




Best Practices for Precast Concrete Tank Inspections

29th Annual GSDI Spring Septic System Conference & Expo
Monday March 14, 2016

Claude Goguen, PE, LEED AP,
National Precast Concrete Association



Happy Pi Day!



What We Will Discuss

- Expectations of a Precast Concrete Tank
- NH Code Requirements
- Installation Best Practices
- Field Inspection



A little history...

- Jean Mouras
- 1860
- France



Mouras Automatic Scavenger
 "A mysterious contrivance consisting of a vault hermetically closed by a hydraulic seal. By a mysterious operation, and one which reveals an entirely novel principle, it rapidly transforms all the excrementitious matters it receives into a homogeneous fluid, only slightly turbid, and holding all the solid matter in suspension in the form of scarcely visible filaments. The vault is self emptying and continuous in its workings."



>> Tentative Program

29TH ANNUAL GSDI SPRING AUTOMATIC SCAVENGER SYSTEM CONFERENCE & EXPO

Monday March 14 and Tuesday March 15, 2016
Radisson Hotel Manchester, Manchester, NH

- > Designers
- > Installers
- > Pumpers
- > Evaluators

Seating is limited, so don't miss out on this one-stop continuing education opportunity.

REGISTER TODAY!

Our biennial conference is THE industry event of the year where you can earn all six of your continuing education contact hours good for the renewal of your Automatic Scavenger designers and/or installers permit. System evaluators can also earn renewal credits.

Fulfill your continuing education requirements for the 2016-2018 renewal period by registering for both days!

GSDIA.ORG

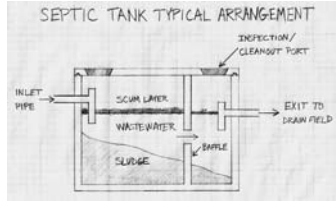
Have Questions?
Call us at 800-328-3233 or email us at info@gsdi.org.

Heart of the System?



What Happens in a Septic Tank?

- Separation
- Flotation
- Settling
- Digestion
- Anoxic
- BOD
- TSS
- N and P



What do we expect from a precast concrete tank?



Watertight

Indiana Code 410 IAC 6-8.3-60 Septic tanks: general requirements

Sec. 60. (a) Septic tanks shall be:

- (1) **watertight** and constructed of durable material such as concrete, fiberglass, polyethylene, or polypropylene; and
- (2) protected from corrosion.

- *“of such tight construction or fit as to be impermeable to water except when under sufficient pressure to produce structural discontinuity”*

Merriam Webster



Watertight

- **Env-Wq 1010.03 Watertightness of Septic Tanks.**
- (a) Septic tanks shall be watertight and constructed of materials not subject to corrosion or decay, such as concrete, plastic, or fiberglass
- (b) Any septic tank constructed from separate sections shall be sealed so as to be watertight. A concrete septic tank shall be sealed with joint sealant that has been represented by its manufacturer or distributor as conforming to ASTM C990-09.



Strong

Illinois Adm Code 905.40: A septic tank shall be watertight and constructed of **sound** and durable materials not subject to excessive corrosion, decay, frost damage or cracking due to settling or backfilling

*“in good condition : solid and strong
- free from flaw, defect, or decay”
Merriam Webster*



Strong

NAC 445A.9658: A septic tank included as part of an on-site sewage disposal system must:

- (a) Be constructed of durable materials designed to withstand expected physical loads and corrosive forces.



Durability

NAC 445A.9658 A septic tank included as part of an on-site sewage disposal system must:

(a) Be constructed of **durable** materials designed to withstand expected physical loads and corrosive forces.

“staying strong and in good condition over a long period of time”

Merriam Webster



Meets Specification

Env-Wq 1002.43 "Inspection" means an on-site review by department staff of an individual sewage disposal system to ensure that the installed system is in compliance with the approved plans and specifications.











We expect the tank to be:

- **Watertight**
- **Strong**
- **Durable**
- **Made to Specifications**



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Watertightness - Keeping the Water In and Out



- Riser and Access
- Horizontal joint
- Pipe Connections
- Concrete itself









TANK SEAM / JOINT SEAL

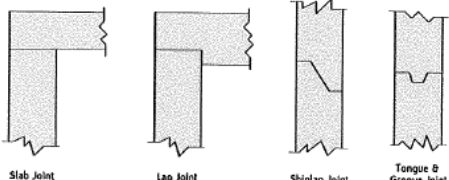


- 3/8" maximum gap between two mating joint surfaces BEFORE sealant is applied.
- ASTM C 1227 Section 10.3




What Makes Precast Concrete Structures Watertight?

Joint Configurations



Slab Joint Lap Joint Shiplap Joint Tongue & Groove Joint

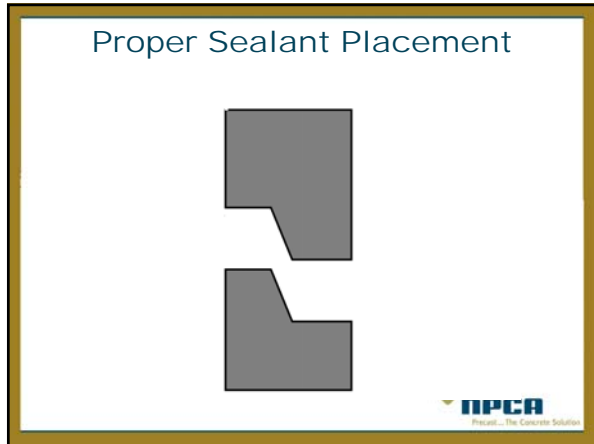


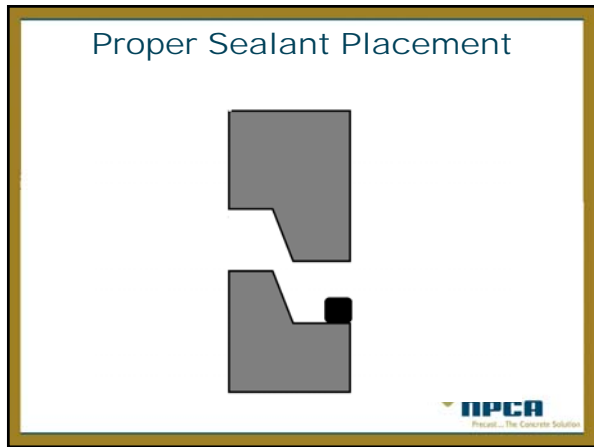
Joint Sealant

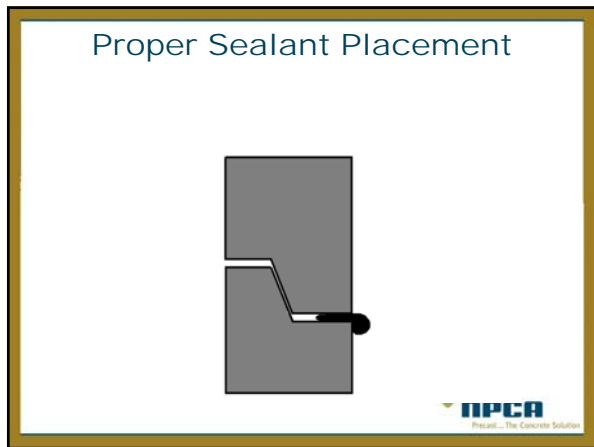


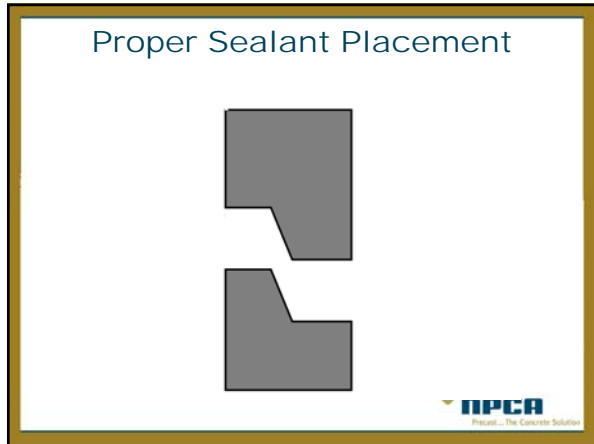
Must conform to ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

