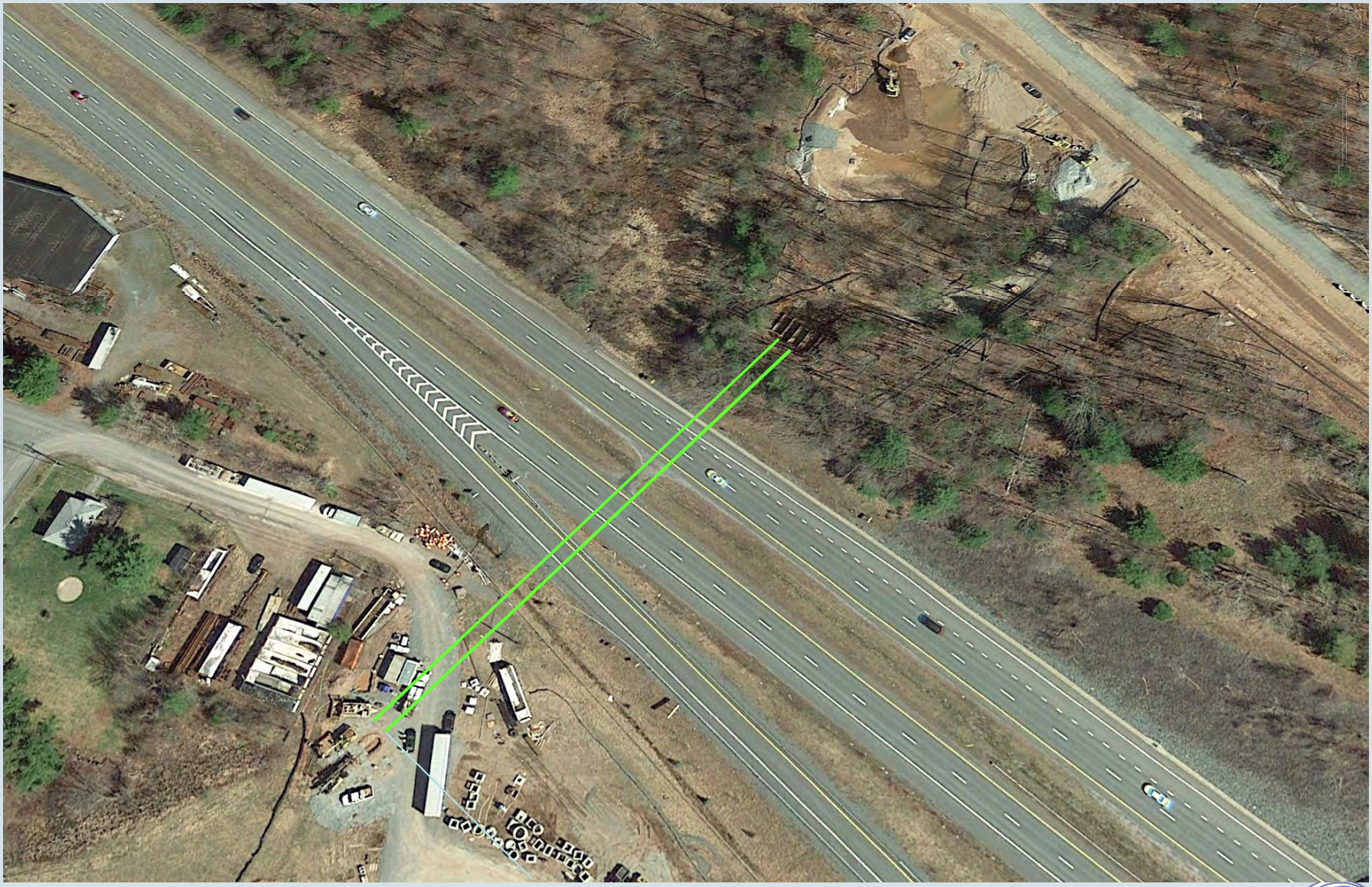


Contractor: "installation of the 24-inch OD steel casing using jack and bore techniques was not readily constructible given the subsurface conditions at the site"

