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2025 SPRING CONVENTION

AUSTIN, TEXAS • APRIL 13 – 16, 2025

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UNCOMMON CONCRETE SWIMMING POOL REPAIRS

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Associate Principal

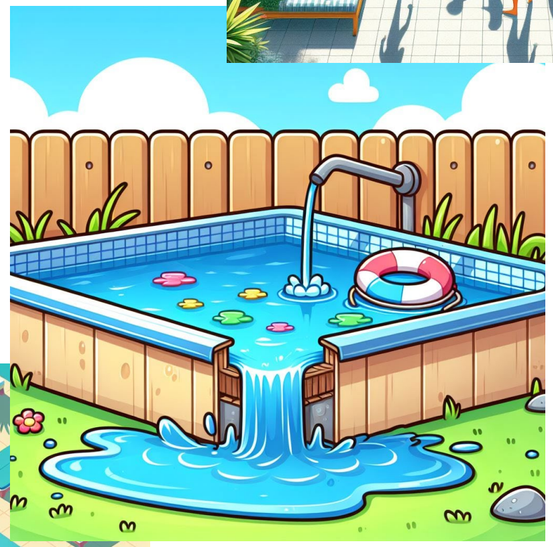
2025 SPRING CONVENTION
APRIL 13– 16, 2025

WHAT POOLS HAVE IN COMMON?

MAKE PEOPLE HAPPY

WHICH PROBLEM CONCRETE POOLS HAVE IN COMMON?

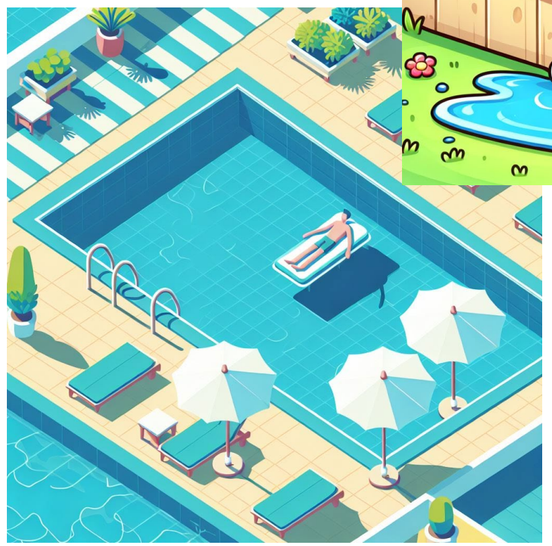
LEAK



WHICH POOLS ARE BEST?

THE ONES WHERE YOU ARE THE<u>GUEST</u>!

You come and leave and let other people worry about it



WHAT IS UNIQUE ABOUT POOL STRUCTURES?

- Constantly exposed to harsh environment
  - Chemically treated water
  - High humidity in natatoriums
- If not inground, space below them is typically occupied and used as
  - Storage space
  - Parking
  - Office space
- When they leak it affects the space below them
- When they leak it costs a significant amount of money to keep the water level
- Short period of time when they can be repaired. Typically, during swimming competion season breaks or short time closures for basic maintenance

WHAT IS TYPICAL DISTRESS?

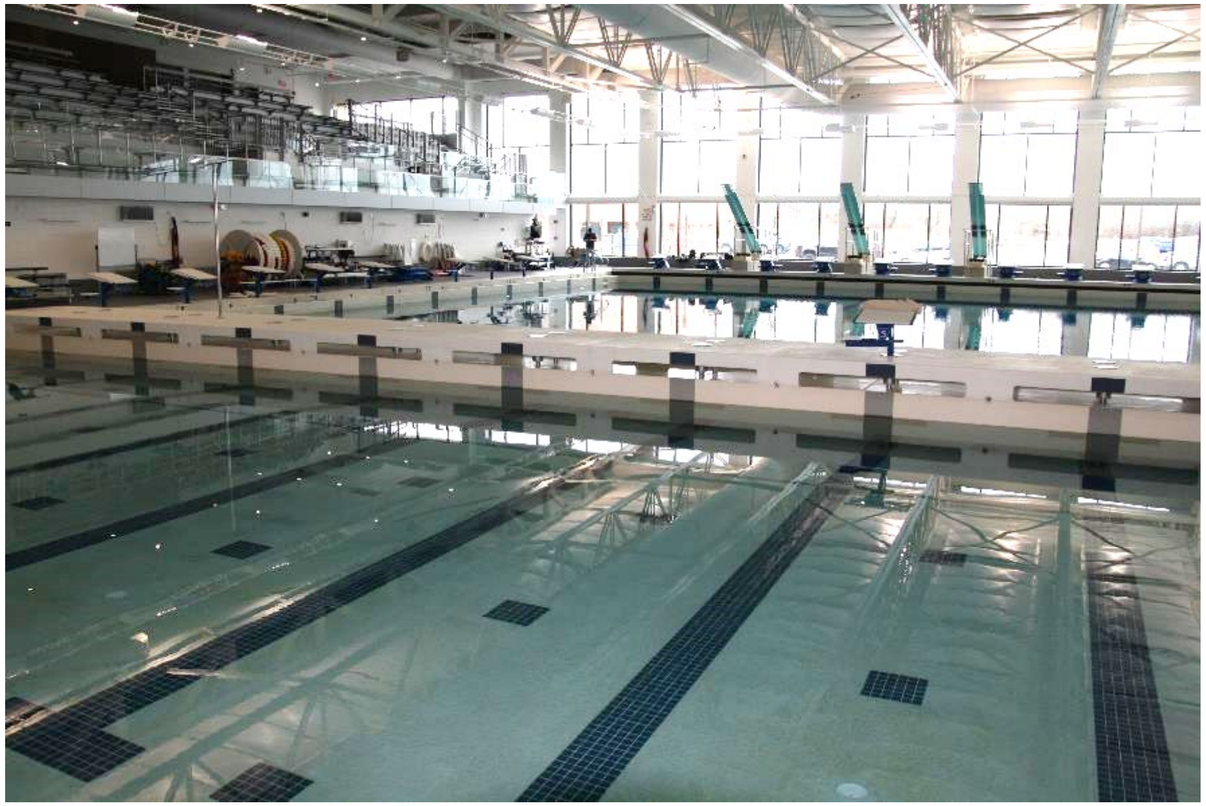
- Cracked and debonded tiles
- Cracked and debonded plaster
- Breached liners
- Breached waterproofing membrane
- Concrete delaminations /spalls
- Corrosion of metals
- Clogged drains / leaking drains
- Sealant - debonded / deteriorated / stained
- Damaged grates at gutters, bulkheads and drains
- Bulkheads – deteriorated bearings
- Corroded / broken duct supports at the ceiling of indoor pools

FOCUS OF THIS PRESENTATION

Four different projects will be presenting with some uncommon concrete swimming pool repairs such as:

- Repair of expansion joint
- Repair of leaching butyl -rubber waterstop through construction joints
- Repair of pool deck in area above chlorine storage and embedded high voltage corroded conduits in it
- Repair of pool deck supported by steel framing

Project No. 1 - Pool with Expansion Joint in Walls and Floor Slab



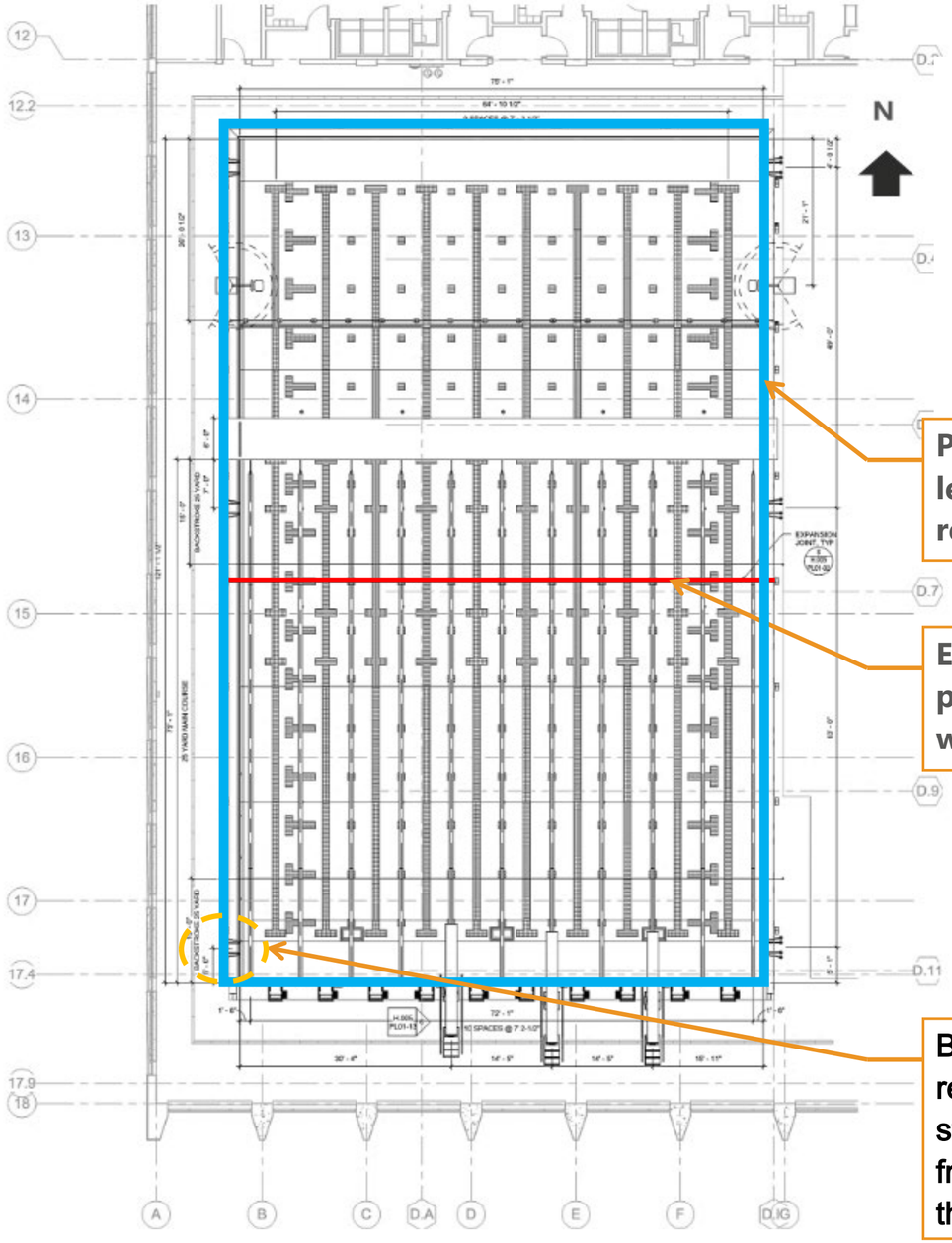
<u>Issues</u>

- Pool started losing water immediately after opening
- Black gooey-like material (waterstop residue) started leaching through pool walls and inside the gutter at several locations after one year of opening

Live Content Slide

When playing as a slideshow, this slide will display live content

Poll: Have you ever seen an expansion joint inside a pool?

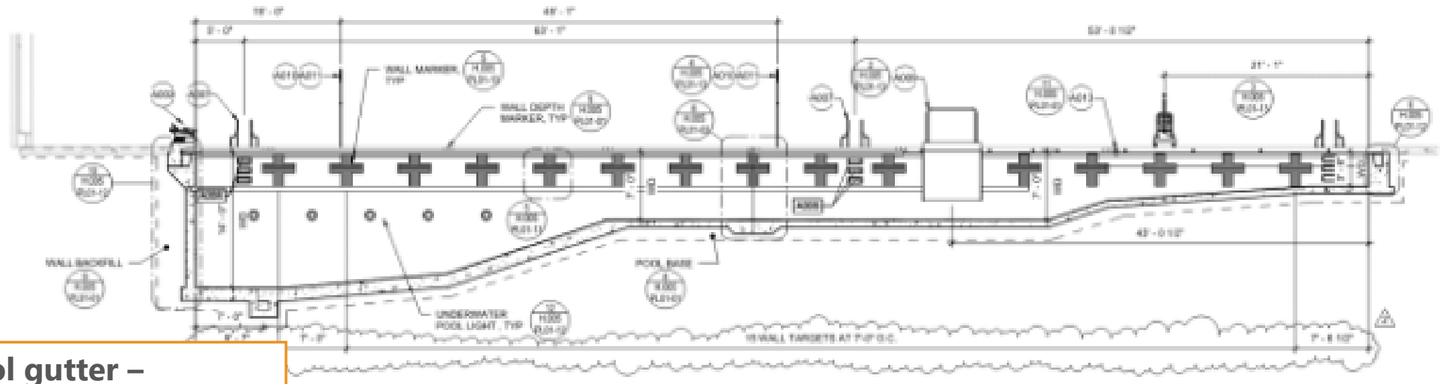


Pool Plan View

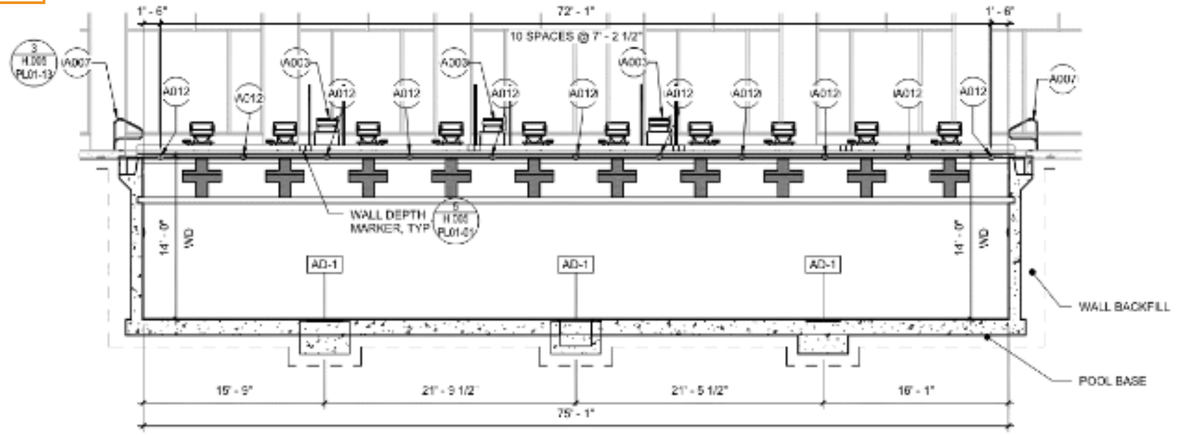
Pool gutter – leaching waterstop residue