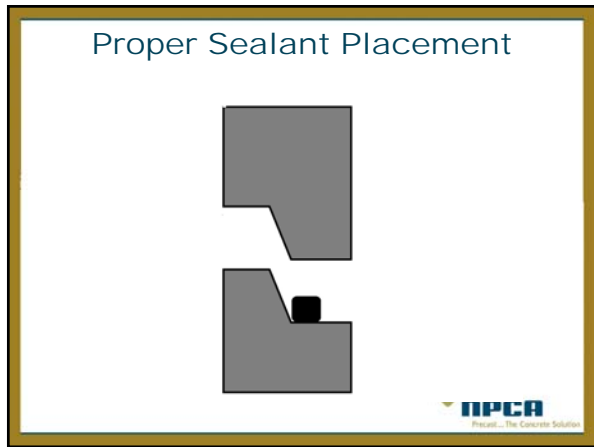


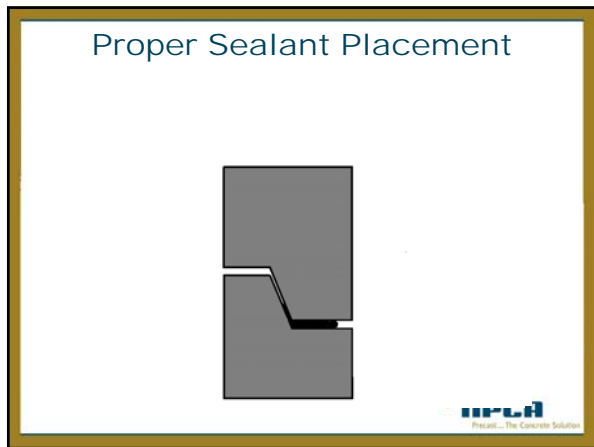












What Makes Precast Concrete Structures Watertight?

Recommended Practice

BAD BETTER BEST

KNEAD SEALANT INTO ONE PIECE


12" MIN. 12" MIN.

What Makes Precast Concrete Structures Watertight?

Watertightness - Keeping the Water In and Out

Pipe Connections


Connectors



Pipe to Tank Connections

Basic Function – Prevent Infiltration and Exfiltration

- Provide a permanent flexible connection between pipe and tank.
- Provide for angular deflection of pipe.
- Provide for shear deflection of pipe.
- Provide sure, simple connection for installer.



Connectors

Anatomy



Must conform to:

ASTM C1644 –
Specification for Resilient
Connectors Between
Reinforced Concrete On-
Site Wastewater Tanks and
Pipes.



According to Code

Env-Wq 1010.08 Pipe to Tank Connections.

(a) All connections between a septic tank and the pipes leading to and exiting from the septic tank shall be sealed with a watertight, flexible joint connector that will accommodate normal movement of the septic tank without leaking or breaking.


(b) The slope of the interior length of any pipe that extends into a septic tank shall not exceed the minimum pitch as specified in Env-Wq 1009.05(a).

Env-Wq 1009.05 Slope of Pipe.

(a) The slope of the pipe from the building to the septic tank shall be not less than 2% and not more than 15%.

(b) The pipe shall be below ground surface for not less than 5 feet leading to the septic tank inlet.

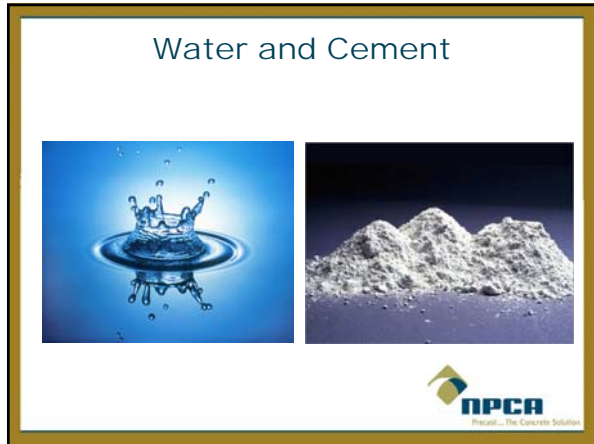
(c) The slope of the pipe from the septic tank to the distribution box shall be not less than 1/8 inch per foot.

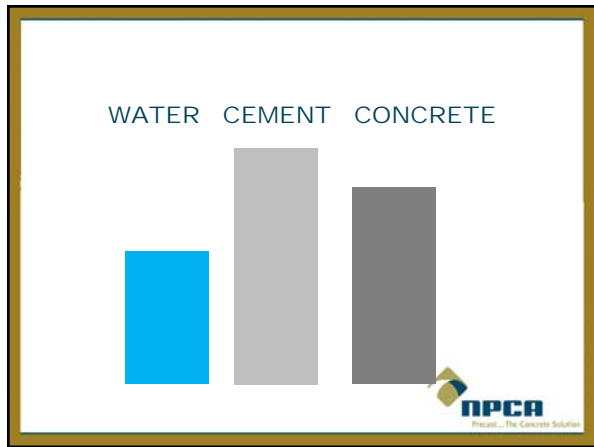


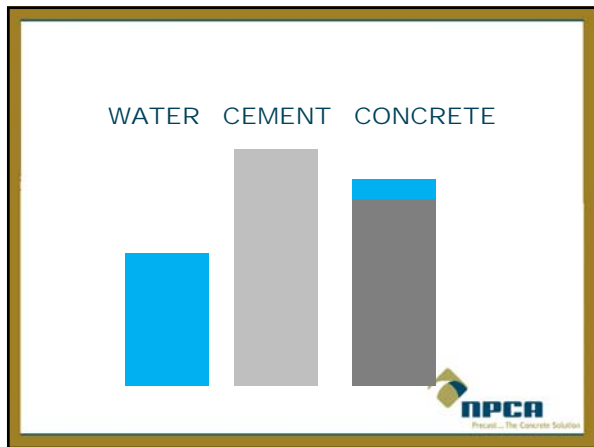








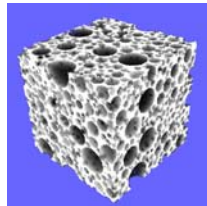




Concrete Watertightness

Porosity

- Pores are the remnants of mixing water
- w/c sufficient for proper hydration of cement
- w/c > water remains in pockets (pores)
- Pores do not carry load → more pores means less strength



We expect the tank to be:

- Watertight
- Strong
- Durable
- Made to Specifications



Concrete Strength

Indiana 410 IAC 6-8.3-61 (j) Reinforced concrete septic tanks shall be constructed of concrete with a compressive strength of four thousand (4,000) pounds per square inch or greater.

