



Turkey Point Units 6 & 7 Underground Injection Control

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**The information provided in the following
presentation is of a preliminary nature
and is considered DRAFT**

Agenda

Provide the NRC with an overview of the use and success of Underground Injection Control (UIC) in Florida

- General UIC Information
- Florida UIC Permitting Process
- UIC Design, Construction and Testing
- Fluid Migration Detection

Turkey Point Units 6 & 7 – Underground Injection Control

History of Underground Injection in Florida

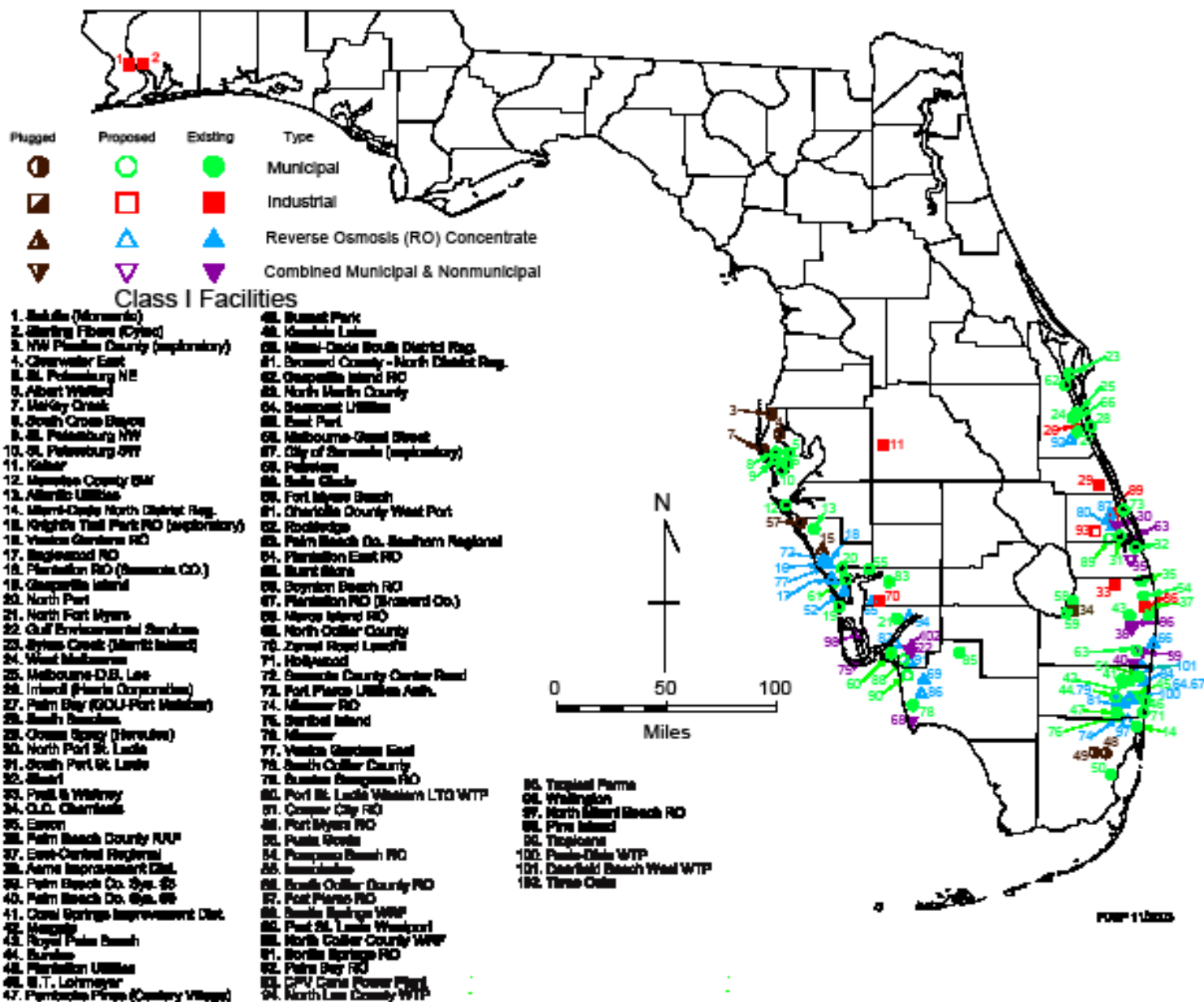
- **1943 – First injection into the Floridan Aquifer took place**
 - Oil Field Brine
- **1959 – First injection of municipal effluent into the Upper Floridan Aquifer**
- **1966 – First injection of non-oil field related industrial wastewater into the Lower Floridan Aquifer (Boulder Zone)**
- **1970s – Injection into Upper Floridan ceases and is replaced by injection into the Boulder Zone**
- **1983 - Florida is granted primacy of the State's UIC Program**
- **Today there are approximately 127 active Class I injection wells in Florida**