Expansion joint at pool slab and walls

Black waterstop residue at pool stairs, leaching from the joint at the gutter level



Pool Longitudinal Section



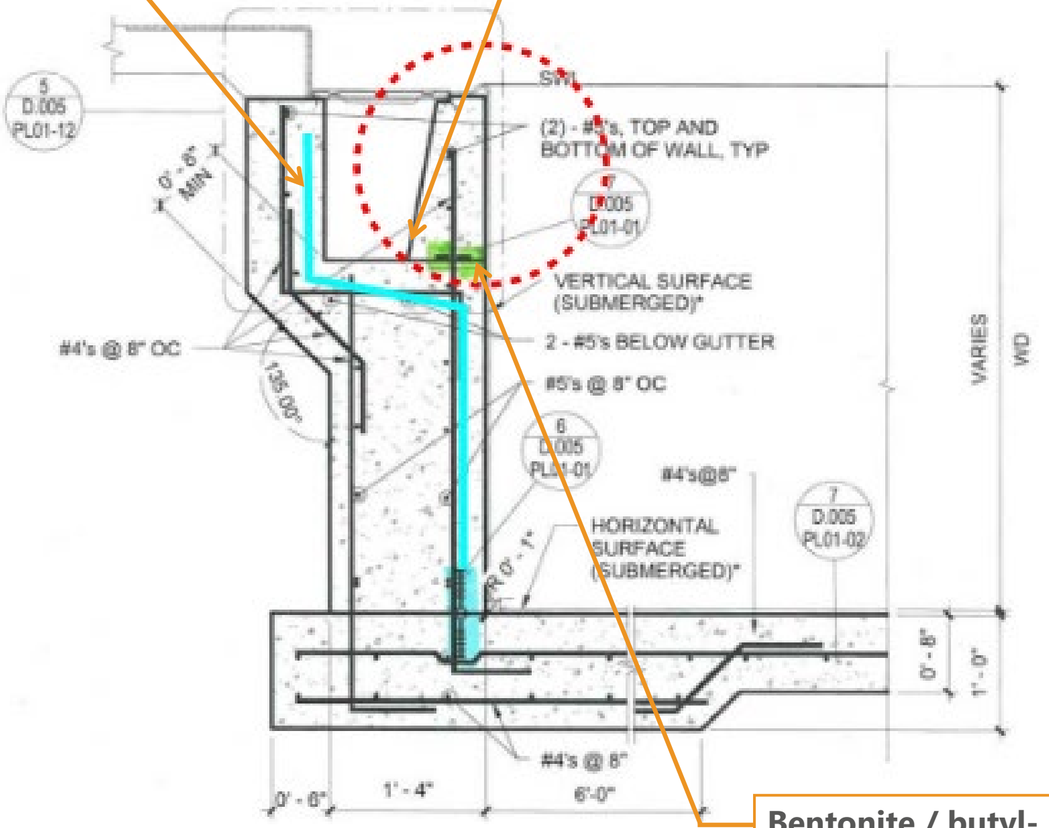
Pool Perpendicular Section

Pool walls

PVC waterstop in wall

Leaching waterstop inside gutter

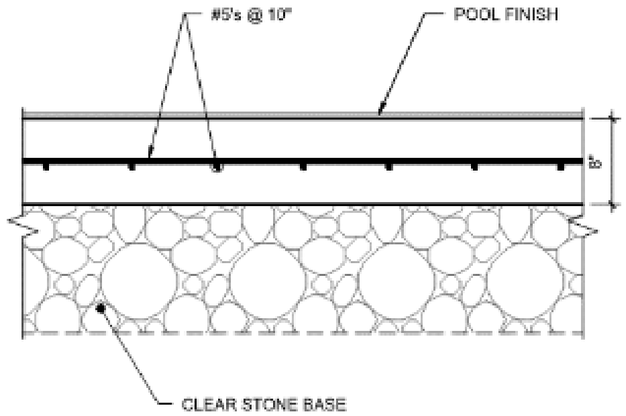
Condition of PVC waterstop documented during construction



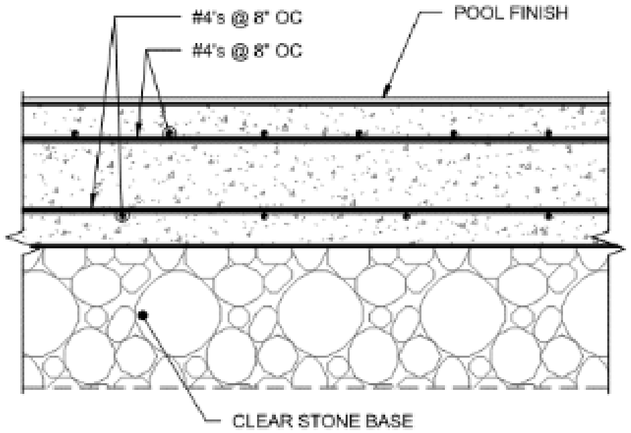
Section

Bentonite / butyl-rubber non expandable waterstop

Expansion Joint in Floor Slab

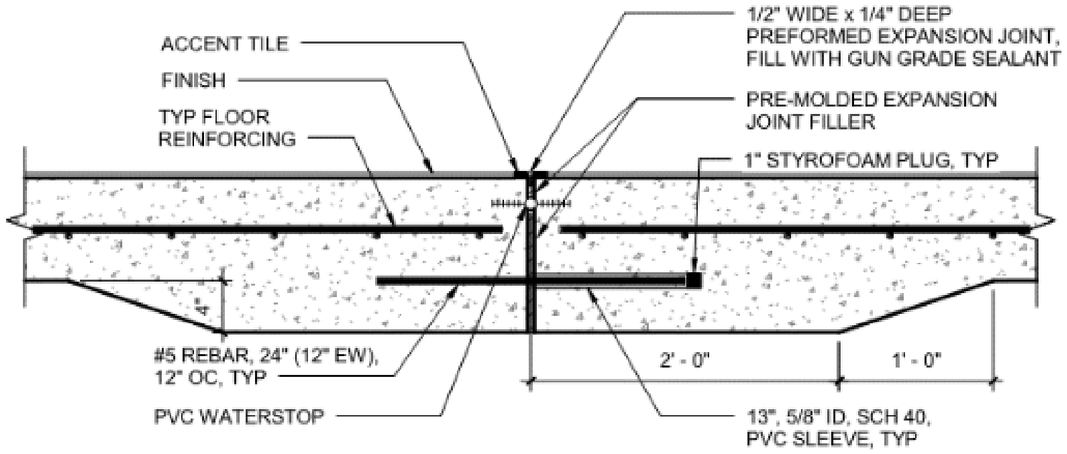


8" thick

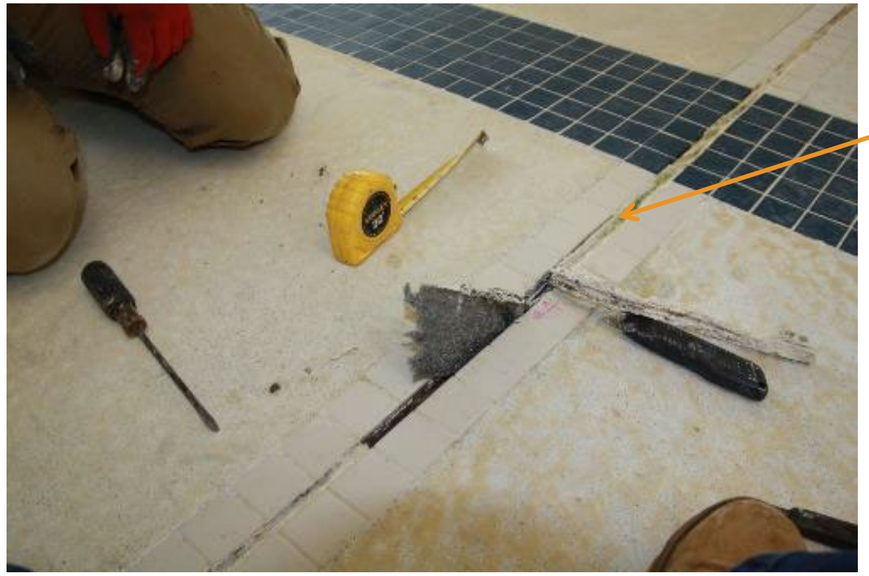


12" thick

Pool slab



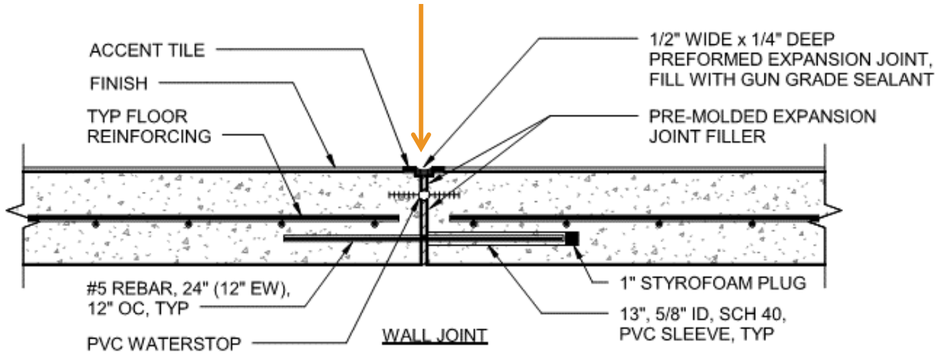
Expansion joint in pool floor slab

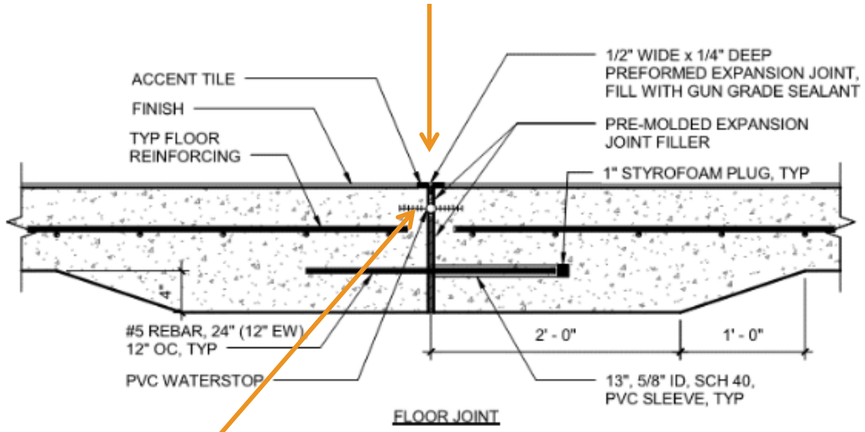


Deteriorated and debonded sealant over expandable joint filler

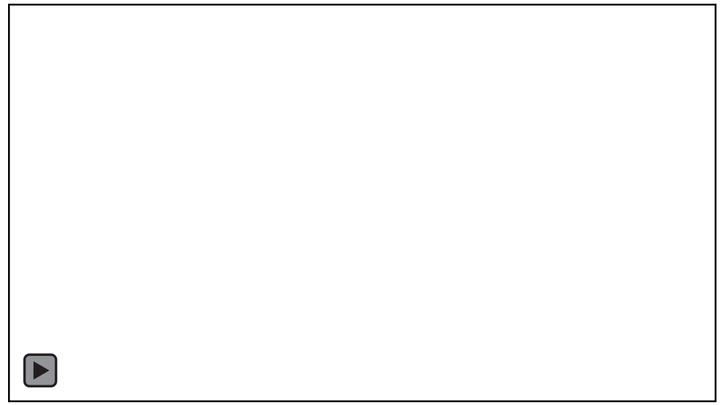
As built joint

Testing of Expansion Joint





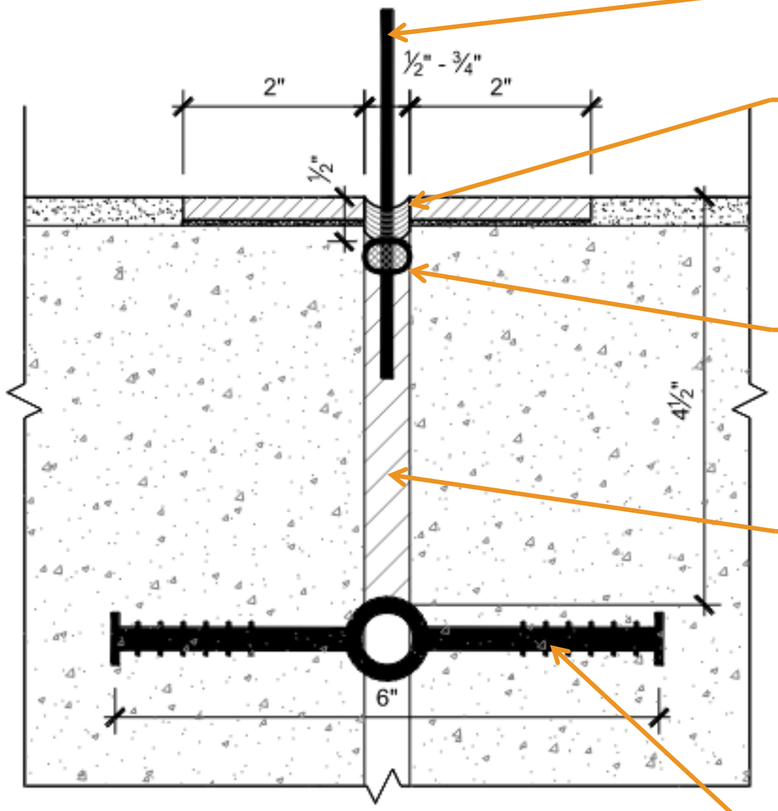
6" wide PVC waterstop was installed instead of 9" wide



