

- **Memo** -

Date: **August 30,2020**

The following notes are the result of a call to Carl Childs PE about his report on his report regarding the Richmond Water Tank and my further investigations on the Water Tank.

1. Refer to attached memo about the results of my telephone call with Carl Childs, PE. Carl has reviewed the notes and has in essence concurred with them.
2. After the call, I made a site visit to the water tank and took the some pictures. My observations are as follows:
  - a. Pic 1 and 3 show active leaks. Pic 3 shows that the coating is flaking off the concrete and is ¼” elevated from surface of the concrete.
  - b. Pic 6.. As far as I could tell, this seems as a patch that was made. Not sure when patch was made, guessing when tank was just accepted.
  - c. The Cementous coating of the tank is coming off, especially on the roof. See pic 4 and 9.
  - d. The steep slope has long grass and a few shrubs starting to grow. Refer to pic 7
3. After the above, I made a few calls to structural engineers in order to determine what other structural engineers would say about the use of epoxy rebar and the Richmond Water Tank:
  - a. Mel Doherty, a Vermont structural licensed engineer, stated he has not been involved in the design of water tanks and suggested that I contact Engineering Ventures.
  - b. I called Engineering Ventures and left a message for them to call me. They returned the call, but I was unavailable to pick up.
  - c. I called Tim Hardy (Licensed PE in Vt), owner of Hardy Engineering in Colchester Vermont. Tim also said that he was not a person familiar or had done the design of water tanks, and suggested that I talk to an engineering firm that was involved in the design of water tanks. He thought that I should contact companies like Forcier Aldrich or Dubois and King Inc. He also stated that engineers would probably follow the recommendations of ACI (American Concrete Institute) in the design of Water tanks.
  - d. I researched the web and found several articles where the use of epoxy reinforcing steel was **not discussed** and **some articles** which suggested the use of Epoxy Reinforcing Steel. See attached article written by Engineer who does recommend the use.
  - e. I also called Pete DeGraff former owner of Otter Creek engineering and was unable to connect with him.

The following are my comments and recommendations on the Richmond Water Tank:

- For a tank that has a 40-50 year expected life, the visual signs of the efflorescence in the tank are a concern for the writer. Especially active seeps which are prone to the freeze and thaw cycle.
- When the writer was doing inspection reports for the Army Corps of Engineers, mowing of the slopes of Vermont dams was encouraged as a means of visual detecting active leaks on the Dam. Growth of

shrubs and trees on the back slope of dams was noted as lack of maintenance. Tall grass and a couple of shrubs on the steep embankments were noted.

- The writer is not a fan of Cementous coatings applied to a concrete structure to make it more aesthetically pleasing. The writer noted that the coating is flaking off the main structure especially on the roof. The writer is surprised to find the coating flaking off after less than 5 years after installation.
- The writer is not sure if epoxy or coated reinforcing should have been used. Granted the cost of the tank construction would have been more, but it is the writers thinking that the tank would last longer. Noting signs of rust colored spots in two locations, the writer is concerned that the chlorinated water will deteriorate the rebar and cause the concrete to spall.

In conclusion, the writer feels that an independent engineer familiar with the design and problems associated with Water tanks should be hired to evaluate the Town water tank and give recommendations to the Water Sewer Commission on it and recommend fixes if needed as well as annual maintenance steps that the Richmond Water Sewer should consider doing.

Respectfully



Don G. Morin

Cc: Josh  
Bard Hill  
Kendall Chamberlin

Attachment: Memo on Tel Conversation with Carl Childs, PE dated 8-7-2020  
3 pages of Pics  
Copy of Article from Web (3 pages)