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Class I Wells

- **Class I - industrial and municipal disposal wells which inject fluids beneath the lowermost unit containing an underground source of drinking water (USDW)**
 - Class I Municipal – disposes of treated domestic wastewater
 - Class I Industrial – disposes of non-hazardous industrial wastewater
- **Most dispose of treated municipal effluent**
- **Many dispose of reverse osmosis (RO) concentrate or a combination of treated wastewater and RO concentrate**
- **Power Plant industrial wastewater – primarily cooling tower blowdown**

CLASS I INJECTION FACILITIES

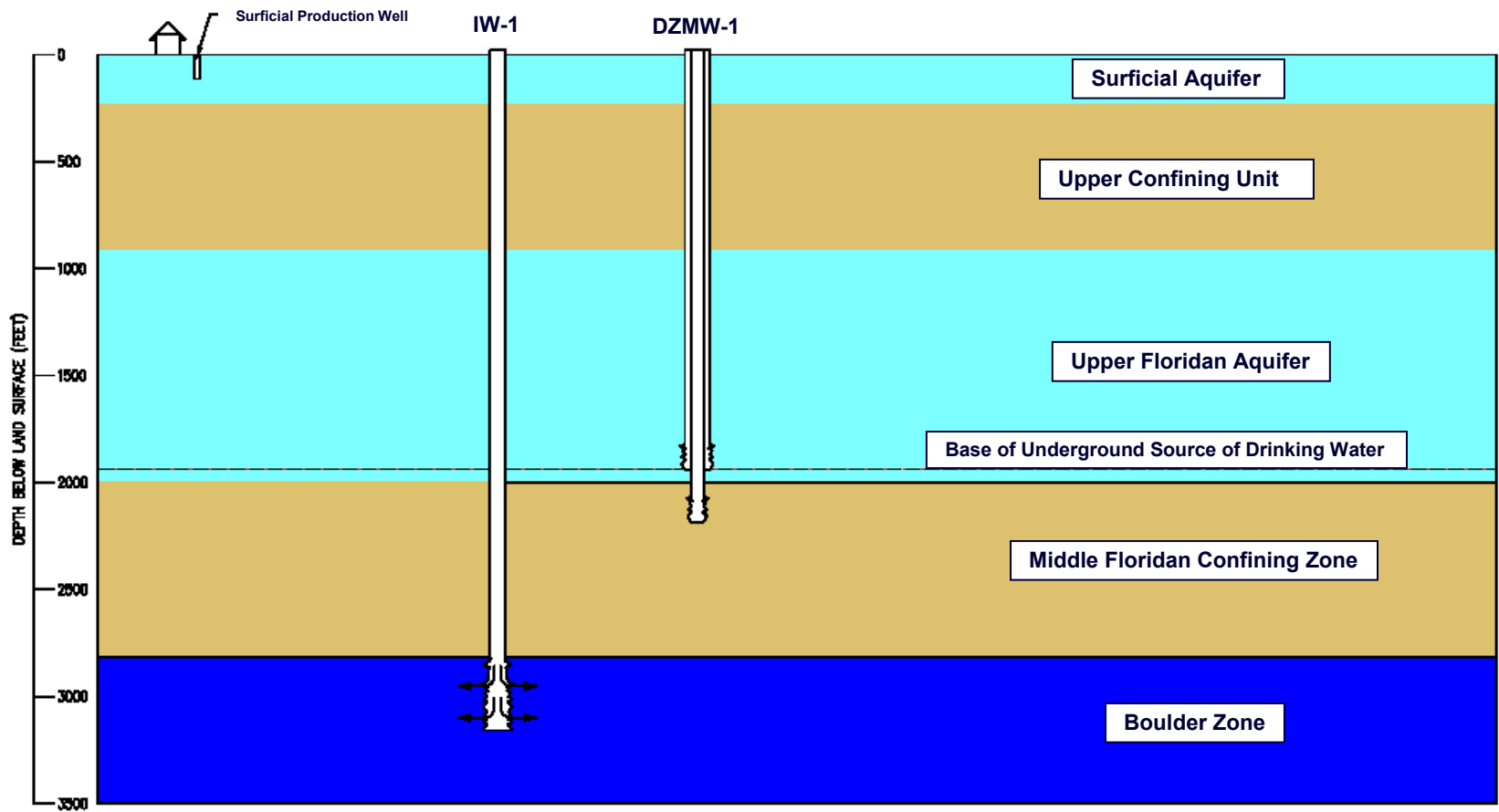


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Class I Injection Technology

- **Inject into the Boulder Zone in the Lower Floridan Aquifer**
- **Thick confining beds separate the Boulder Zone from the Underground Source of Drinking Water (USDW)**
 - USDW = an aquifer or its portion that contains water with a total dissolved solids concentration of less than 10,000 mg/L.
- **Confinement is low permeability limestone and dolomite**
 - Typically 800 – 1,000 feet thick
 - Vertical hydraulic conductivity typically 10^{-4} to 10^{-9} cm/sec

TYPICAL INJECTION WELL SYSTEM



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Florida's UIC Permitting Process

- **The Florida Department of Environmental Protection (FDEP) administers the UIC Program in Florida**
- **Chapter 62-528, Florida Administrative Code**
- **Technical Advisory Committee (TAC)**
 - District and Tallahassee FDEP offices, USGS, Water Management District, local Health Department, and USEPA

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Florida's UIC Permitting Process – cont.

- **Exploratory Well Construction Permit**
 - Well construction to evaluate site geology and hydrogeology
- **Class I Construction Permit**
 - Conversion of exploratory well to a Class I injection well
 - Short-Term injection test
 - Operational testing – 6 to 24 months of test operation with increased monitoring requirements
- **Operating Permit**
 - Allows operation of the Class I injection well system
 - Must be renewed every 5 years