During dye testing the following was discovered:

1. **Expansion joint was leaking at the gutter level**
2. **Expansion joint leaks down the side of the pool walls as well as across the floor slab**

Repair of Expansion Joint



Injection needle

Polysulfide sealant

Dry oakum

Injected polyurethane grout

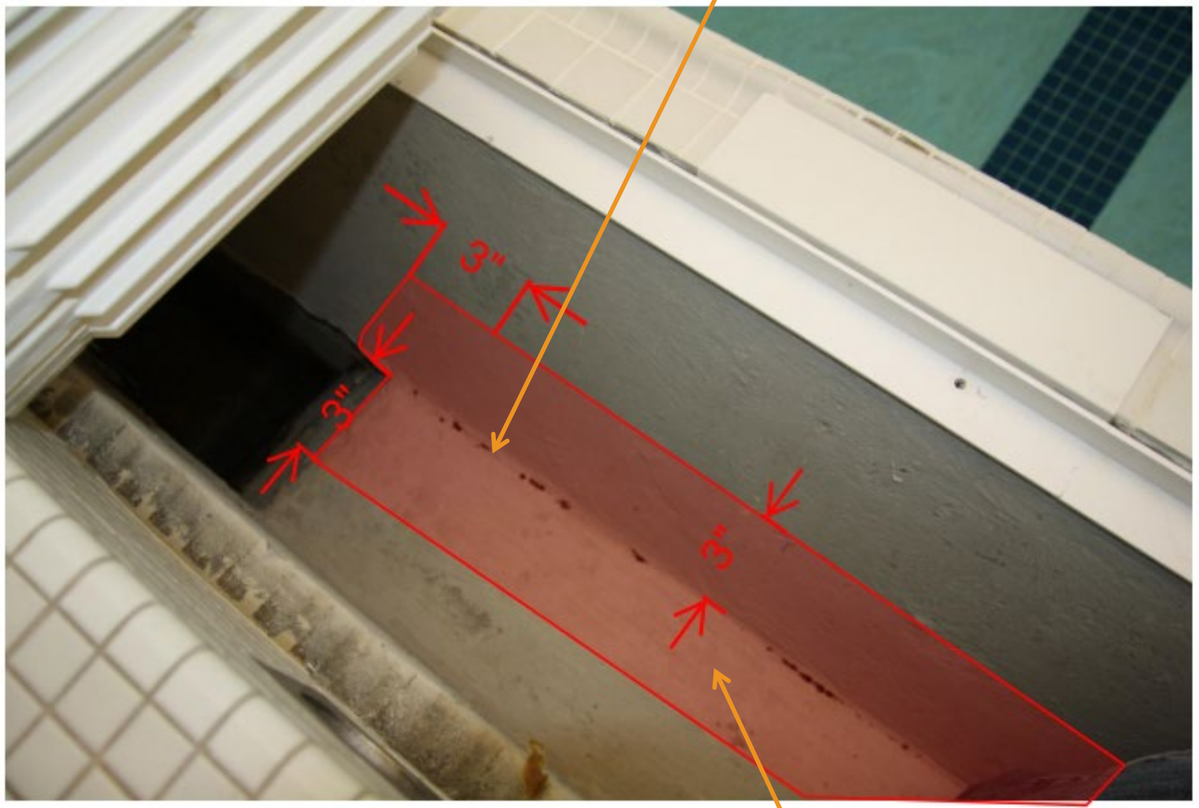
PVC waterstop

Expansion joint at pool floor and walls

Repaired joint prior to installation of polysulfide sealant

Repair of Leaching Waterstop at Joints

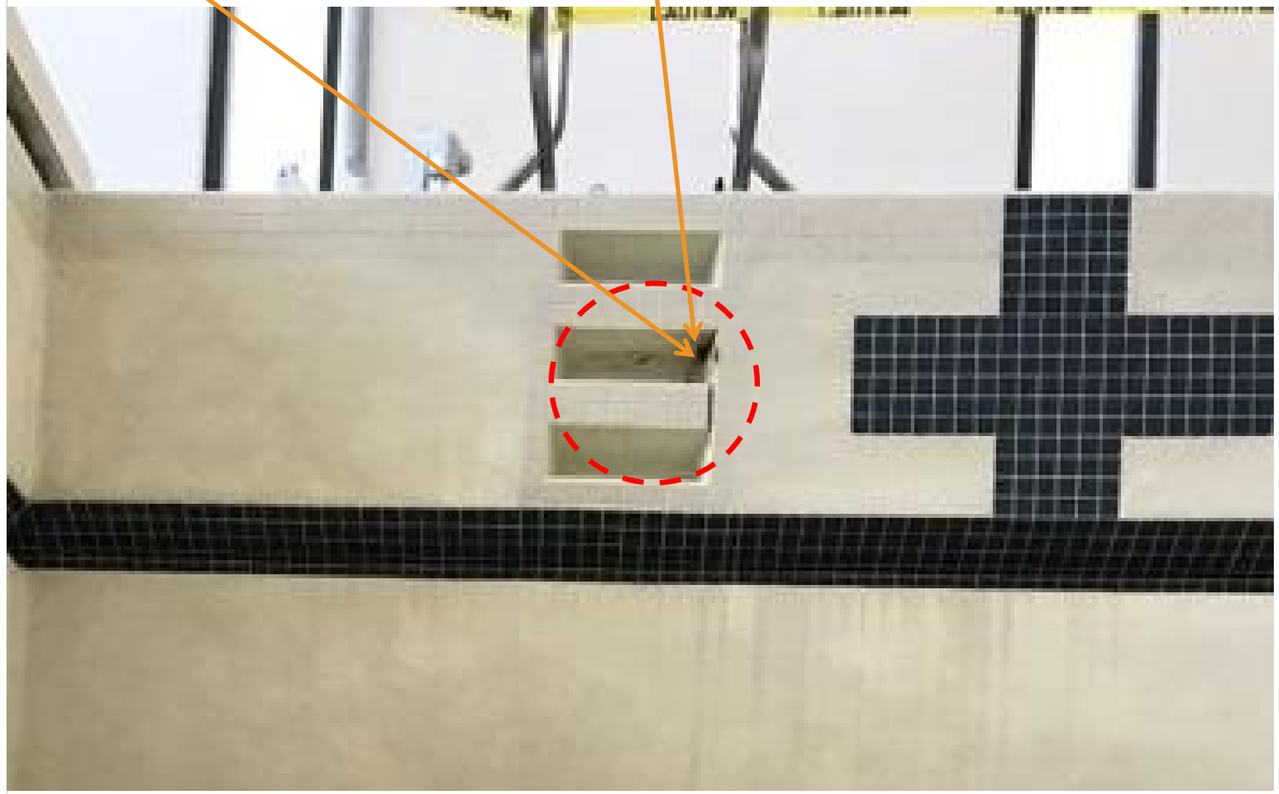
Leaching residue from black waterstop



Inside pool gutter

Cementitious coating installed over urethane waterproofing membrane with full sand refusal

Quarts plaster finish installed over urethane waterproofing membrane with full sand refusal



At pool stairs

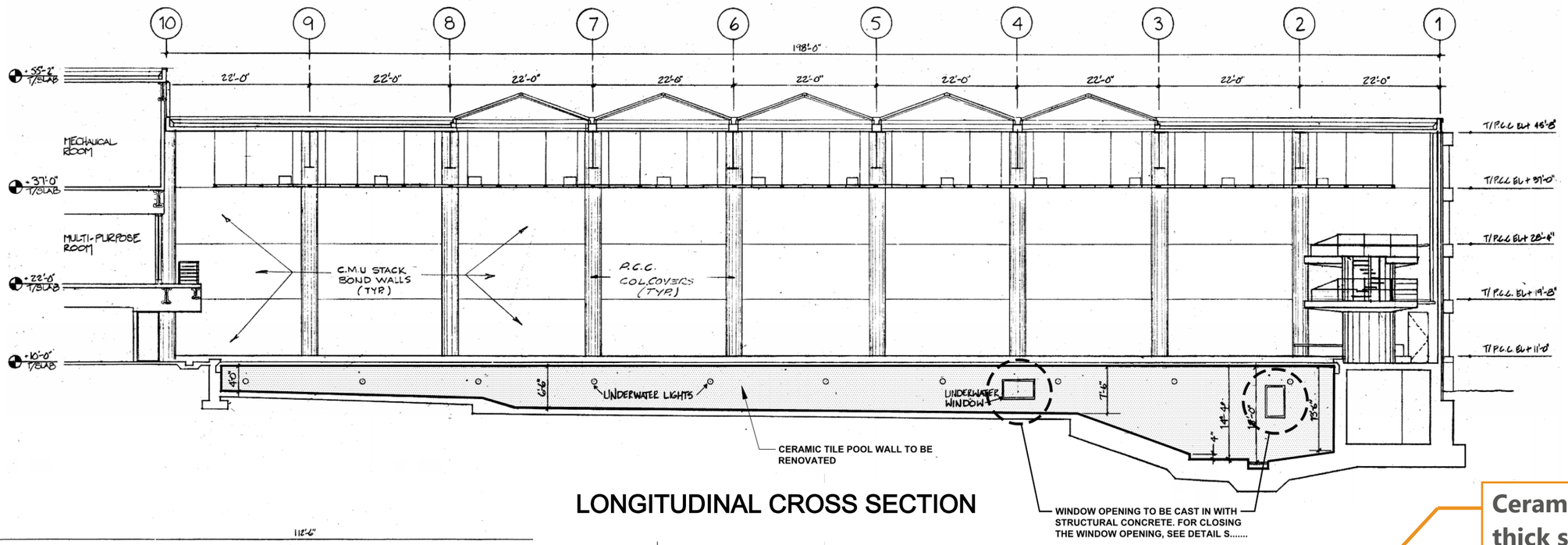
Project No.2 - Pool Deck Area Over Chlorine Storage and Filtration Tanks