## Memo on Telephone Conversation with Carl Childs, PE

**Date:** 8-7-2020

**Reference:** Town of Richmond Water Storage tank

Engineering Report dated July 14, 2020

### Discussions:

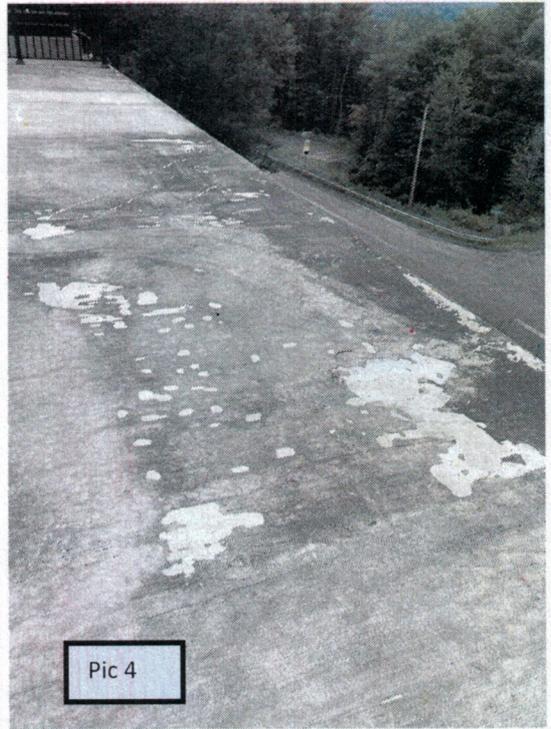
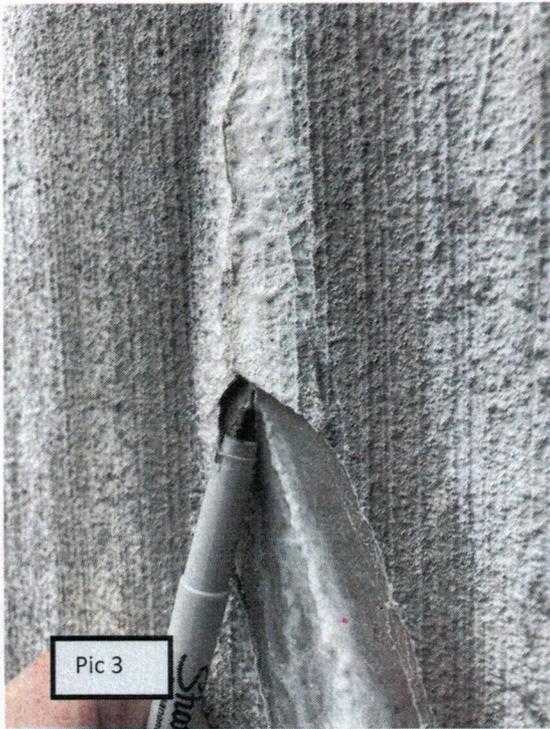
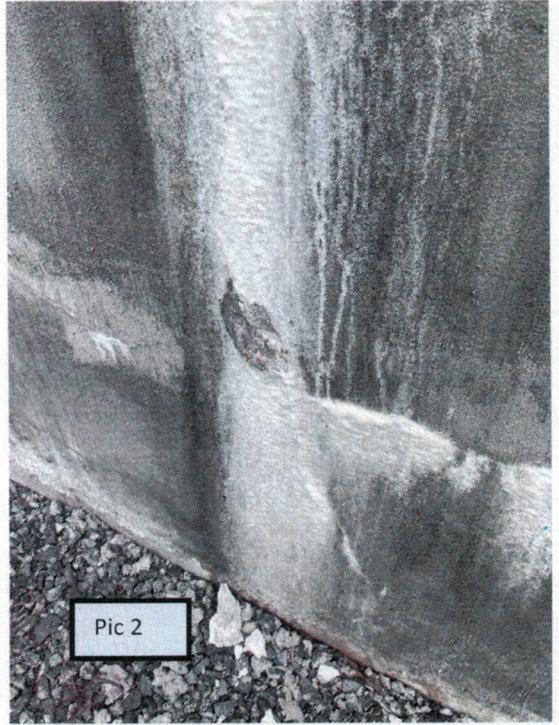
1. Carl is a structural engineer that was hired by Green Mountain Engineering Ins to design the water tank. He has designed many water tanks in the past.
2. Efflorescence: He noted in his report that some efflorescence seeps are active and some were not. Active efflorescence speaks will not freeze, since they are active and water is flowing through them.
3. It is normal for small seeps to develop in a water tank after initial filling. The pores of the concrete will usually seal them selves with in a year. When water finds a tiny small capillary channel in concrete to flow through, it tends to seal itself with in a year. The water combined with the chemicals in concrete tend to activate the hydration of concrete to stop water going through it. Seeps that are 5 years older probably do not fit that description.
4. He noted that S D Ireland had issues meeting the leakage testing after construction. S D Ireland hired Nicom Coating to inject various seeps in effort to seal the tank. He noted that he couldn't recall how many times that Nicom injected epoxy, but said it was several times.
5. He noted that the Specs called for a type of certain type of water proofing admixture (Xpex C-500), but that SD Ireland submitted an alternate Pentron Admix SB. The alternate was approved.
6. Was epoxy coated or HDG coated rebar used. No, it was not considered and has never been used in his designs. I questioned why the State of Vt uses Epoxy coated rebar on Bridges and he explained that the salt solution that the state of Vt uses is much more corrosive that Chlorinated water.
7. Asked him about why the tank was coated with a Cementous coating. He stated it was for aesthetic purposes. He also noted that this was in the original bid documents and was not an afterthought.



Don G. Morin

The above notes represent the writer's interpretation of what was discussed and agreed at this meeting. If any attendees have any comments or differences, these should be brought to the attention of the writer in writing on or before 7 days of receipt of these meetings.