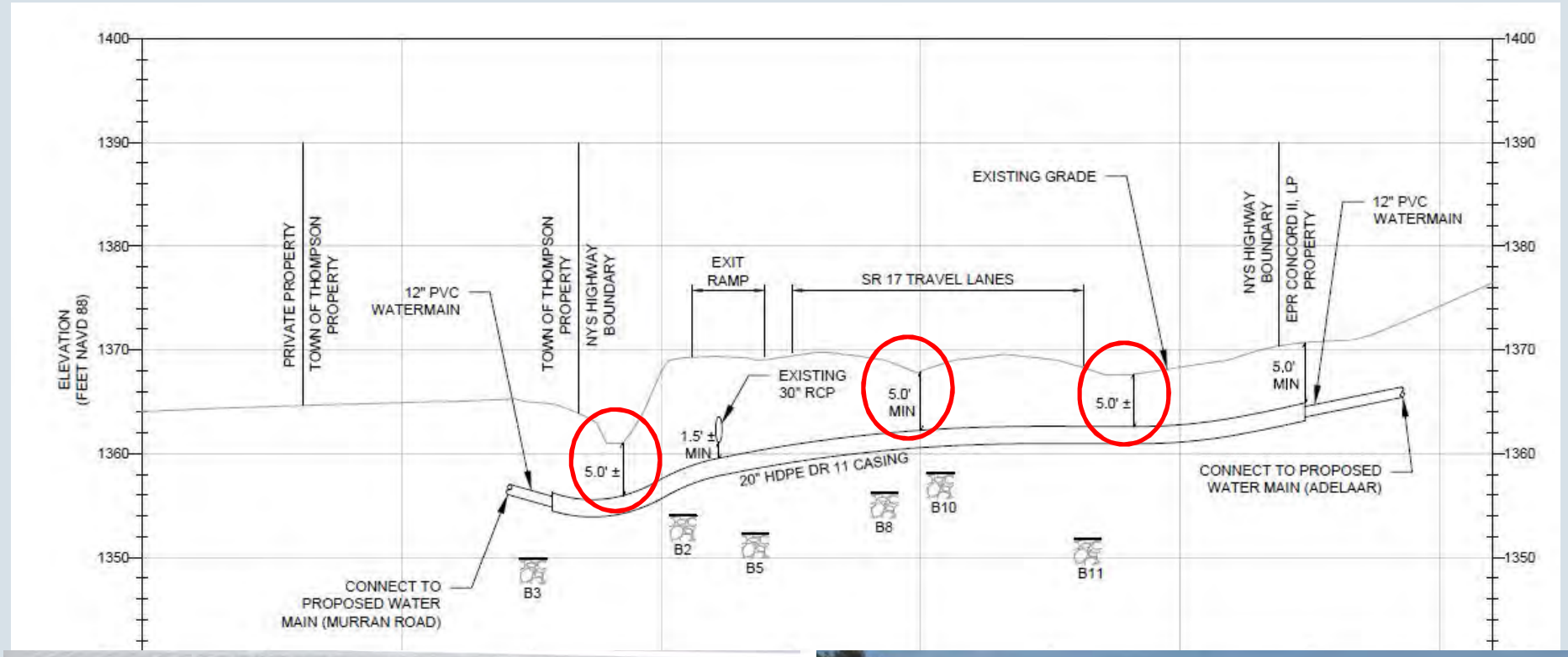
Owner: "Contractor should have known better given local geology"