310 CMR 15.226 Tank construction materials shall meet the following minimum specifications or an ASTM equivalent standard:

- 1. Concrete Strength f'c 4,000 PSI @ 28 days. Density 140 PCF

Env-Wq 1010.06 Septic Tank Design Requirements

(4) The minimum compressive strength for the concrete shall be 4,000 pounds per square inch at 28 days.



Concrete Strength



@ 28 days?...



From Illinois Adm Code 905.40

2) Engineering Specifications

B) Tanks shall be designed and constructed so that they will not collapse or rupture when subjected to anticipated earth and hydrostatic pressures when the tanks are either full or empty.



From Illinois Adm Code 905.40

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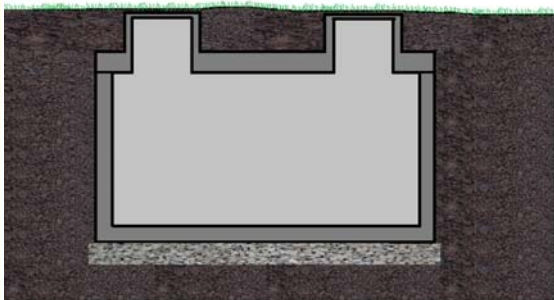
From Illinois Adm Code 905.40

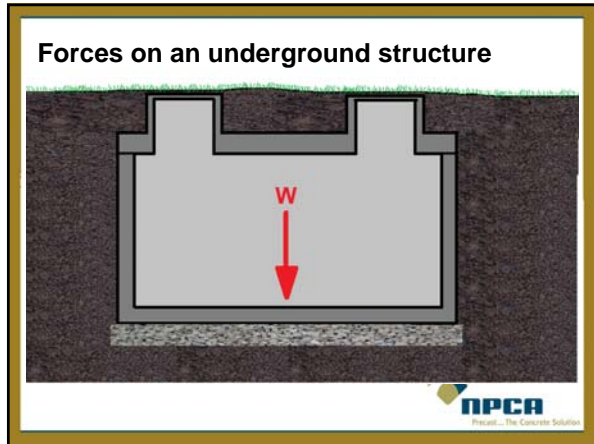
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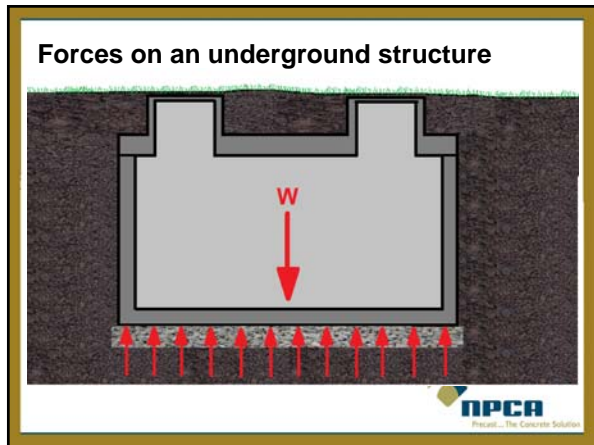
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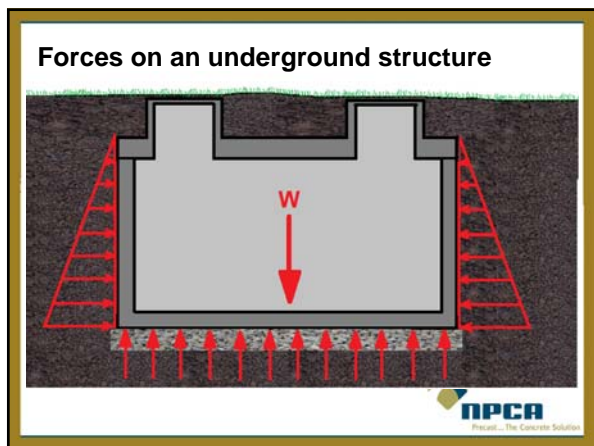