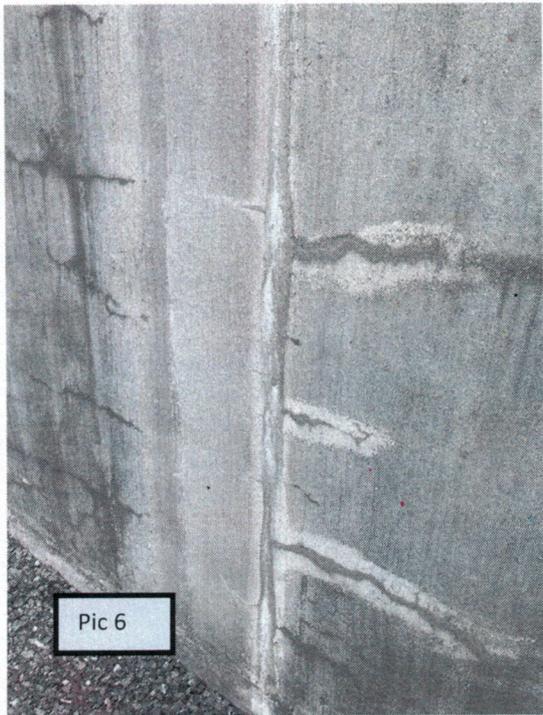
Cc: Carl Childs, Josh Arneson, Bard Hill



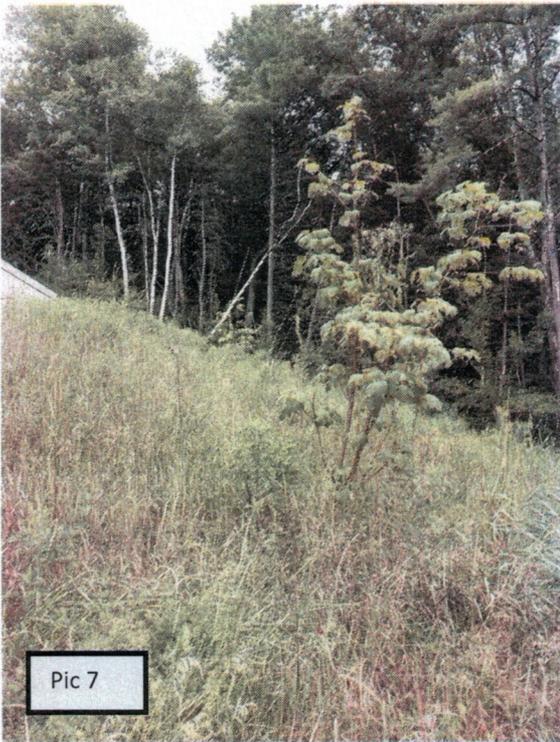
6 pages



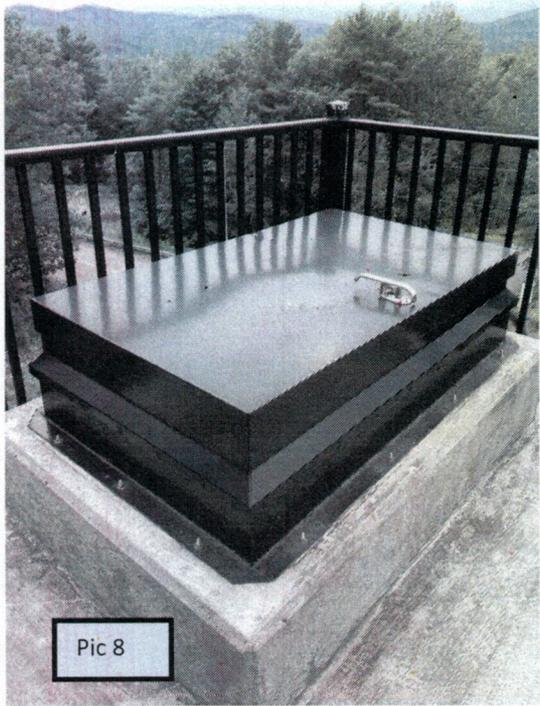
Pic 5



Pic 6



Pic 7



Pic 8



Pic 9

Article from Web  
Structural Design Consultations  
by Gene Gopenko, PE  
(51 pages)

## References

- ACI 318-89. Building Code Requirements for Reinforced Concrete
- ACI 350R-89. Environmental Engineering Concrete Structures
- “Strength Design for Reinforced Concrete Hydraulic Structures” by ASCE, ( adapted from COE Manual)

## ACI 350R-89:

*“ This report presents recommendations for structural design, materials, and construction of concrete tanks, reservoirs, and other structures commonly used in water containment, industrial and domestic water, and wastewater treatment works, where dense, impermeable concrete with high resistance to chemical attack is required.”*

Among Types of Structures: intakes and conduits.

# Steel Reinforcing

- New Billet Steel to Confirm to ASTM A615 Grade 60
- Epoxy Coated Rebars

## Minimum Concrete Cover:

- Concrete Base=3 inches (4" COE)
- Concrete Walls=2 inches (3" COE)
- Stilling Basin=6" (COE)