BEFORE REPAIRS

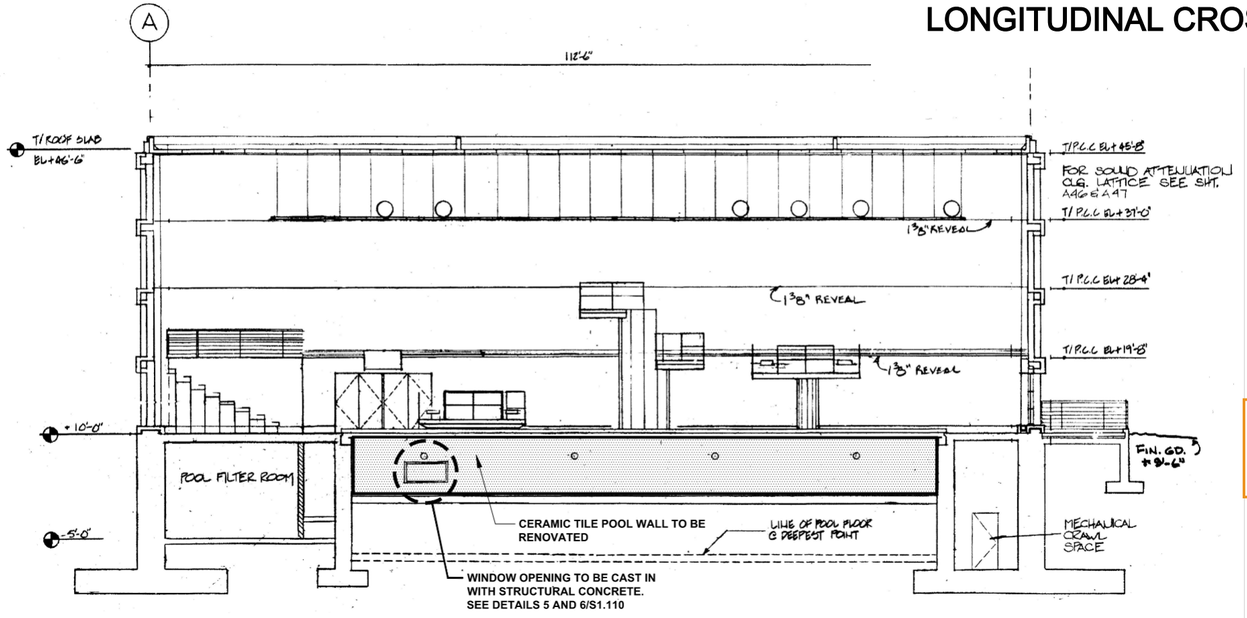
DURING REPAIRS

Area of chlorine storage and filtration tanks below the deck

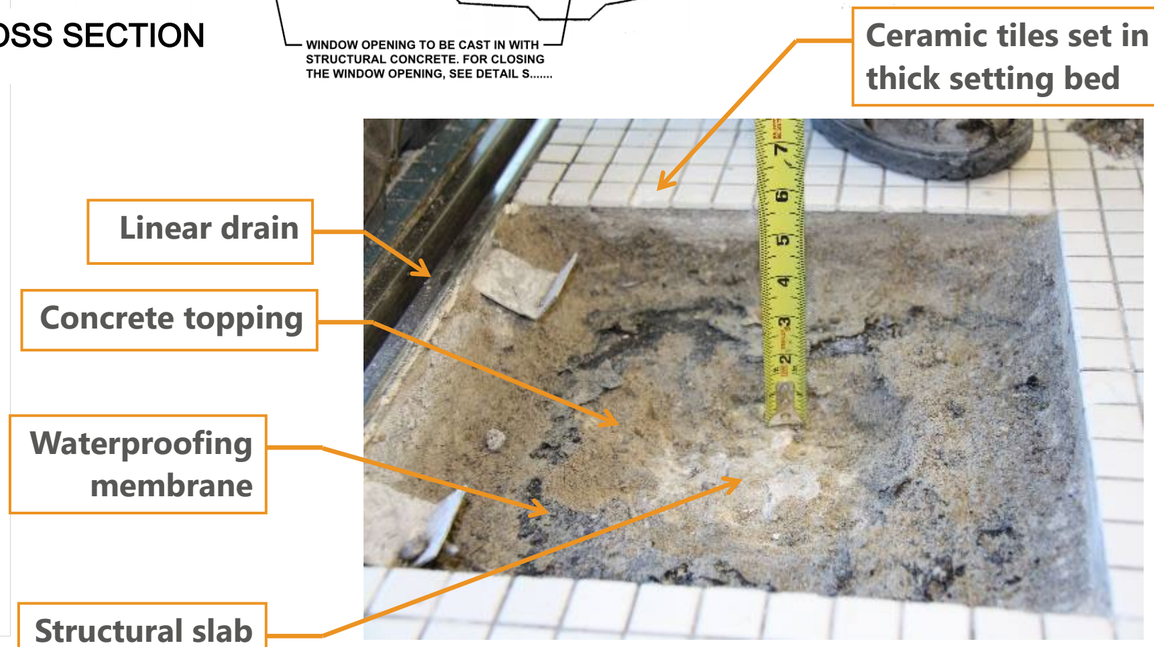
OLYMPIC SIZE POOL– BUILT IN 1985



LONGITUDINAL CROSS SECTION

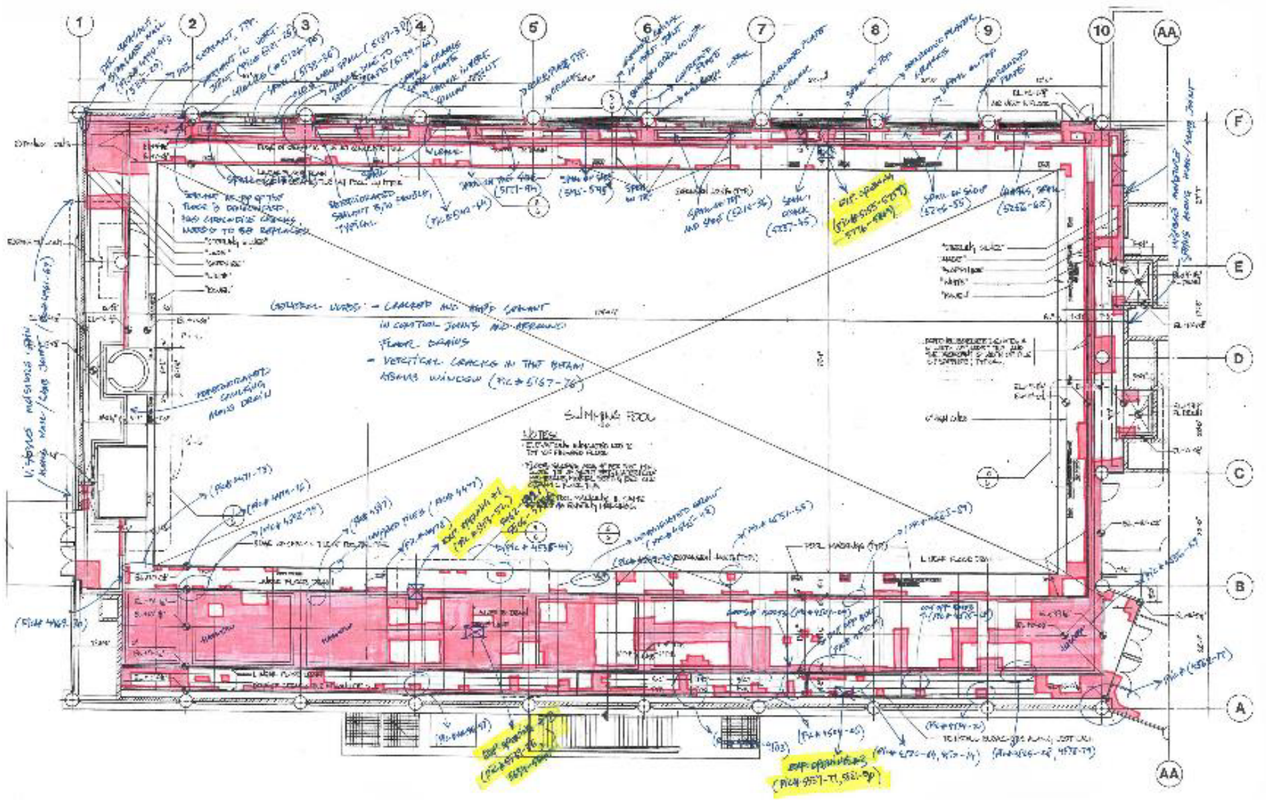


CROSS SECTION

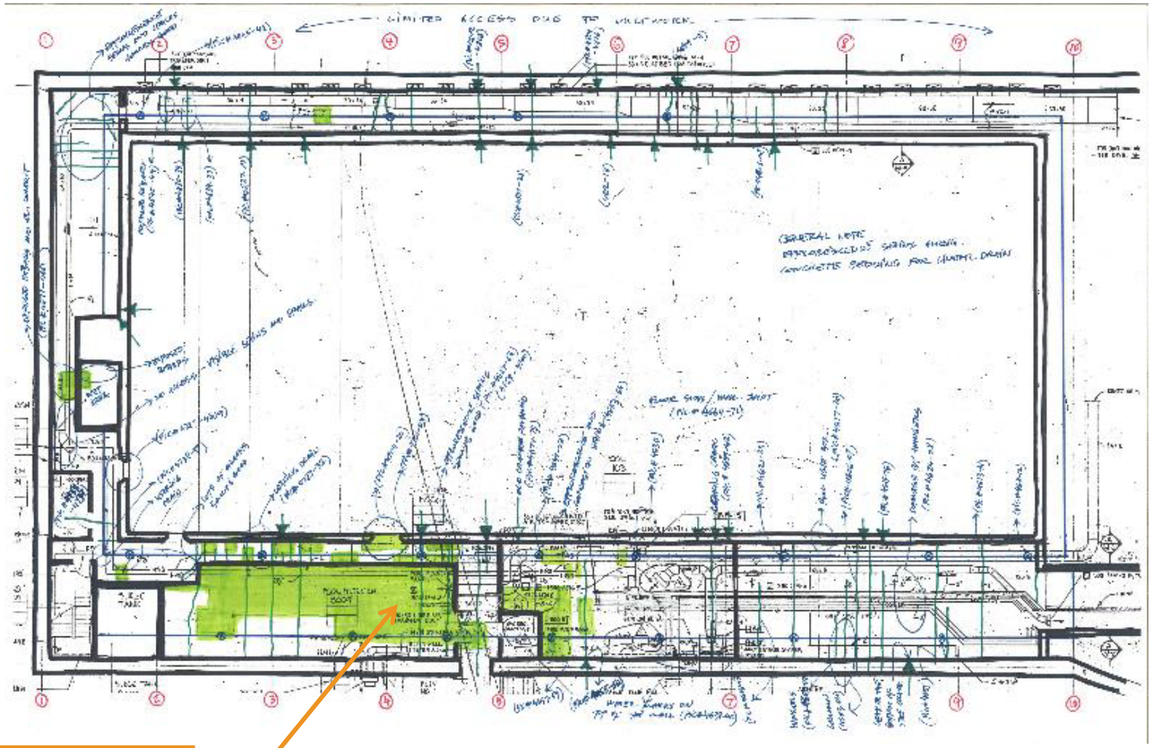


POOL DECK - CONCRETE TOPPING OVER STRUCTURAL SLAB

Delamination Survey



TOP OF THE DECK SLAB



UNDERSIDE OF THE DECK SLAB

Area of chlorine storage and filtration tanks below the deck

Concrete exposed to chlorine evaporation is significantly more prone to deterioration

Scope of Repair Work

At Pool Deck

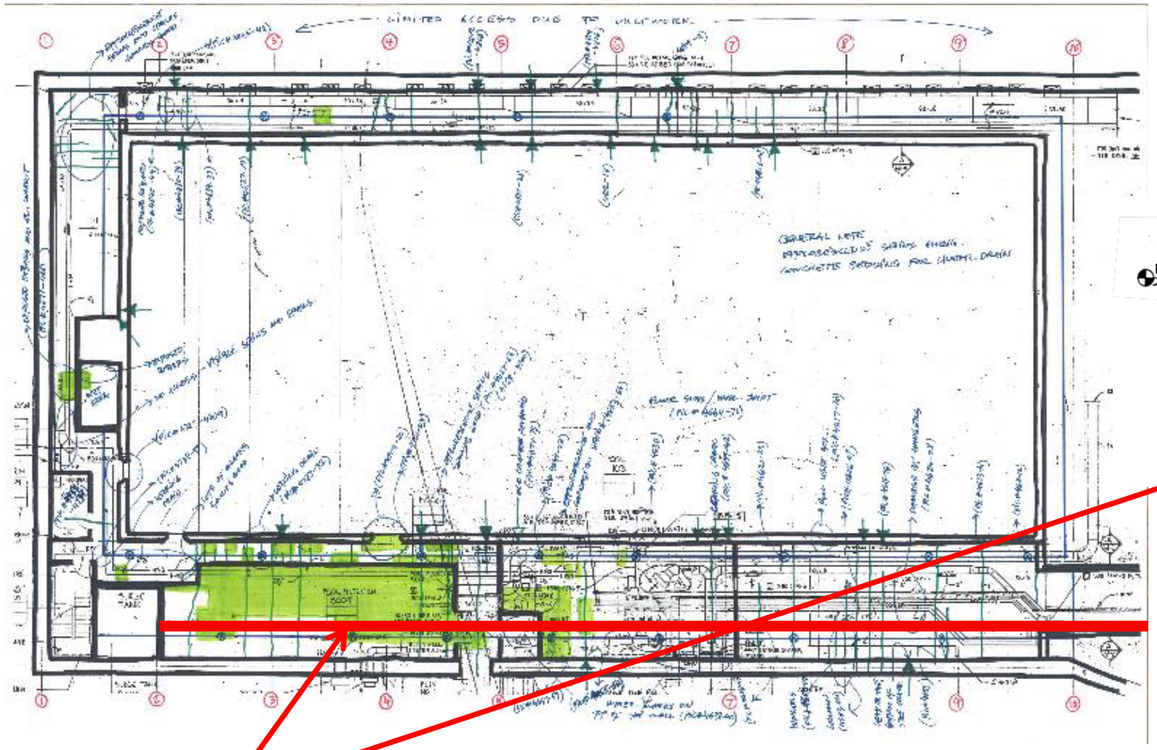
- Replace delaminated concrete topping with ceramic tile finish at all four pool decks
- Repair delaminated concrete slab, top and underside. Full depth repairs were expected at select areas
- Waterproof pool deck
- Replace all linear deck drains