Example #2

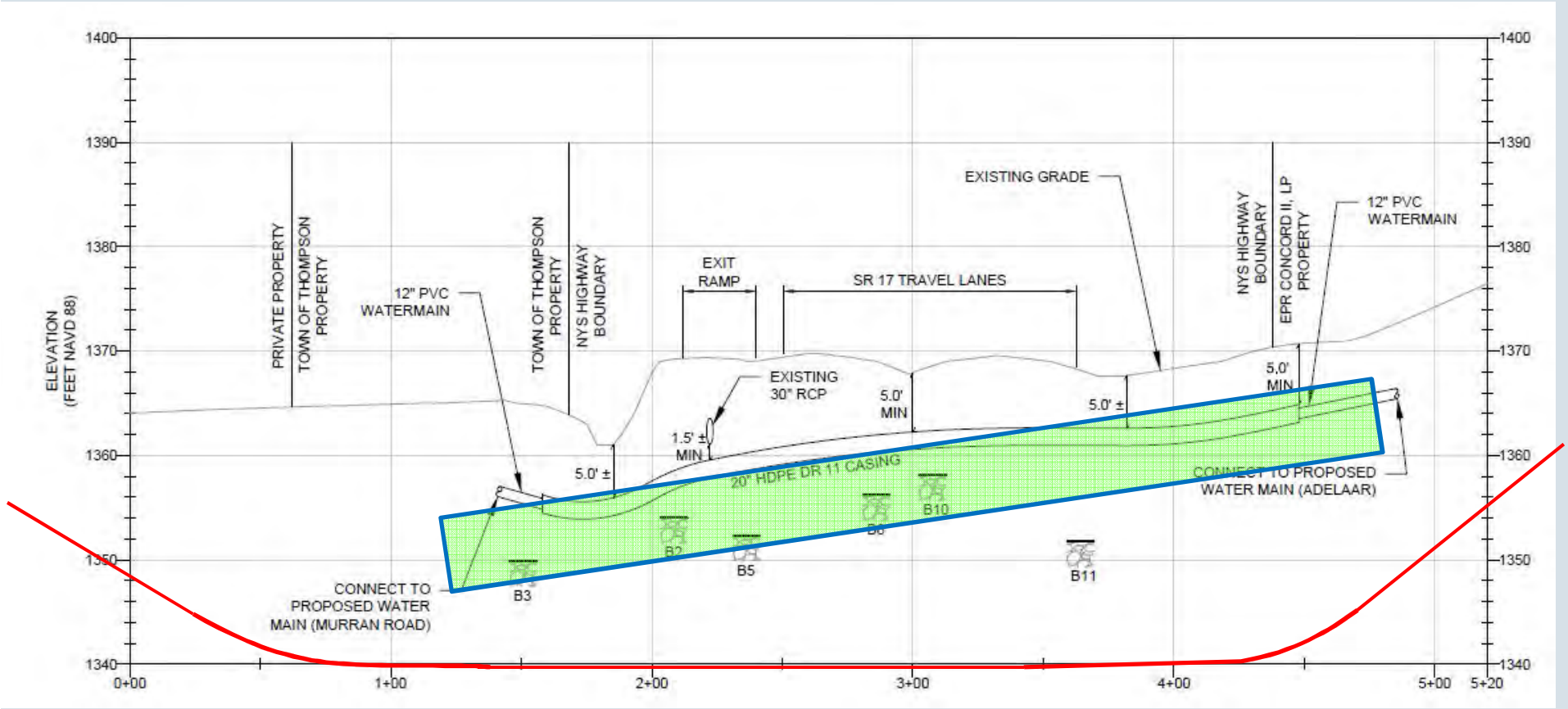
2 x 20” HDPE casing by HDD



Example #2


ELEVATION (FEET NAVD 88)
1400
1390
1380
1370
1360
1350
PRIVATE PROPERTY
TOWN OF THOMPSON PROPERTY
12" PVC WATERMAIN
TOWN OF THOMPSON PROPERTY
NYS HIGHWAY BOUNDARY
EXIT RAMP
SR 17 TRAVEL LANES
EXISTING GRADE
NYS HIGHWAY BOUNDARY
EPR CONCORD II, LP PROPERTY
12" PVC WATERMAIN
EXISTING 30" RCP
1.5' ± MIN
5.0' ±
5.0' MIN
5.0' ±
5.0' MIN
20" HDPE DR 11 CASING
CONNECT TO PROPOSED WATER MAIN (ADELAAR)
CONNECT TO PROPOSED WATER MAIN (MURRAN ROAD)
B3
B2
B5
B8
B10
B11