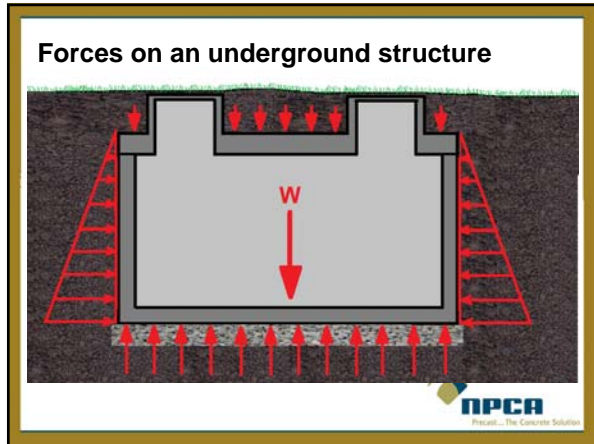
Forces on an underground structure

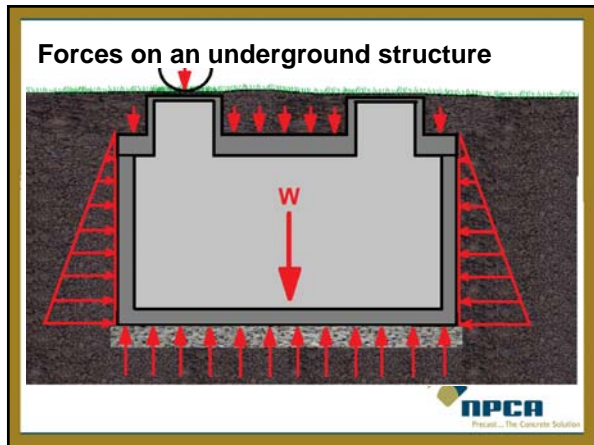


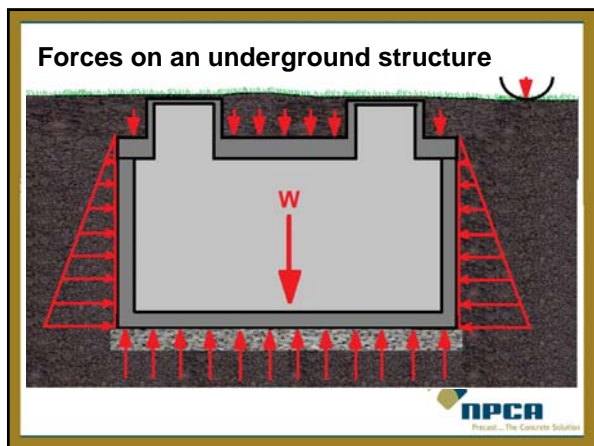


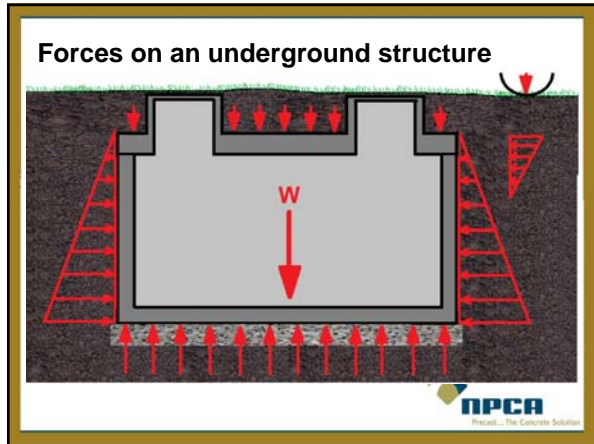


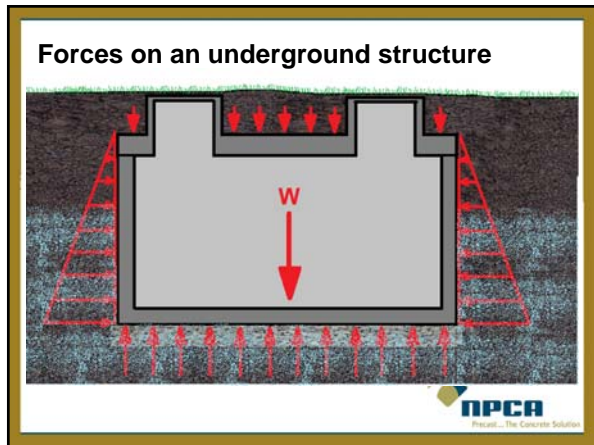


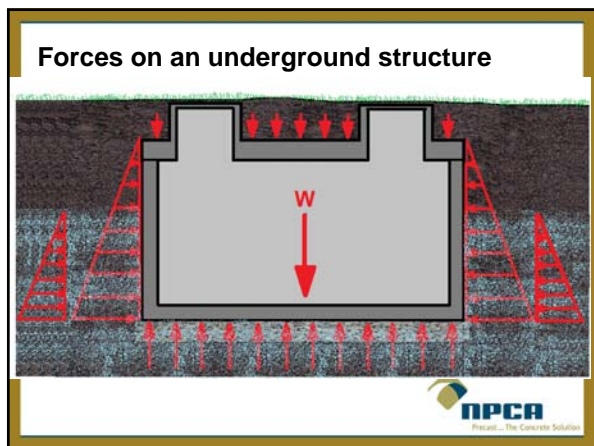


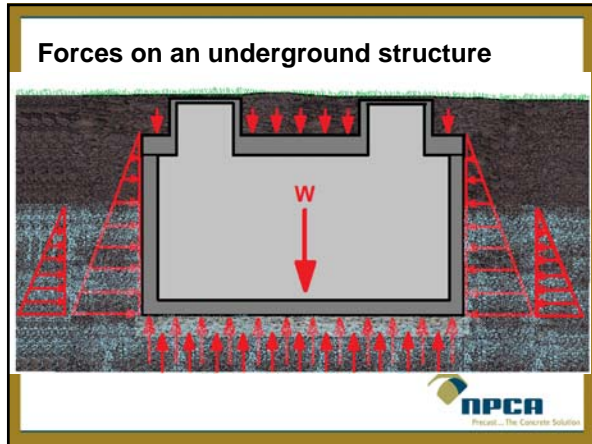


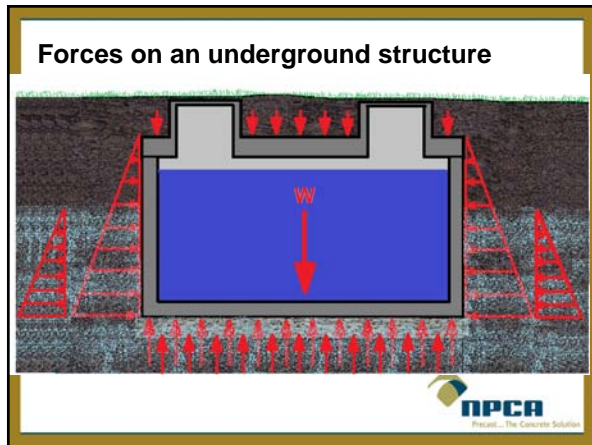


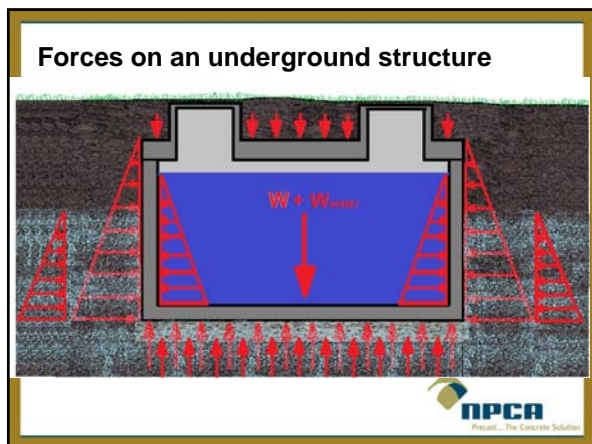












Other forces on an underground structure

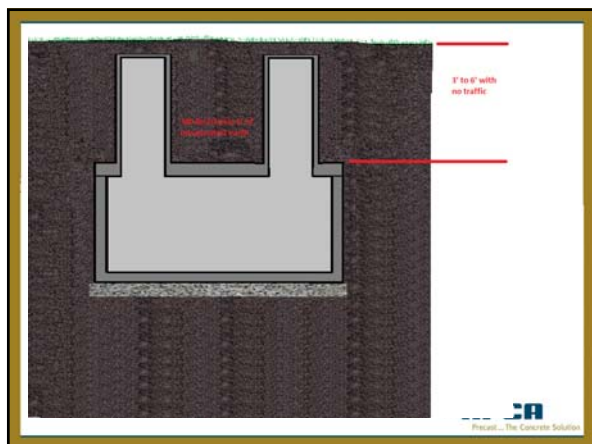
- Handling Loads

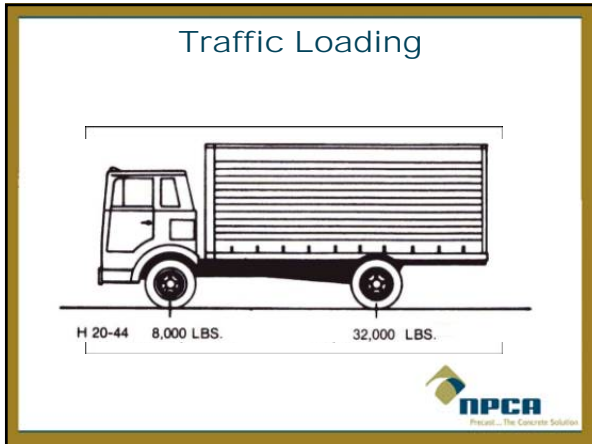


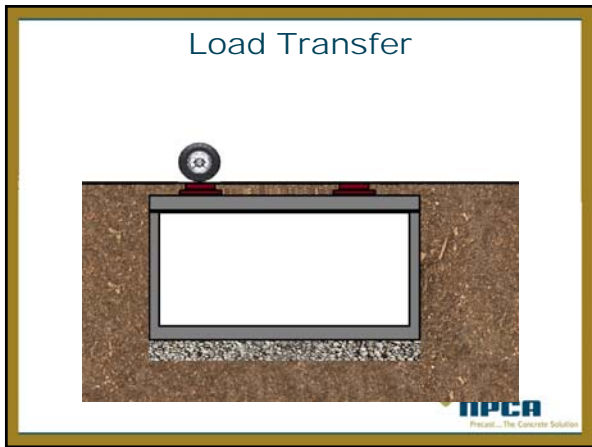