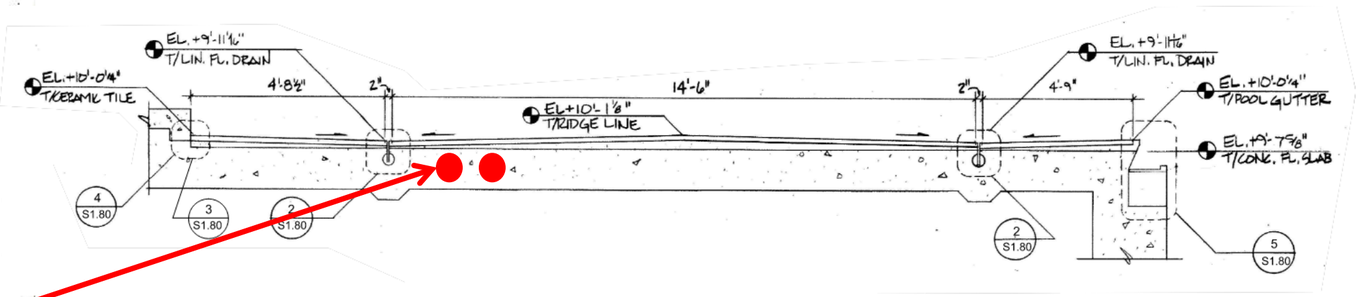
Inside Pool

- Infill two underwater pool windows
- Repair debonded tiles at pool walls and bottom
- Replace sealant around gutters

- Duration of project: 2 months (July – August, opening on Labor Day)

Unforeseen Issue





SECTION THROUGH WEST POOL DECK

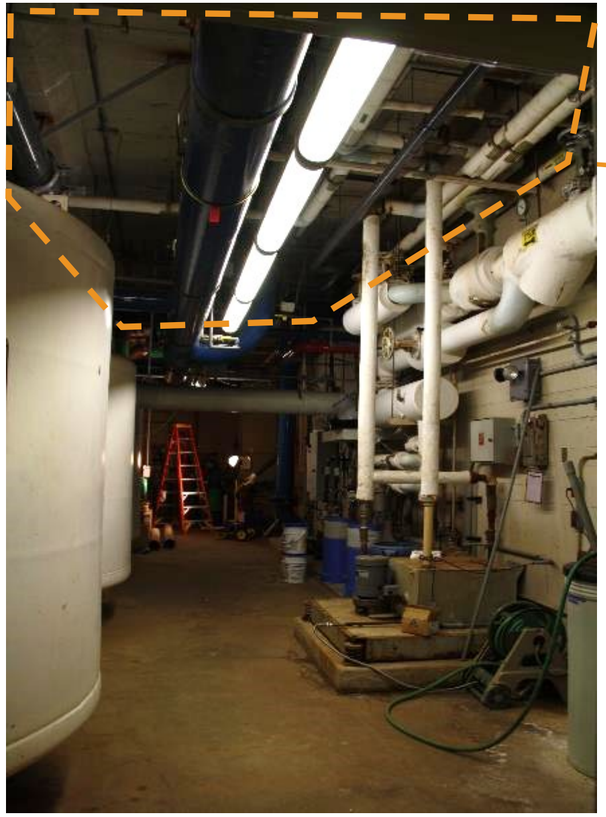
2 - 480 V ELECTRIC CONDUITS

UNDERSIDE OF THE DECK SLAB DELAMINATION AND WALLS SURVEY

Structural Slab Repairs Extended Beyond Projected

Impact on Project

- Embedded 480 V conduits needed to be removed from the slab
- The rest of the electric grid was affected by this too and needed to be repositioned
- This required revision of the project phasing and shoring of equipment around filtration tanks
- Added significant cost to the project, over $2M
- Significantly affected duration of the project



Chlorine storage and filtration tanks room below the deck – overall view

Deck underside during repairs

Project No. 3 - Leaking Inground Outdoor Pool

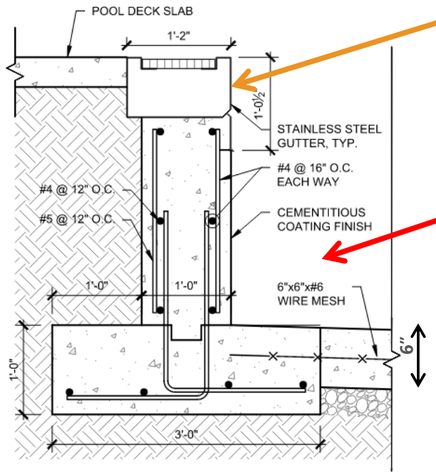
(50 years old)

Issues that prompted investigation:

- Pool has been leaking for years
- Cracks were repaired numerous times. The last repairs were done 2 years prior to our investigation
- Poor workmanship of those repairs

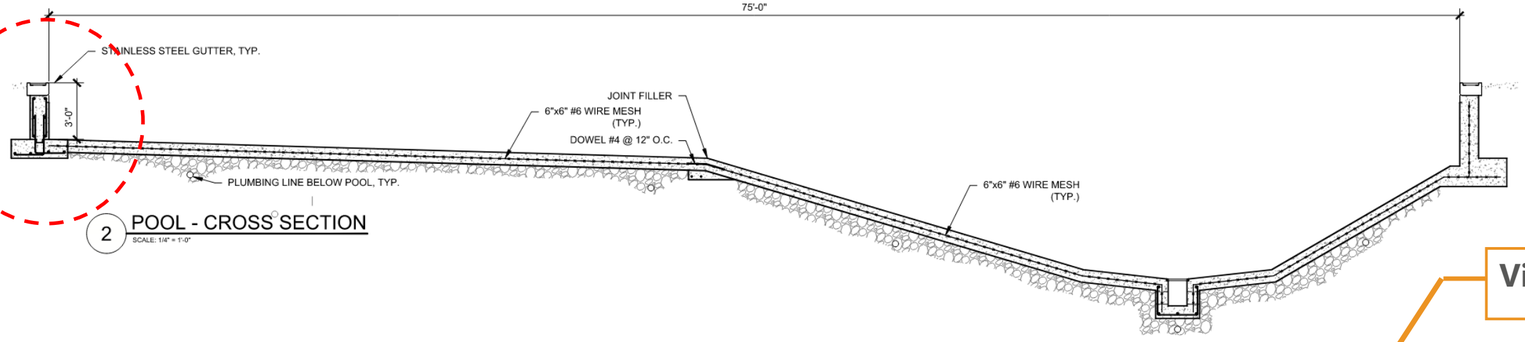
Client wanted answers to two questions:

- Can the leaks be fixed?
- Can the useful life of the pool be extended by 15 years after repairs with minimal maintenance?



4 POOL - TYPICAL WALL
SCALE: 1" = 1'-0"

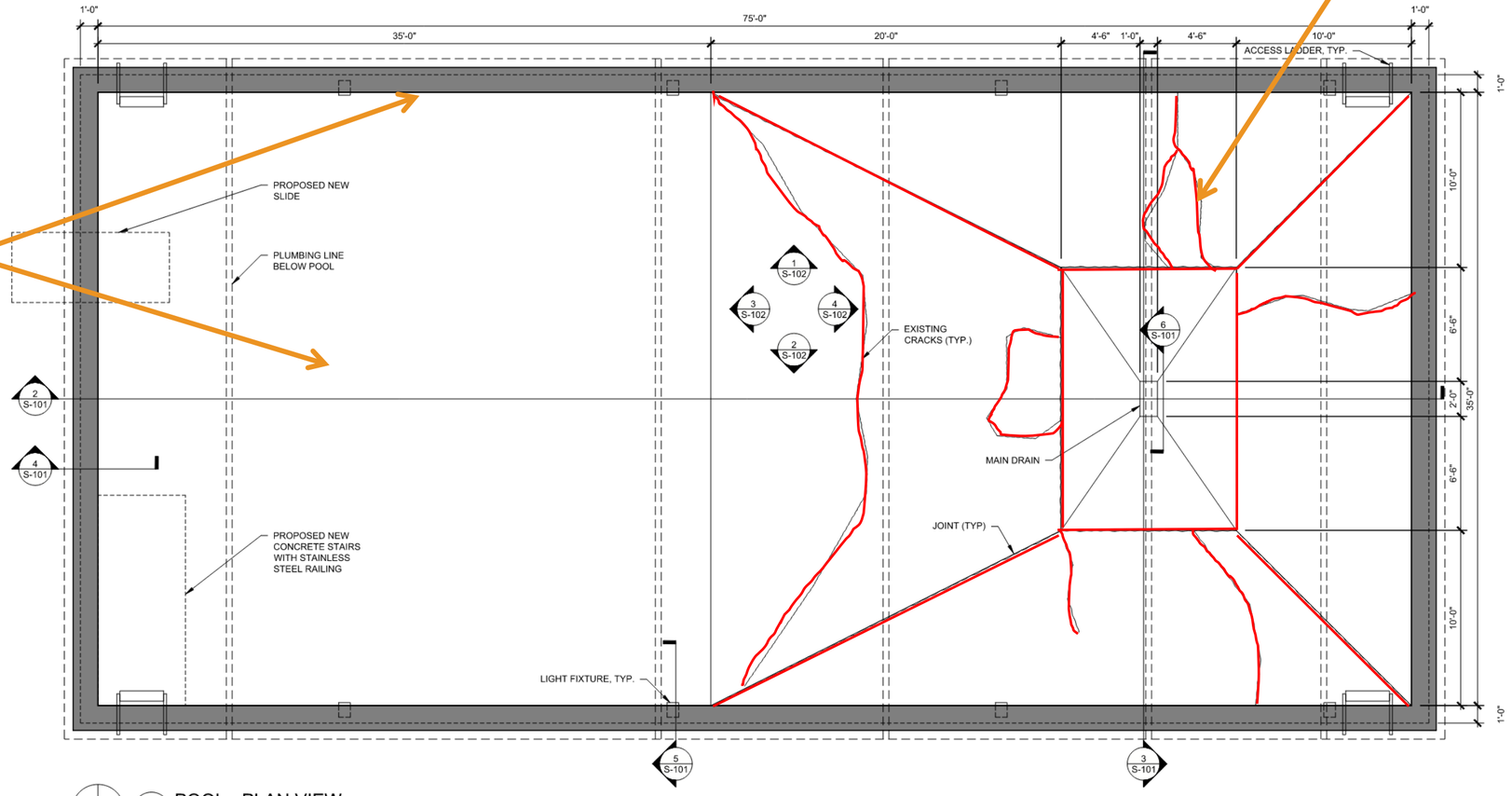
Not original gutter



2 POOL - CROSS SECTION
SCALE: 1/4" = 1'-0"

Visibly repaired cracks

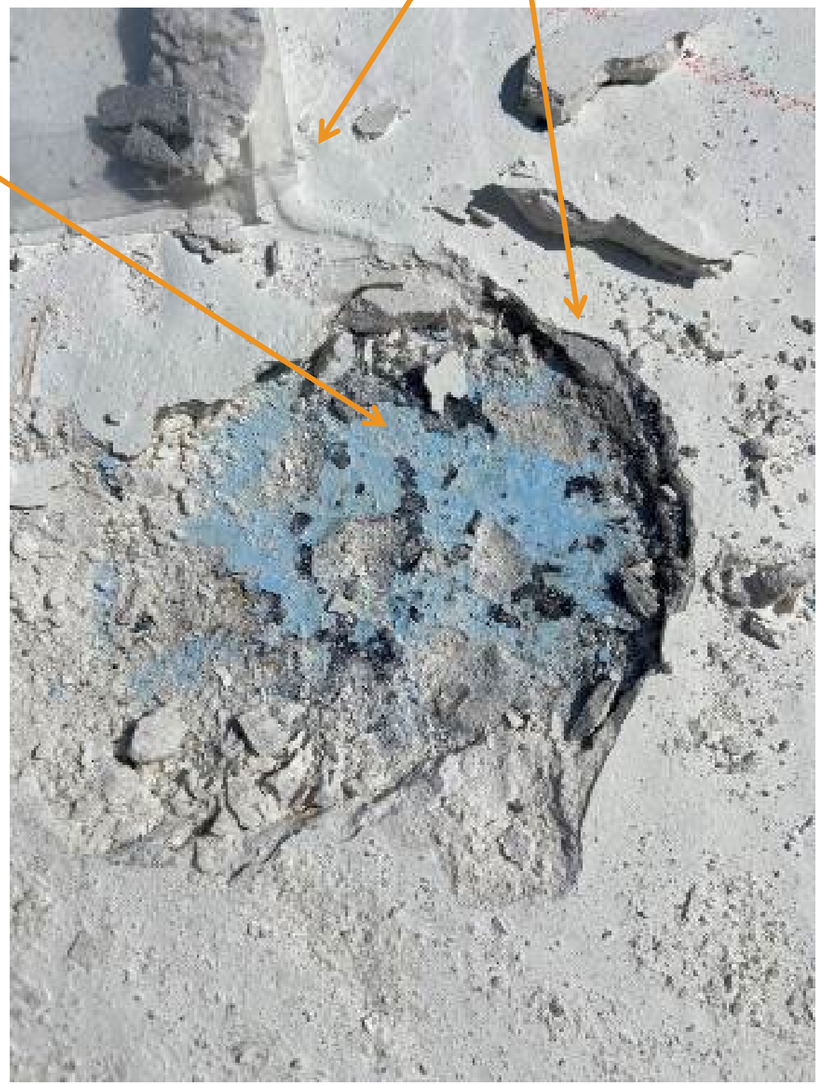
White cementitious pool finish on pool walls and slab