Example #2


ELEVATION (FEET NAVD 88)
1400
1390
1380
1370
1360
1350
1340
0+00
1+00
2+00
3+00
4+00
5+00
5+20
PRIVATE PROPERTY
TOWN OF THOMPSON PROPERTY
12" PVC WATERMAIN
TOWN OF THOMPSON PROPERTY
NYS HIGHWAY BOUNDARY
EXIT RAMP
SR 17 TRAVEL LANES
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B3
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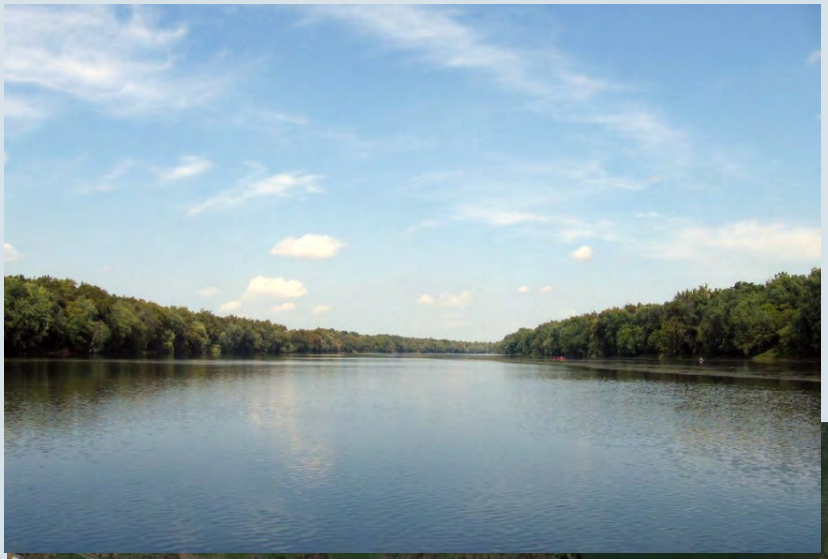
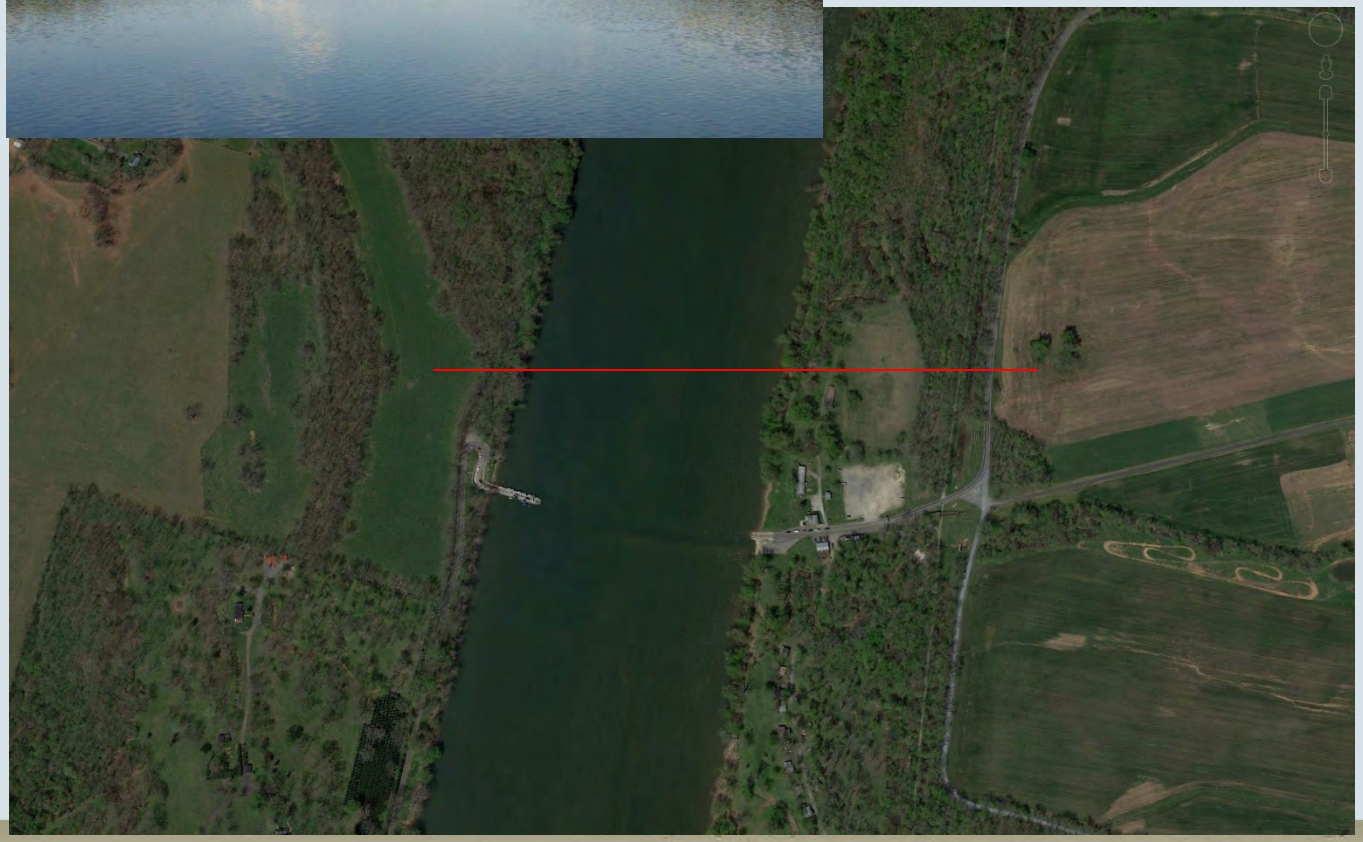
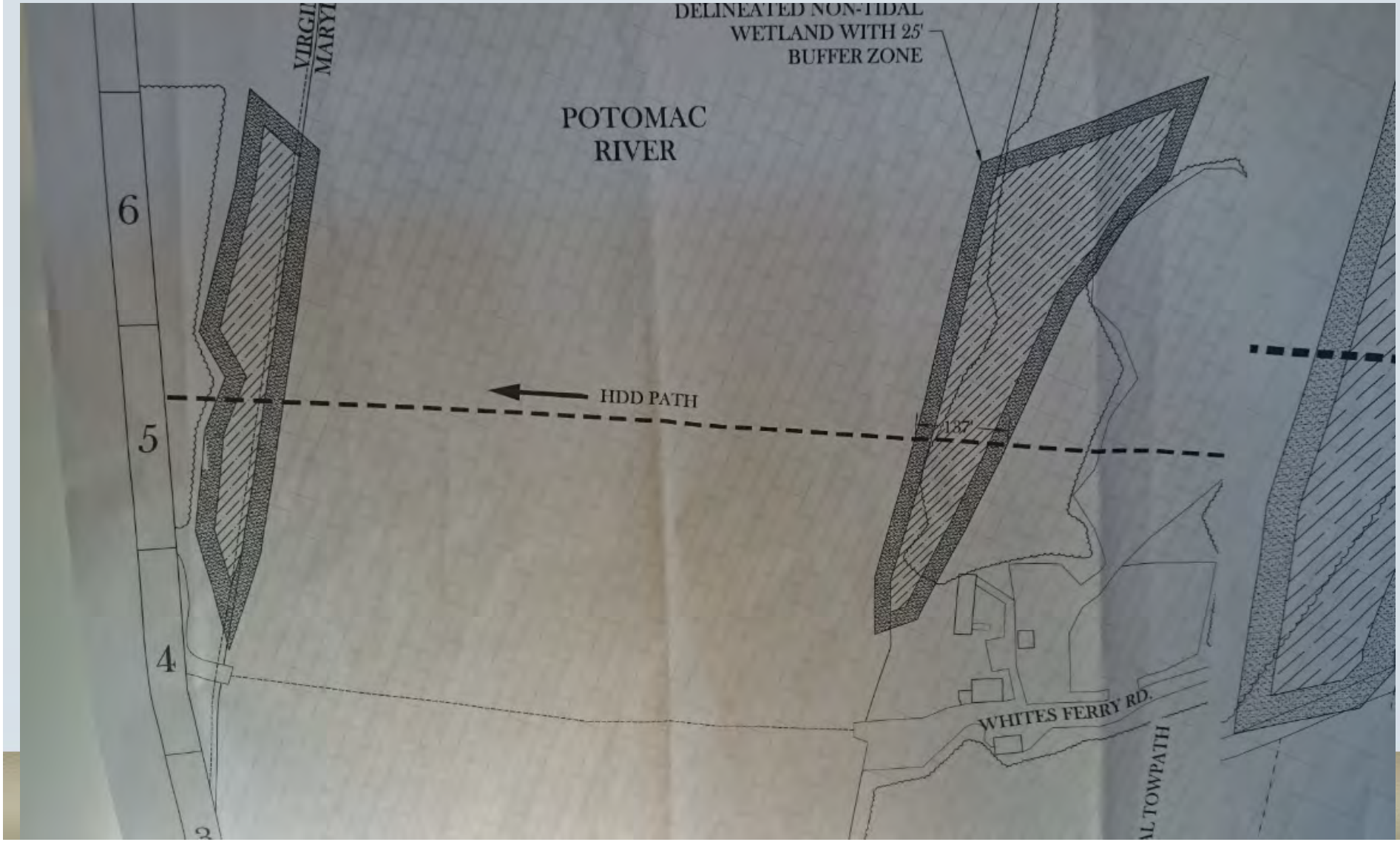
Example #3



- 2,200-ft steel casing by HDD



Example #3


DELINEATED NON-TIDAL
WETLAND WITH 25'
BUFFER ZONE
POTOMAC
RIVER
6
5
4
HDD PATH
135'
WHITES FERRY RD.

From management of major utility:

"Say I have 10 trenchless crossings. I don't bother with test borings, or design, for any of them – no money spent.

If I only have change orders on one crossing, imagine how much money I'm saving……"

Questions?

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