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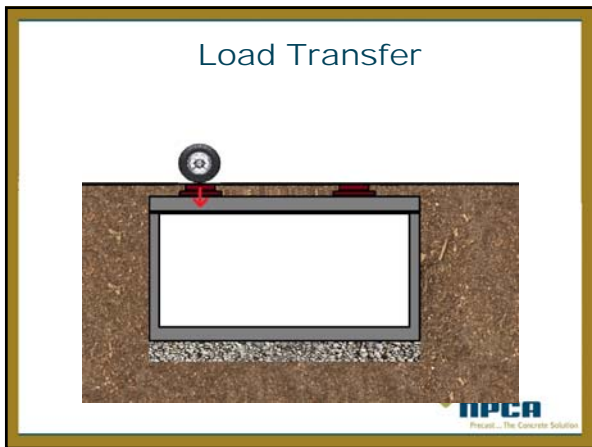


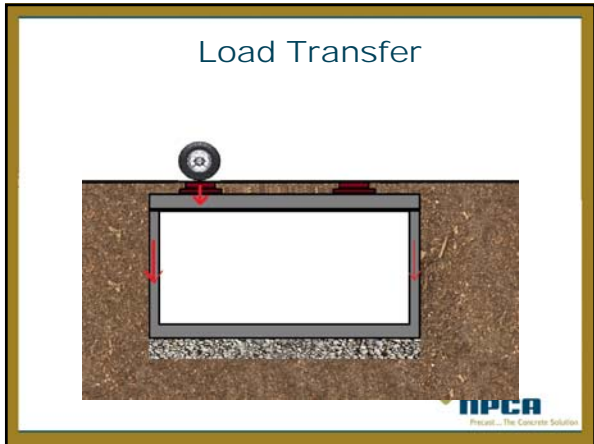


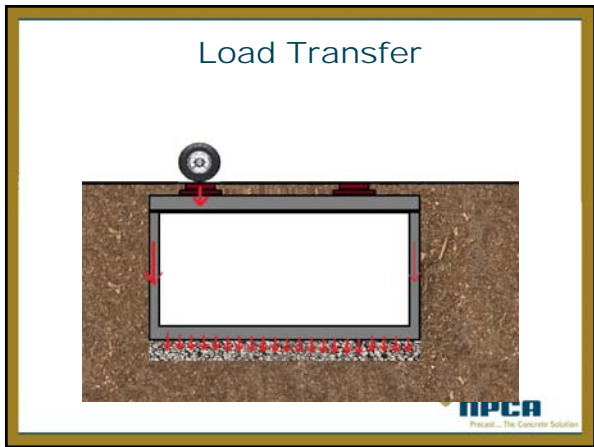












We expect the tank to be:

- Watertight
- Strong
- **Durable**
- Made to Specifications




Durability

Keys to Durable Concrete

- Quality Raw Materials
- Aggregate Gradation
- Low W/C Ratio
- Proper Curing

In Aggressive Environments

- Coatings / Sealants
- Additives





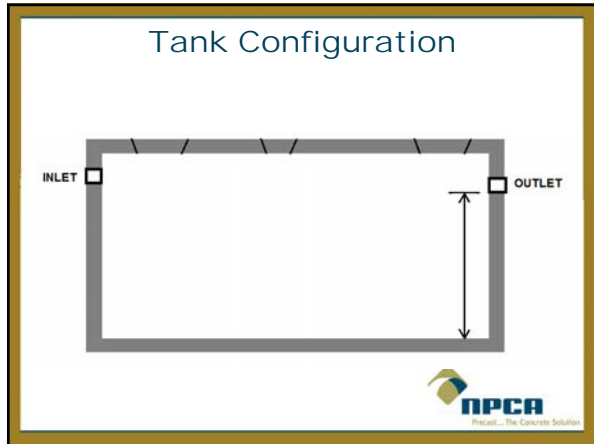
We expect the tank to be:

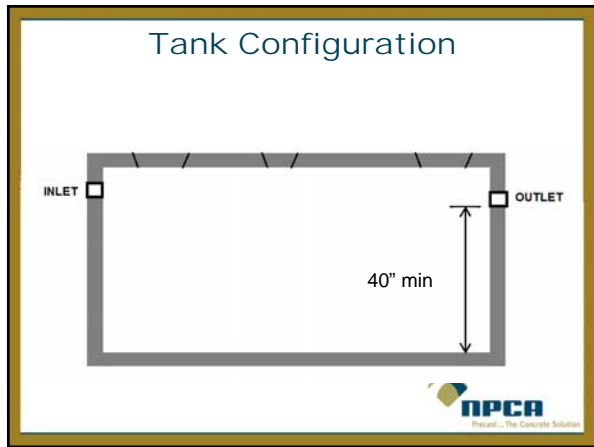
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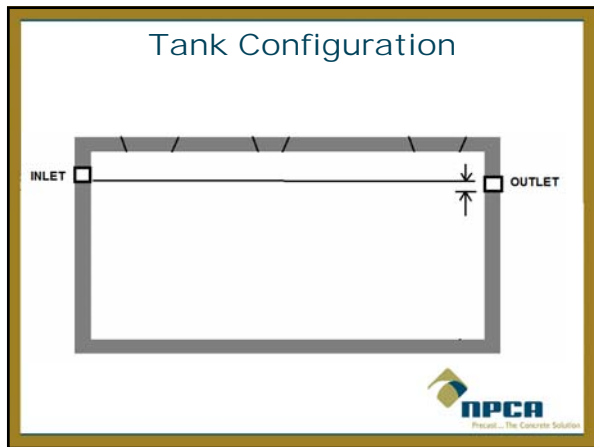