1 POOL - PLAN VIEW
SCALE: 1/4" = 1'-0"
N

Past Repairs

Photo taken by the client during past repair, prior to installation of cementitious coating

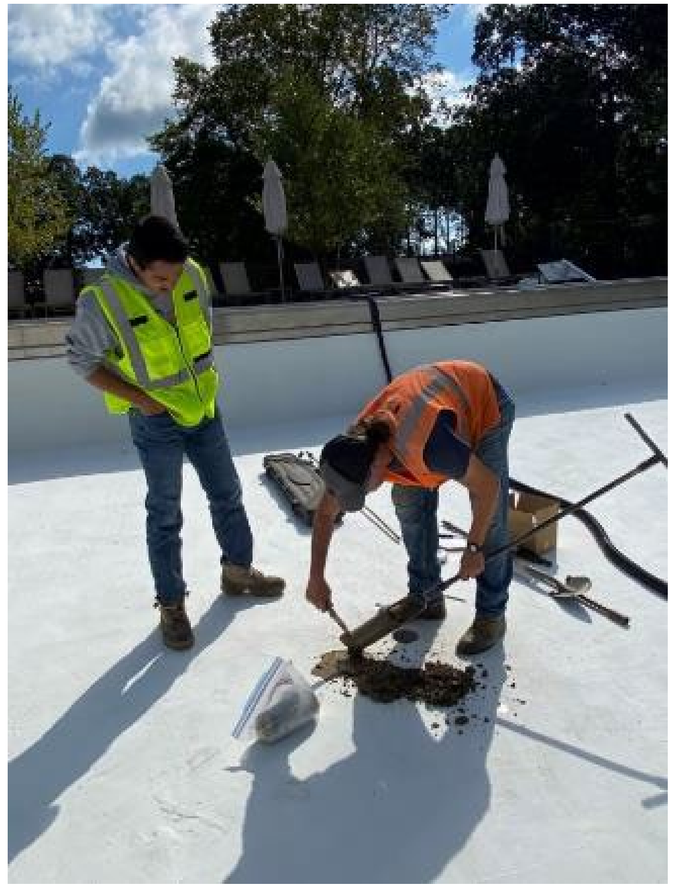


Cementitious coating finish

Investigation to Determine As -Built Conditions

GPR scan of slab and walls

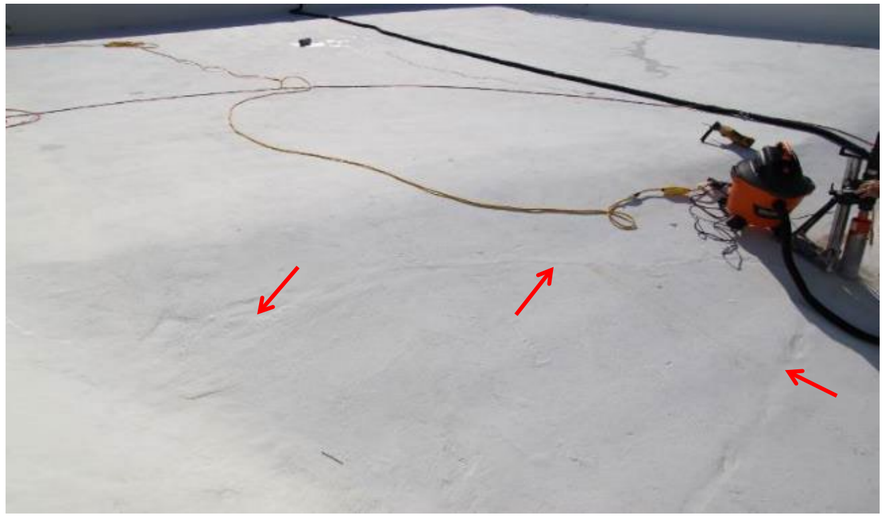
Taking concrete cores



Getting soil samples with hand auger

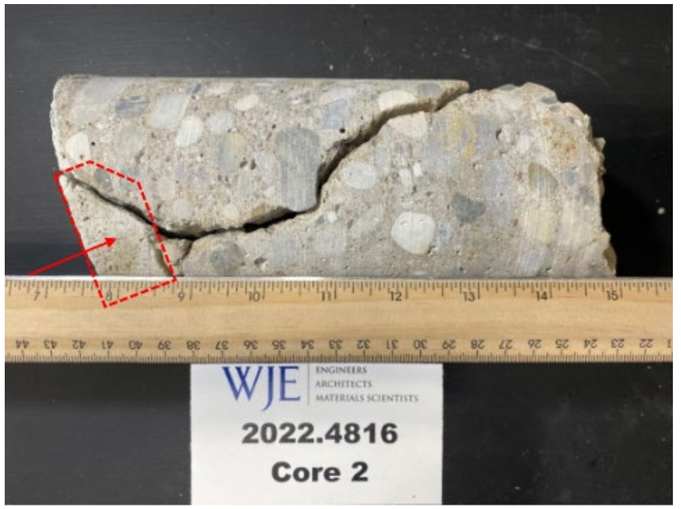
All pool walls and slab were sounded with hammer and chain drag

Concrete Samples



Typical cracks observed in the deep end of the floor

Shallow end – 6” thick floor slab



Shallow end floor – 6” thick slab

Deep end– 3” thick floor slab

Reinforcing mesh was observed at the bottom of the concrete slab

No cores were done at walls. By sounding, only minor deterioration was detected around pool lights

Repairs of Pool Walls

Removal of old paint and cementitious coatings in progress

One to two inches of concrete on walls were soft and crumbling

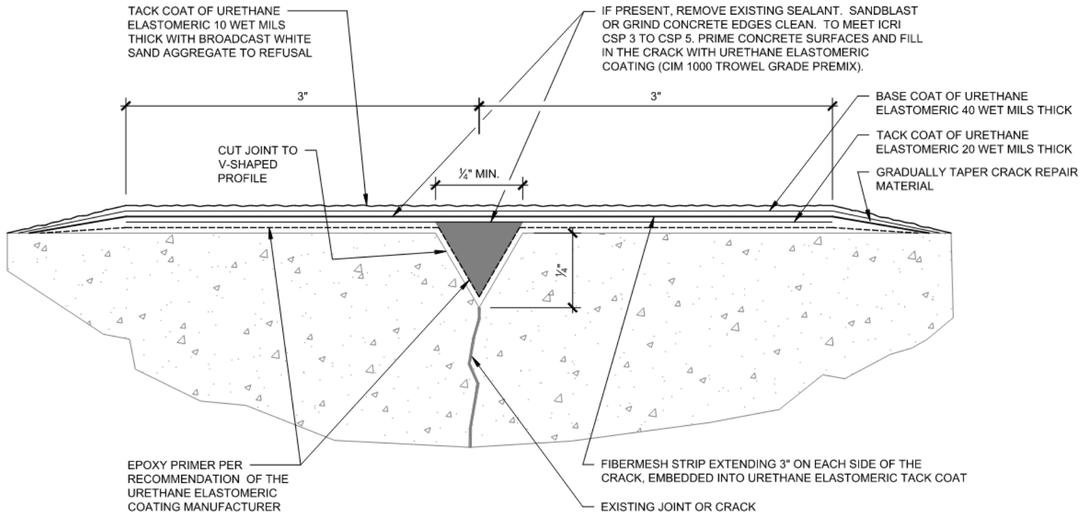
Wall Repair Options - Mockups

Mockups of various depth removal, repair expectations and final finish

Crack Repairs

Cracks were repaired at shallow and deep end of the pool

Issues with water under hydrostatic pressure



Crack repair detail

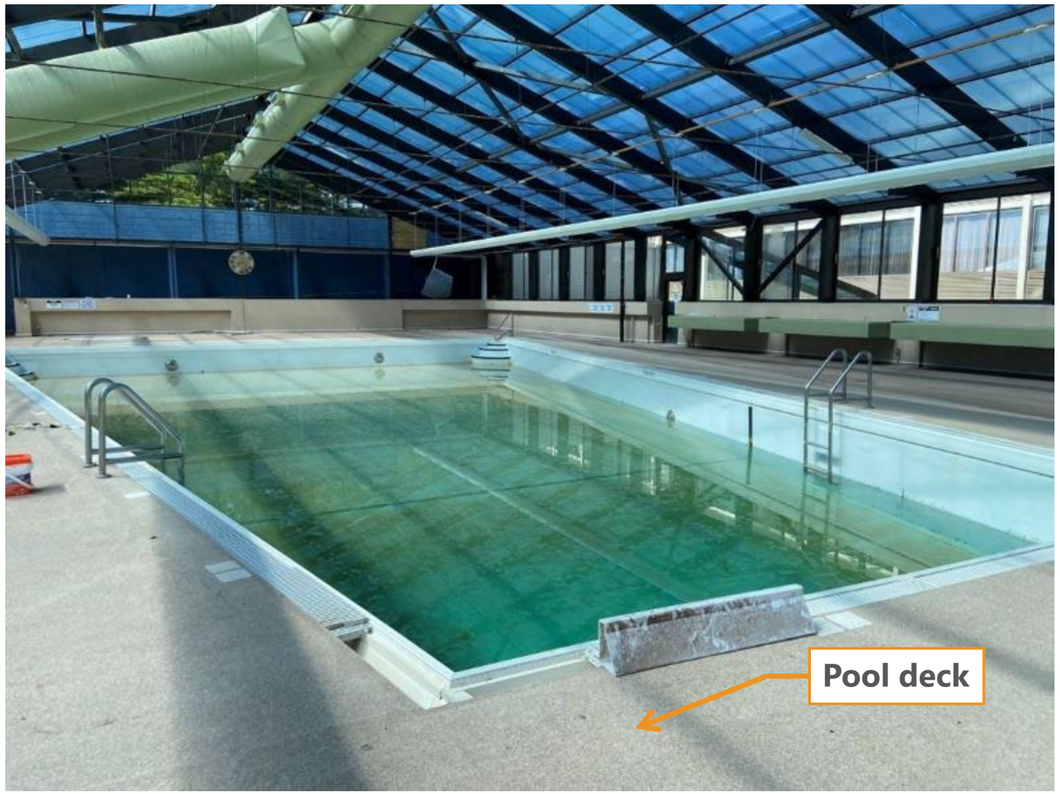
Completed Repairs

Condition of the pool at the end of repairs

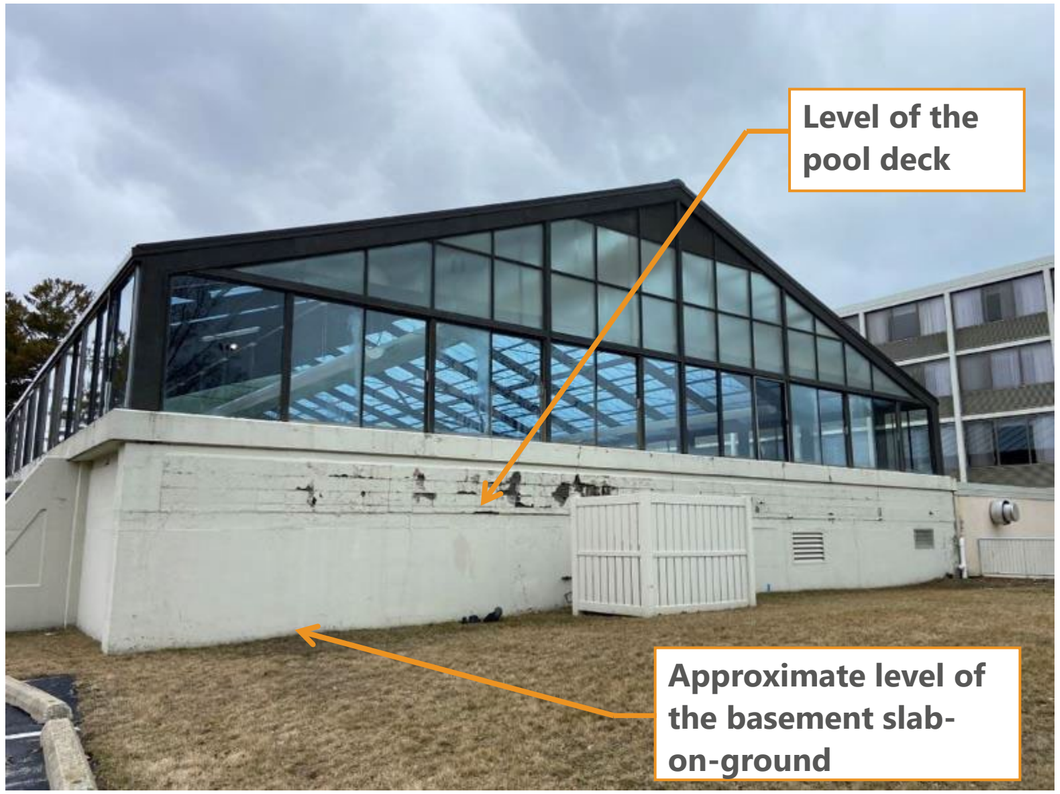
Condition of the pool two years after the repairs

No leaks were reported

Project No. 4 - Partially Elevated Pool Deck Supported by Steel Beams

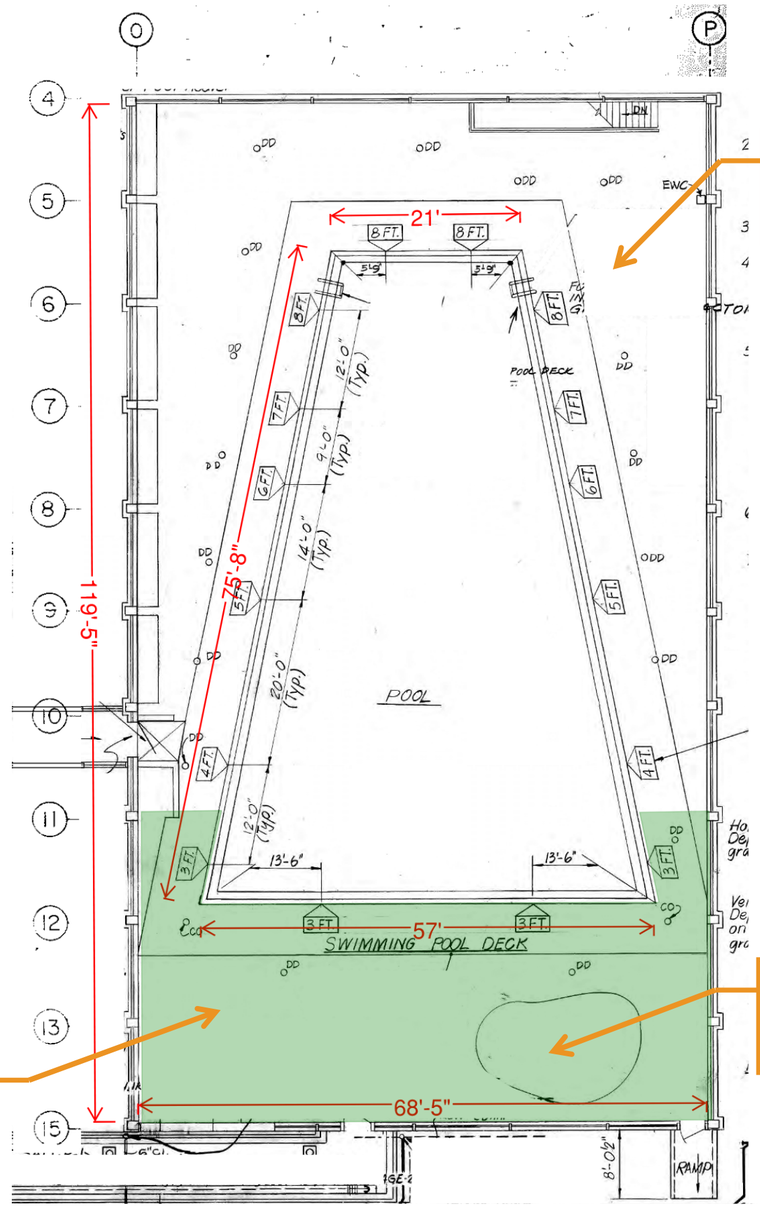


Overall view of the pool and the pool deck

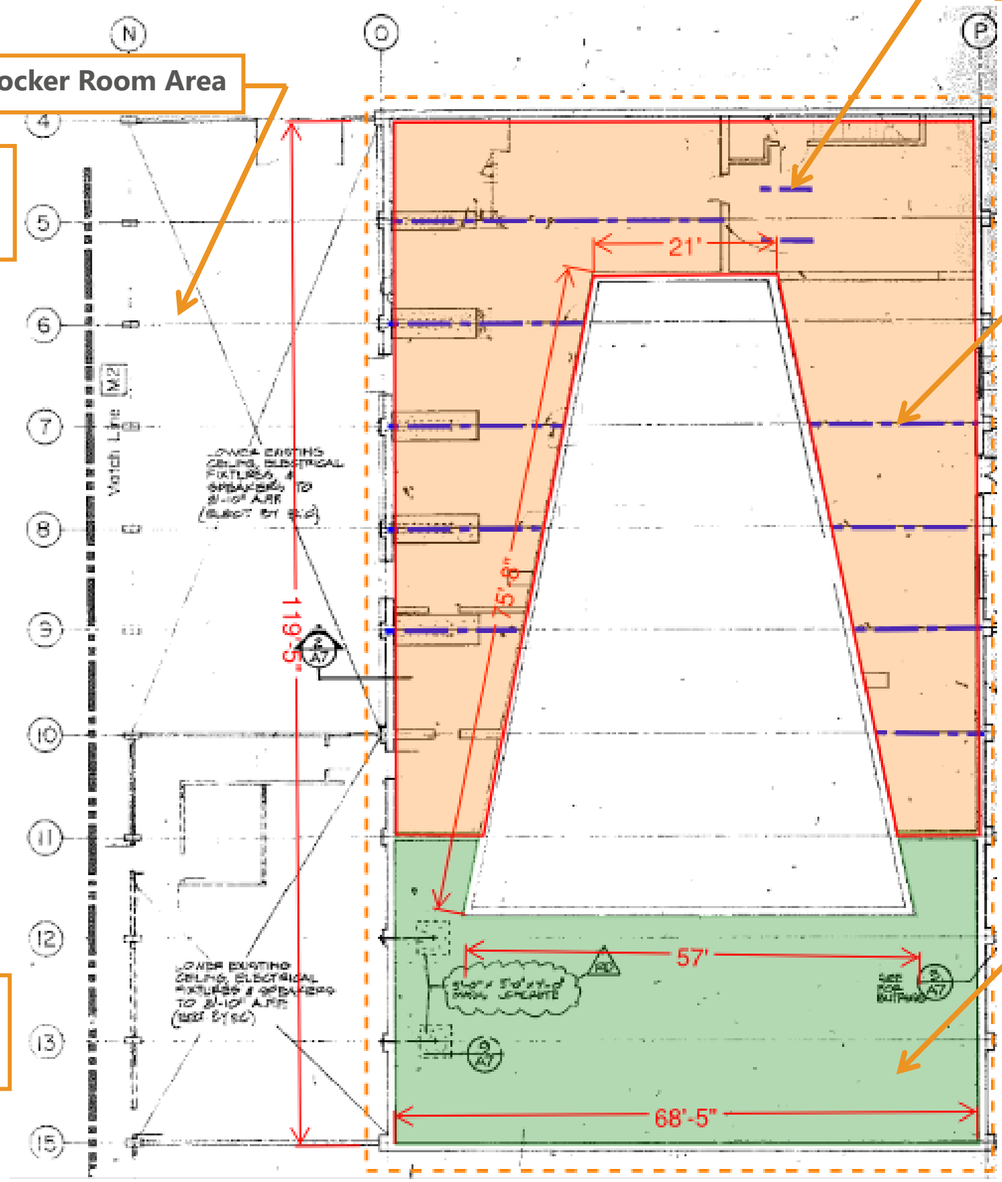


View of the pool enclosure (south elevation)

Structural Framing - Plan Views



Pool deck level – plan view



Basement level - plan view

Pool deck supported

Locker Room Area

Pool Mechanical Equipment Room

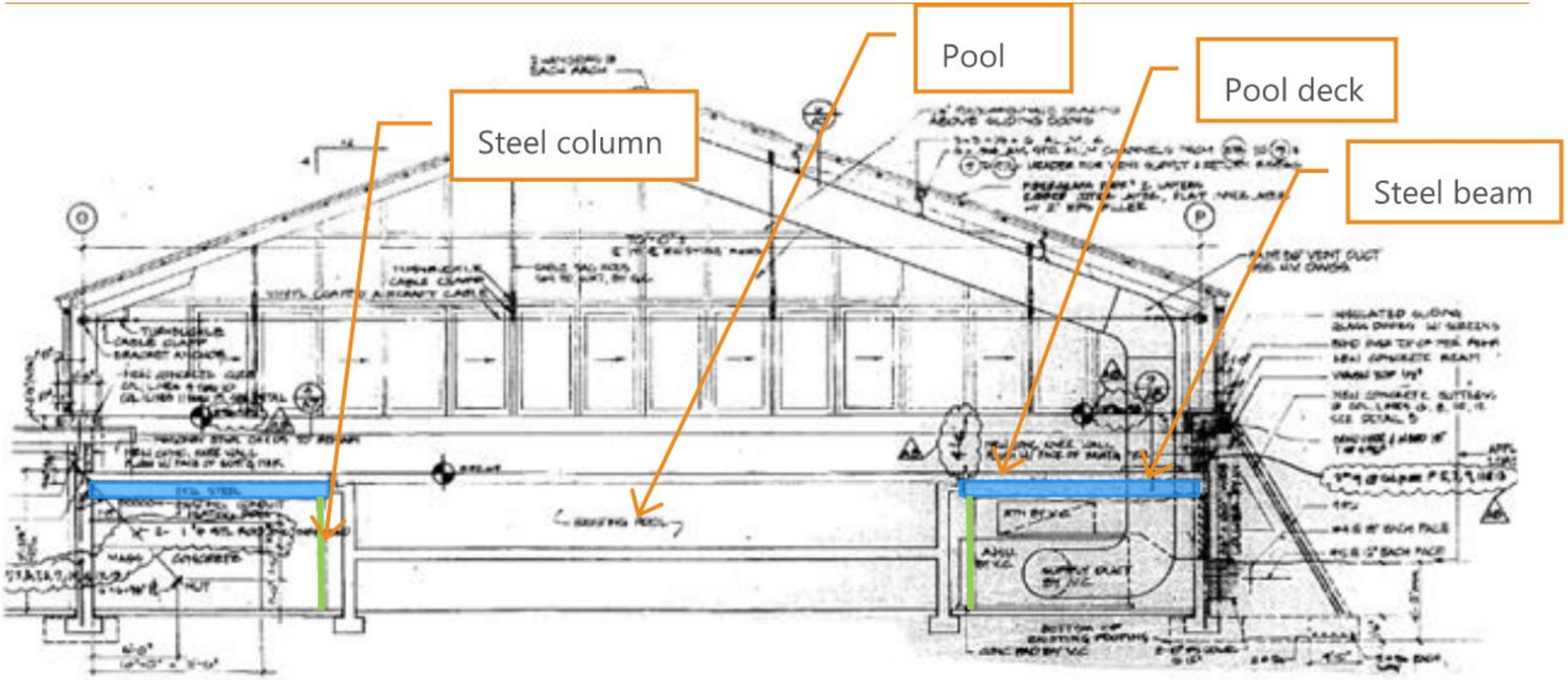
Steel beam supporting the concrete pool deck above (typ.)