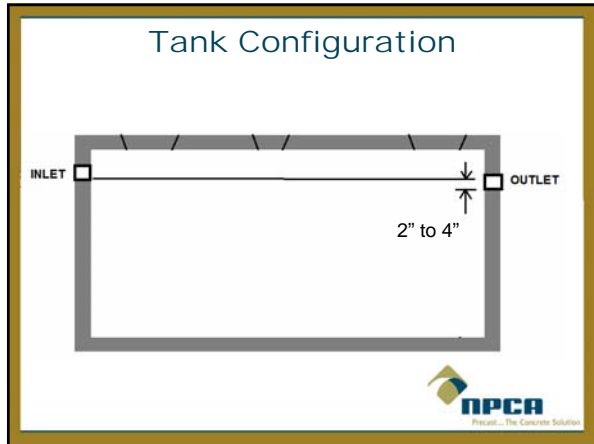
Tank Configuration

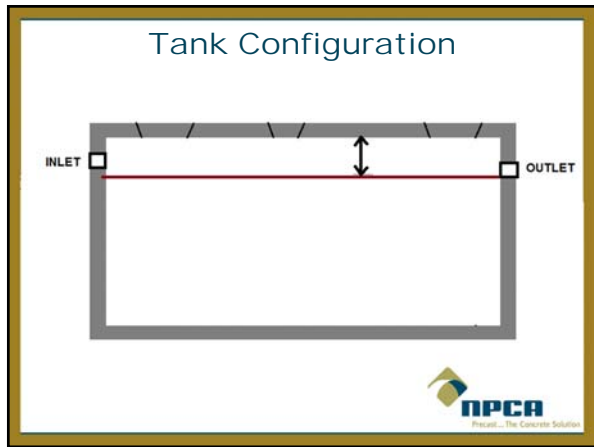


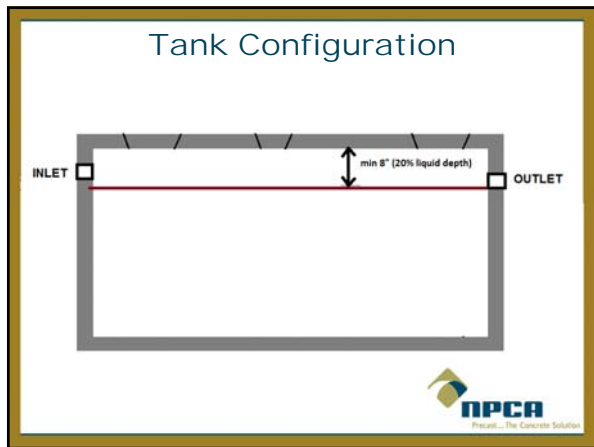


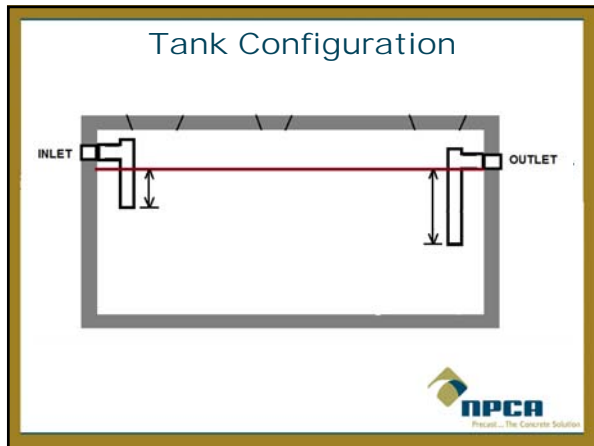


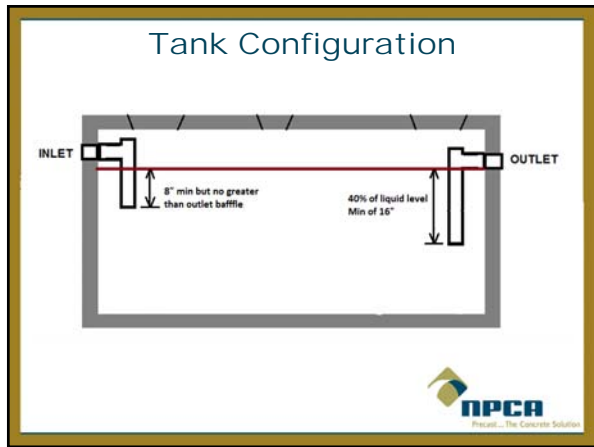


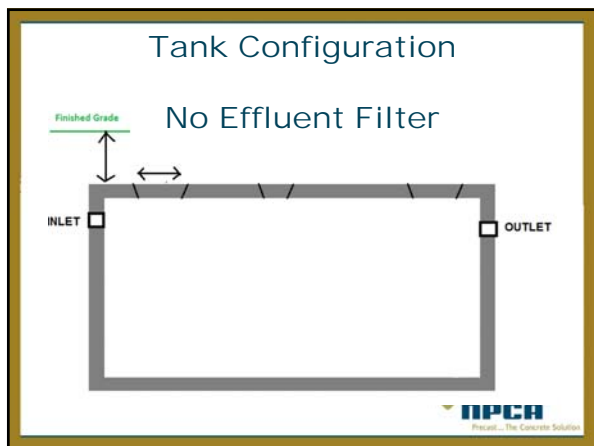


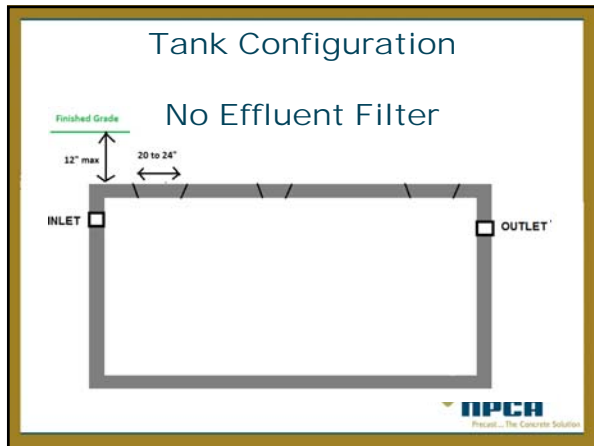


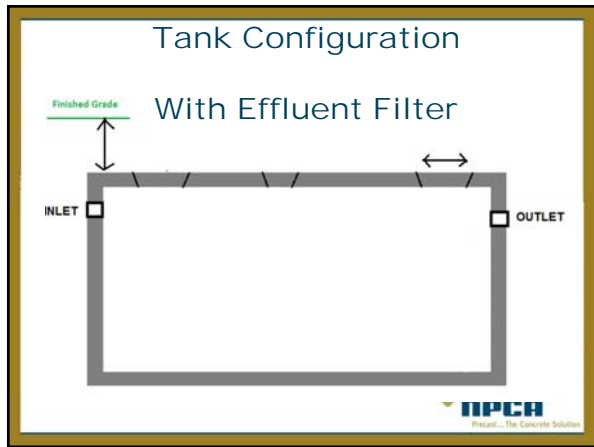


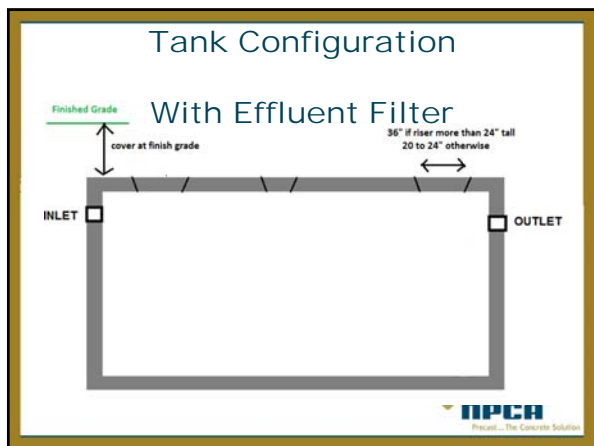


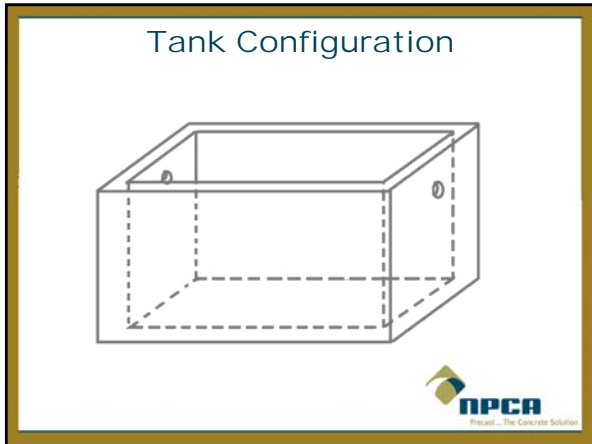


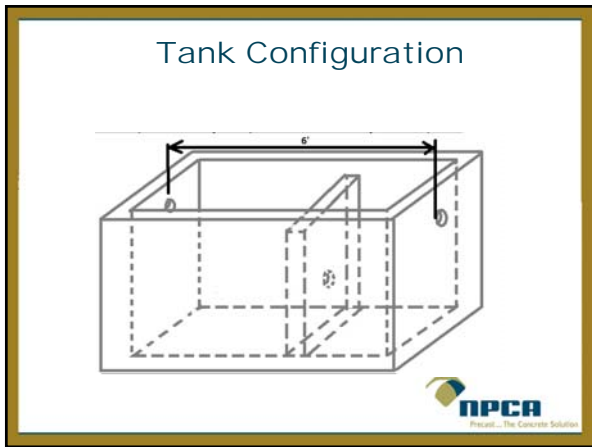


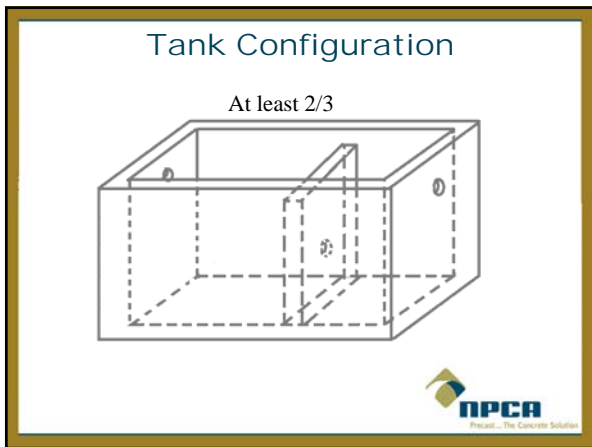




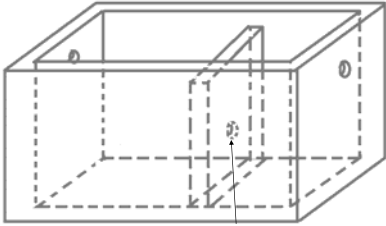









Tank Configuration



As per ASTM C1227 At least 50 square inches
Middle 25%



Field Inspection



What do we look for?

Existing Tanks

- Condition of cover
- Appearance of wastewater
- Liquid level
- Tank & Riser materials
- Risers – watertight?
- Condition of tank
- Condition of baffles
- Capacity of tank
- Scum Sludge levels
- Evidence of leaking? Root invasion
- Effluent filter



What do we look for?


New Tanks

- Appearance of tank. Defects?
- Markings
- Capacity / Sizing / Compartments / Baffles
- Joint condition
- Connectors
- Risers
- On site testing if applicable
- Bedding
- Condition prior to backfill
- Backfilling practices
- Connections



Visible Defects

- Cracking
- Bugholes
- Honeycombing
- Cold Joints
- Exposed Reinforcing

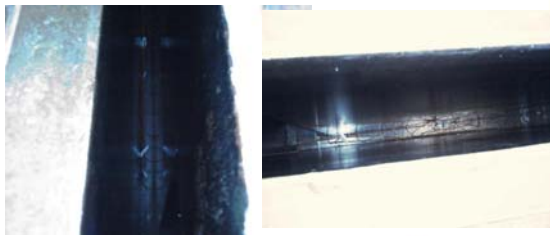




Exposed Reinforcing



Rebar Touching Form



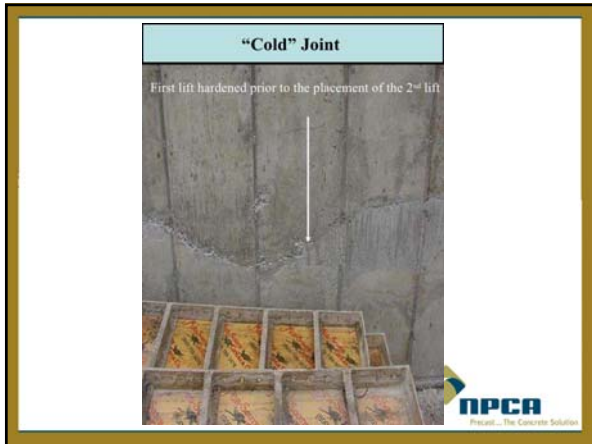
Cracking

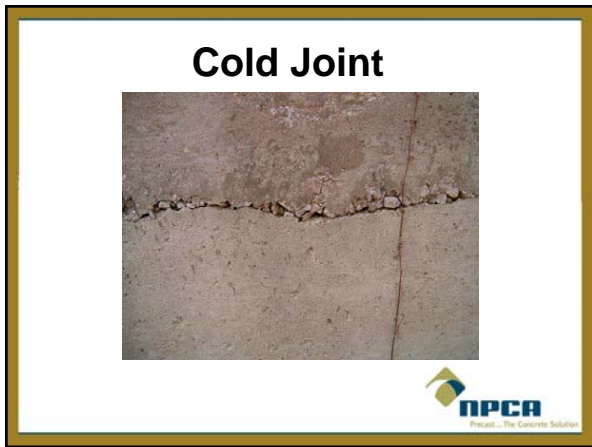


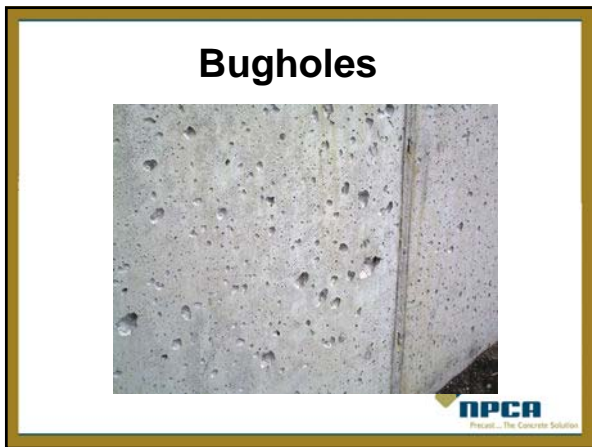












Installation Best Practices Avoids Costly Issues in the Future

- Bedding
- Tank is level
- Check inlet / outlet elevations
- Proper application of sealant
- Care when backfilling
- Pipe connections