Whirlpool filled with concrete

Pool deck slab-on-ground

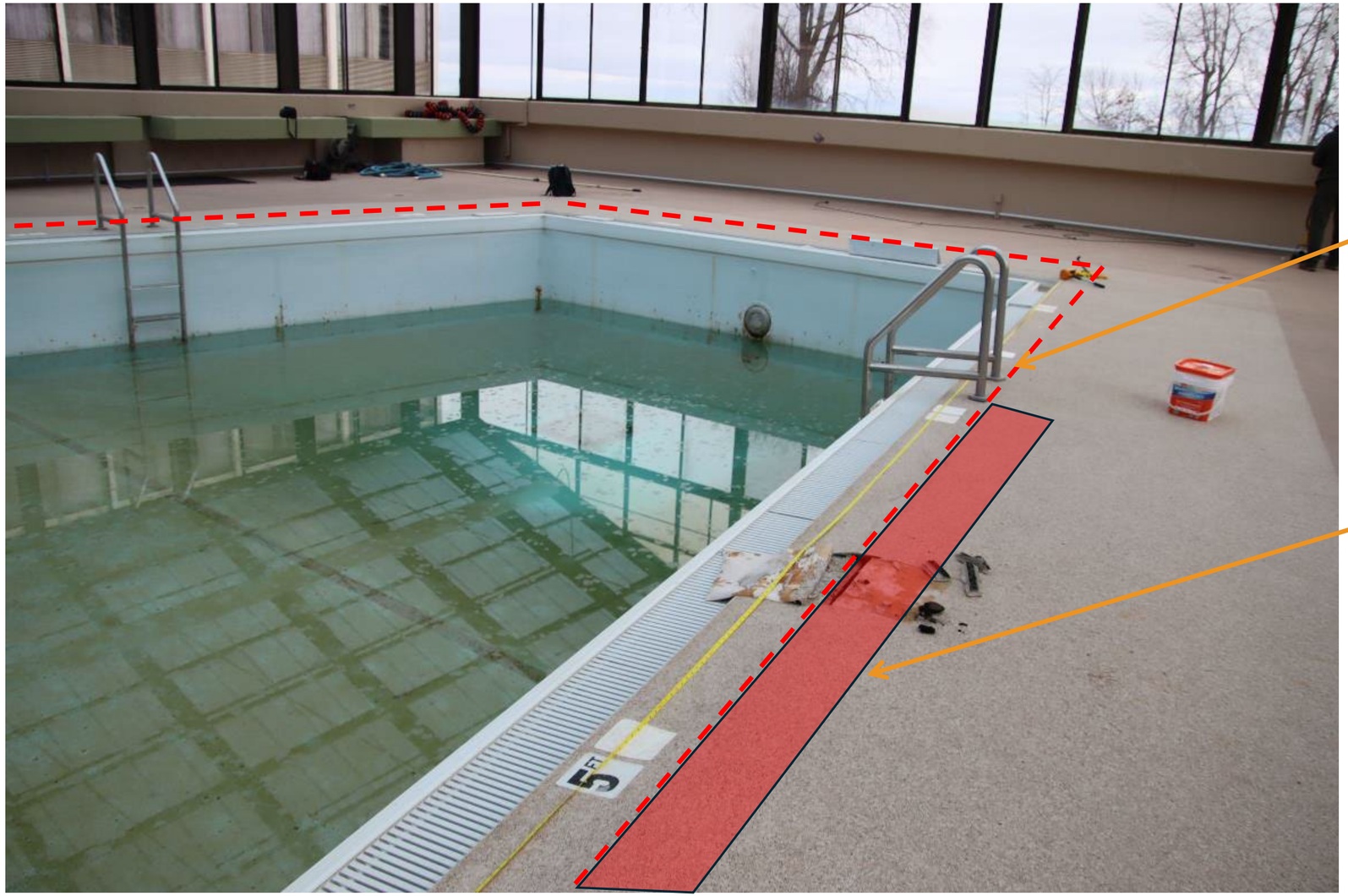
Inground area

Structural Framing - Section



Cross section through the pool building, north-south direction

Client's Concern



Expansion joint below sheet membrane

Area of upward displacement of deck

Client stated that pool is operable and not leaking

Upward displacement of the south deck along expansion joint

Top of the Pool Deck Slab

Sound concrete underneath sheet membrane

Exposed expansion joint

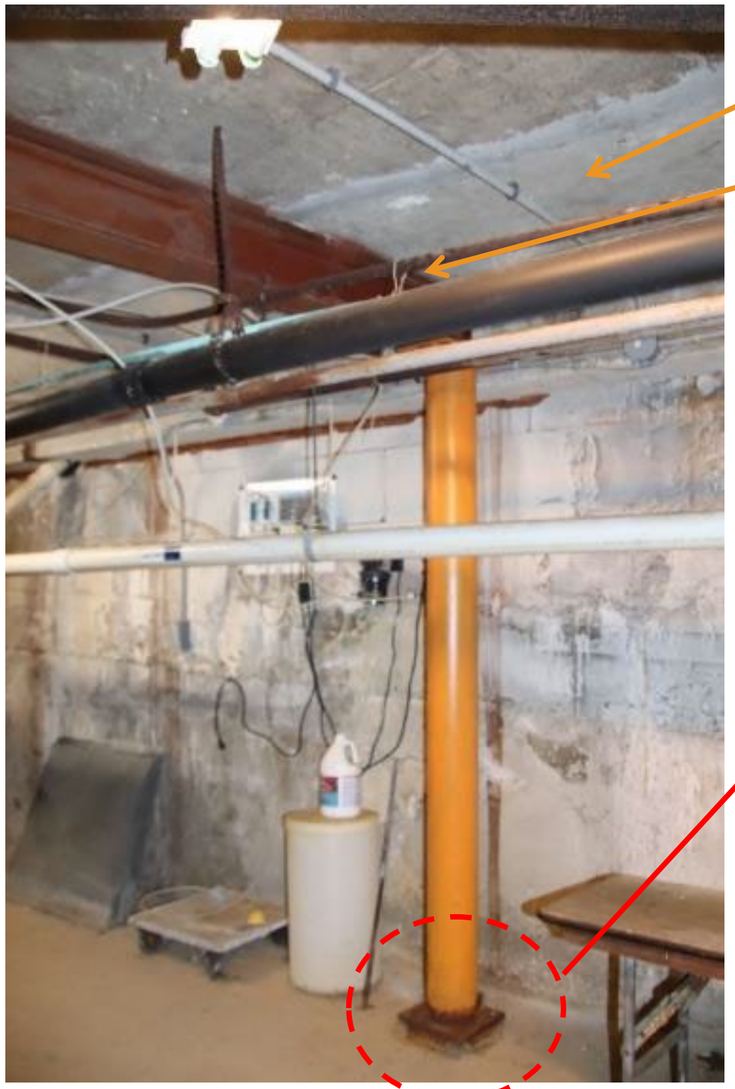
Upward Displacement of South Pool Deck

Top View

Underside View

Upward displacement of the South pool deck (1 ¼ inch) – South deck

Underside of the Pool Deck – Corroded Beam Tops and Column Base Plates



Area of concrete repaired in the past was sound

Corrosion present at the top flange

Section loss at the base of the column

Corrosion built up causing jacking of the structure above

Delamination on Underside of the Pool Deck – North and East End

Expansion joint above

Concrete encasement around steel columns – part of past repairs

Along the pool edge / expansion joint

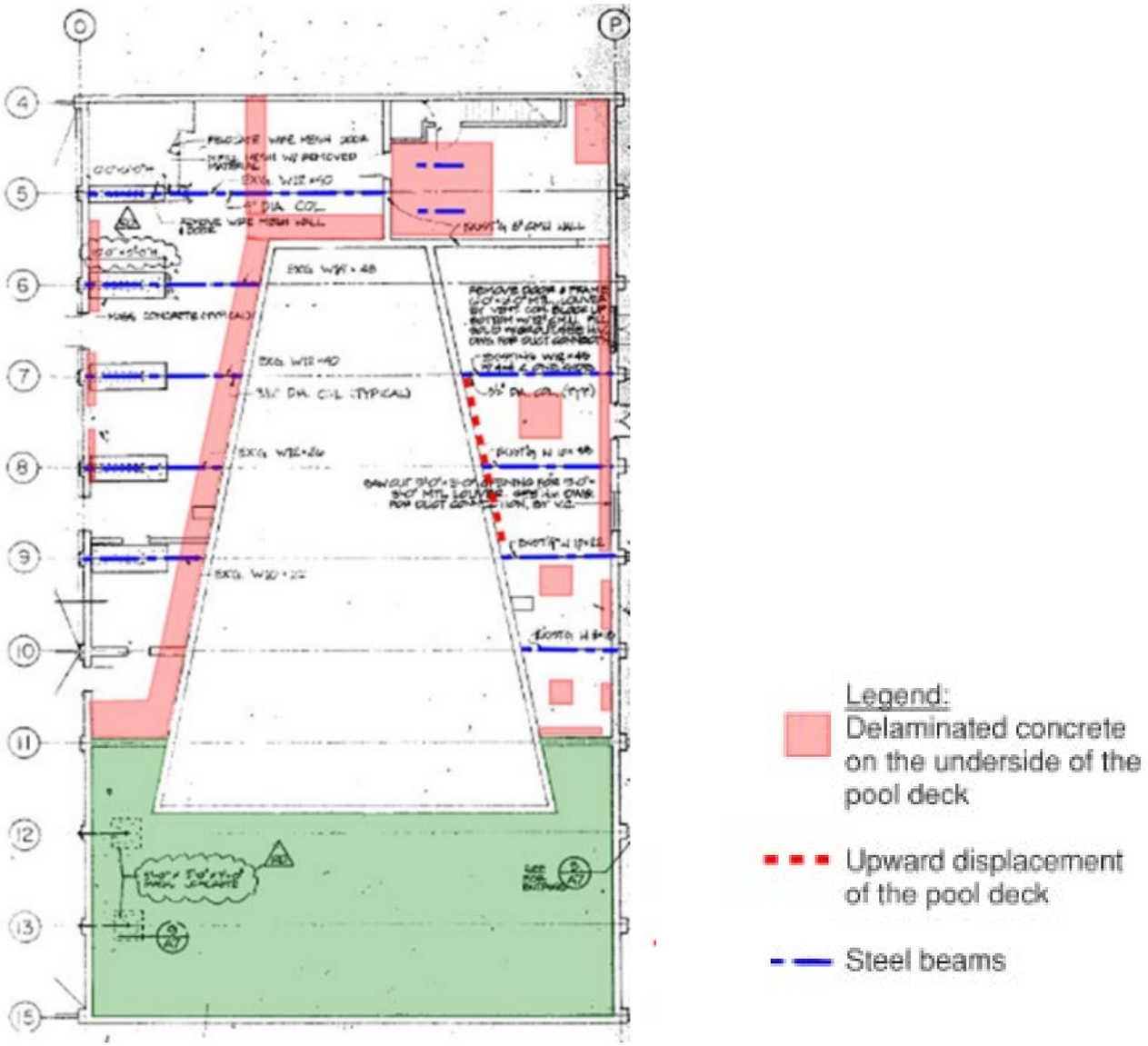
Above the chlorine tanks

Corroded Steel Beam Ends and Post Bases at North Deck

Corroded beam end (north deck)

Corroded post base (north deck)

Summary of Delamination Survey



Delamination survey on the underside of the pool deck

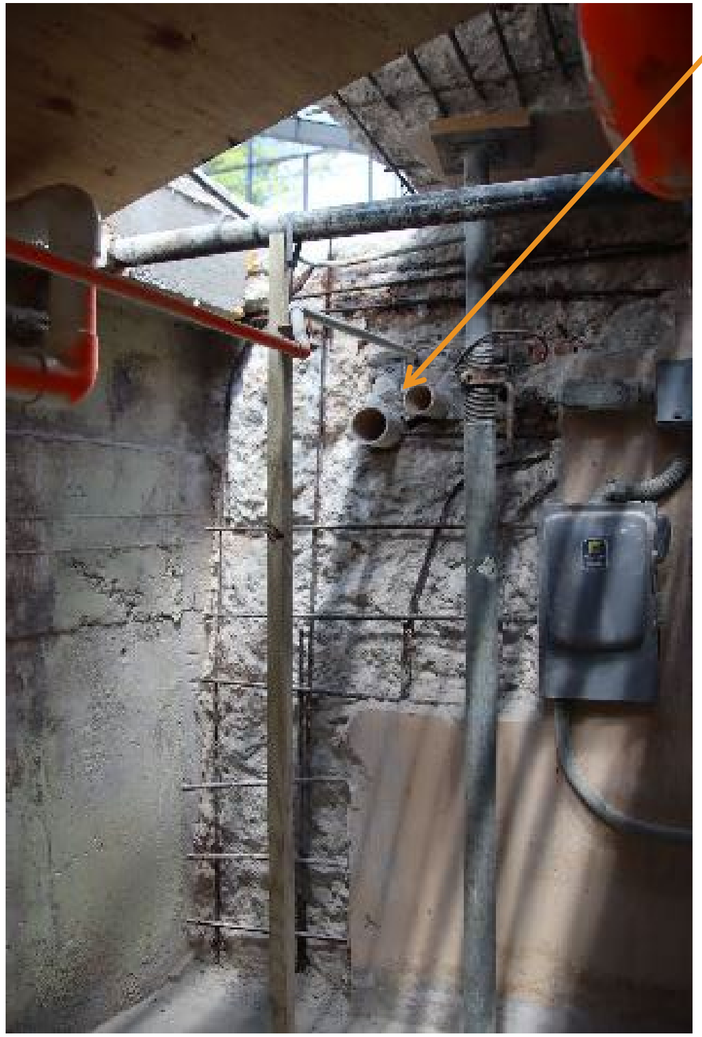
Extent of Deck Repairs in Area Above Chlorine Tanks

Underside of deck prior to concrete removal

Full depth repairs

Repairs at Steel Beams

Repairs Below Deck



Detached drains were discharging water from the west deck on the walls below it

Corroded base plates that were jacking south concrete deck were replaced with new

Completed Repairs

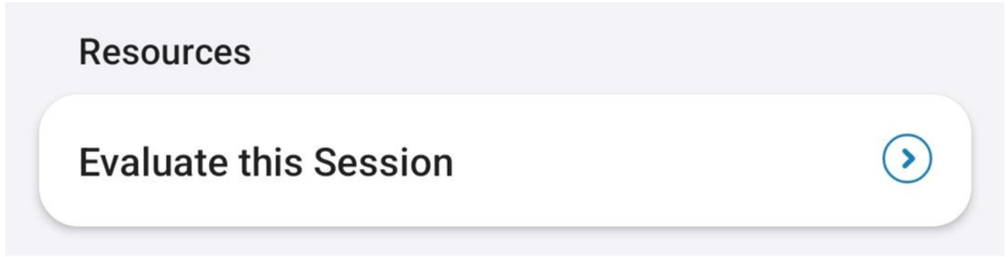
Raised edge of the jacked slab was grinded down

Replacement of pool liner was added as change order and is ongoing

Conclusions

- Although concrete pools on first glance appear to fit the category “ if you’ve seen one, then you’ve seen them all,” each of them have unique design features , regarding both pool decks and pool shells, and failure modes that require thinking-outside-the-box repair approach
- Do not assume that the condition of pool slab is the same as the condition of walls
- It is always wise to add a few extra exploratory openings during the investigation phase
- If asked by the client to focus only on deck, as a minimum glance at the pool as well and point at issues if you see them and follow up in writing
- Test drains during the investigation phase
- Restoration of pools are interesting and rewarding projects, as the difference before and after conditions is typically significant

SESSIONEVALUATION



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Under **Plan Your Event,** select Schedule, and then the Technical Session you are attending. Select the sub-session you are attending, scroll down to Resources, and select Evaluate this Session.

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THANK YOU

Dunja Vla
Associate Principal
Wiss, Janney, Elstner Associates, Inc.

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Restore | Repurpose | Renew

ANY QUESTIONS?