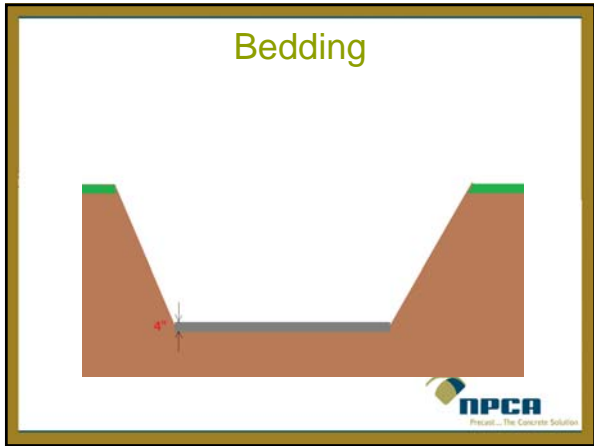
From 310 CMR 15

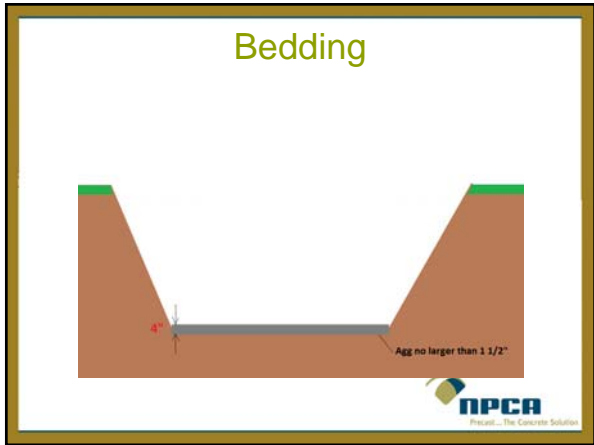
- Septic tanks, grease traps, pump chambers, dosing chambers and distribution boxes shall be constructed or set level and true to grade on a level stable base which has been mechanically compacted. If the component is placed in fill, proper compaction is required to ensure stability and to prevent settling; native ground with a six inch aggregate base is otherwise adequate.

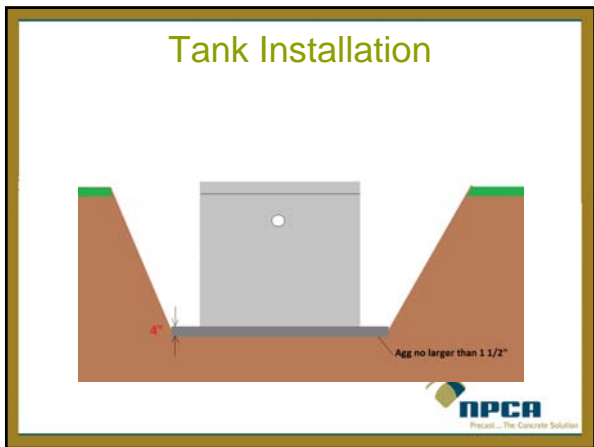


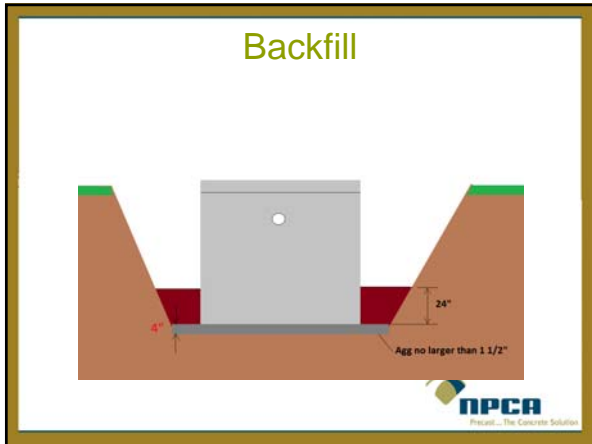
Excavate Safe Hole

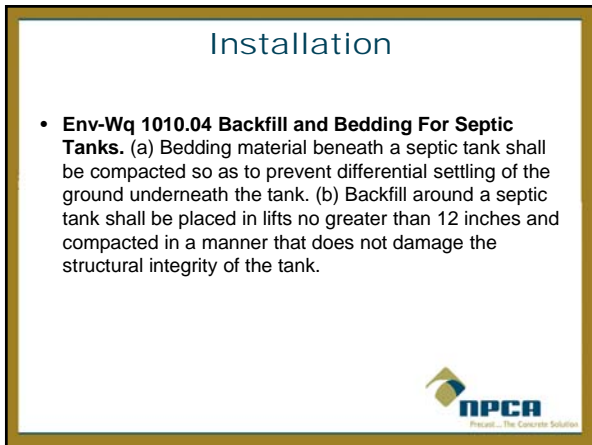


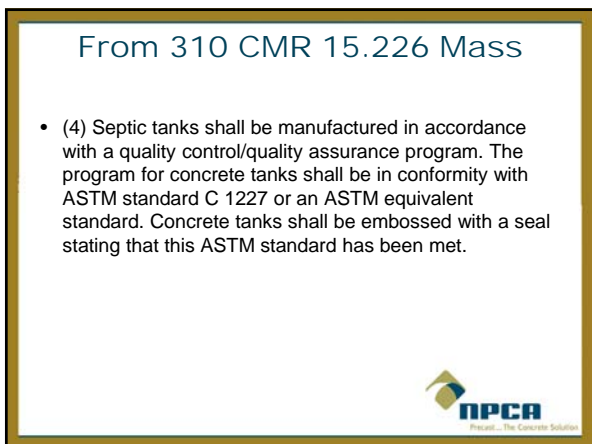














From ADEQ R18-9-A314

- c. A prefabricated concrete septic tank shall meet the “Standard Specification for Precast Concrete Septic Tanks, C1227-03,” published by the American Society for Testing and Materials. This information is incorporated by reference and does not include any later amendments or editions of the incorporated material.



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Quality Control Program



Designation: C1227 – 12

**Standard Specification for
Precast Concrete Septic Tanks¹**

This standard is issued under the fixed designation C1227; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript letter (a) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers design requirements, manufacturing practices, and performance requirements for monolithic or sectional precast concrete septic tanks.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

C843M Specification for Ready-Mixed Concrete
C125 Terminology Relating to Concrete and Concrete Aggregates
C150 Specification for Portland Cement
C311 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260 Specification for Air-Entraining Admixtures for Concrete
C330 Specification for Lightweight Aggregates for Structural Concrete
C898M Specification for Chemical Admixtures for Concrete
C955 Specification for Blended Hydraulic Cements
C618 Specification for Coal Fly Ash and Raw or Calcined Natural Silica Fume for Use in Concrete



Quality Control Program

Precast concrete onsite wastewater structures should be manufactured using a quality control program



Quality Control Program

Precast concrete onsite wastewater structures should be manufactured using a quality control program

- Raw Materials
- Pre-Pour Inspection
- Batching
- Placement
- Curing
- Testing
- Post Pour Inspection




One last thing...

Rely on your local producer



Summary

- Tank is heart of the system
- We expect Watertightness, Strength, Durability and Compliance
- Watertightness – Low w/c, strong, dense, curing, proper joints and connections
- Understand anticipated loading
- Producer should have a quality control program
- Thorough field inspection
- Installation Best Practices
- **Use your producer and NPCA as a resource!!!**




Additional Information & Resources

Septic Tank Best Practices Manual

<http://precast.org/precast-possibilities/products/water-and-wastewater-products/>


NPCA website
<http://precast.org/>



Questions?

- **If you have any questions about this presentation or anything about precast concrete onsite wastewater structures, please contact:**

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THANK YOU!



Best Practices for Precast Concrete Tank Inspections

**29th Annual GSDI Spring Septic System
Conference & Expo
Monday March 14, 2016**

**Claude Goguen, PE, LEED AP,
National Precast Concrete Association**