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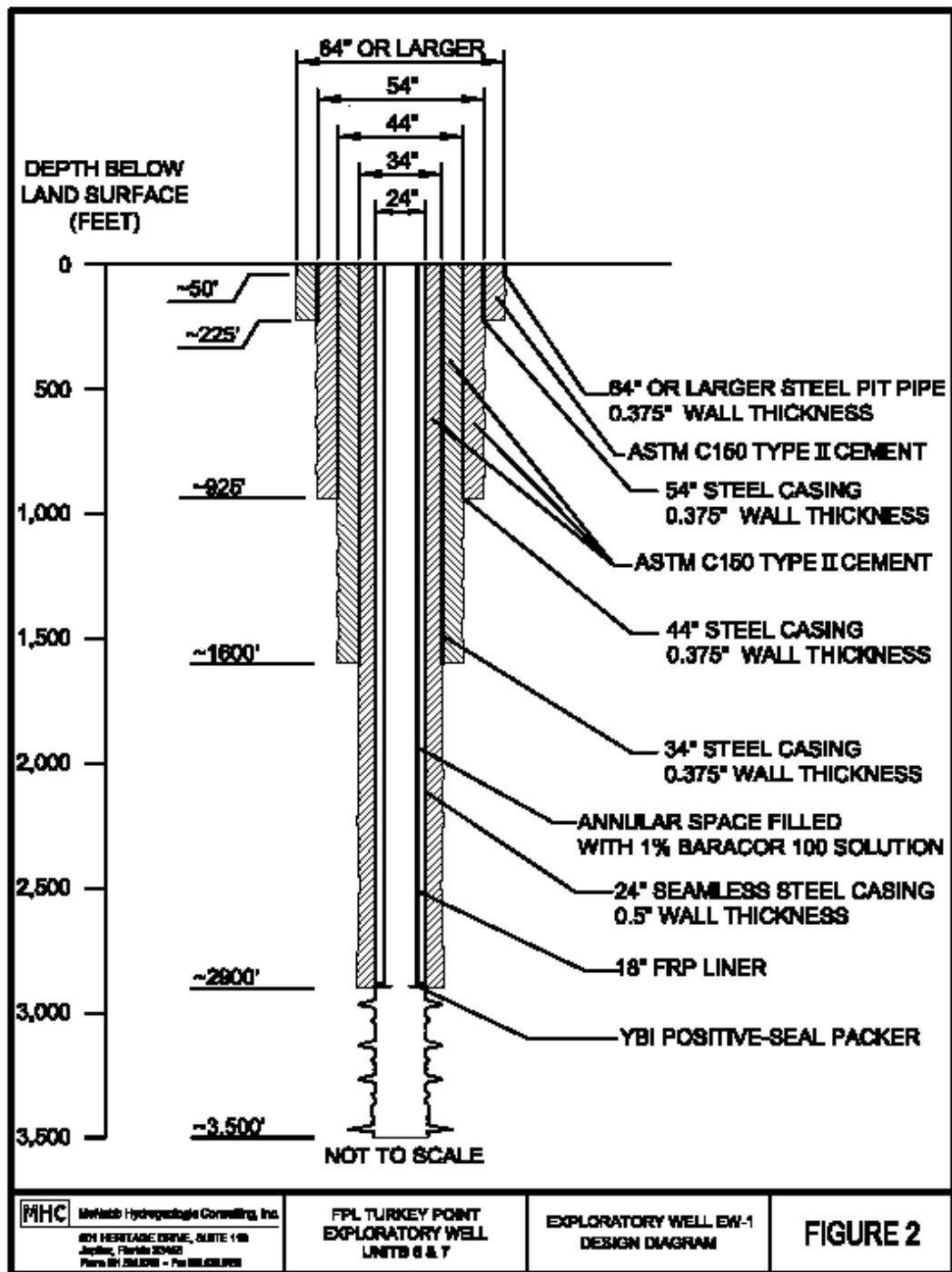
Injection Well Design

- **Multiple concentric casings**
 - 54-, 44-, 34-, and 24-inch diameter steel fully cemented casings
 - 0.375-inch wall thickness except final casing is seamless 0.5-inch
 - 34-inch and 24-inch diameters casings set below base of USDW
- **Fiberglass Reinforced Pipe (FRP) injection tubing**
 - Protects final casing from corrosion
 - Packer at base of FRP isolates FRP-casing annulus
 - Annulus filled with corrosion inhibitor
- **10-inch overdrill on final casing to allow 5-inch cement thickness around casing**

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Injection Well Mechanical Integrity Test

- **Mechanical integrity testing (MIT) is required every 5 years**
- **MIT consist of the following**
 - Video survey – visual inspection of injection tubing, packer and open hole interval
 - High-resolution temperature logging – leak detection
 - Annular pressure test – test for leaks in tubing, final casing and packer
 - Radioactive tracer survey – test the integrity of the cement seal at the base of the final casing
 - Interpretation of previous five years of monitoring and operating data
- **Results compiled in report and submitted to FDEP for review and approval**

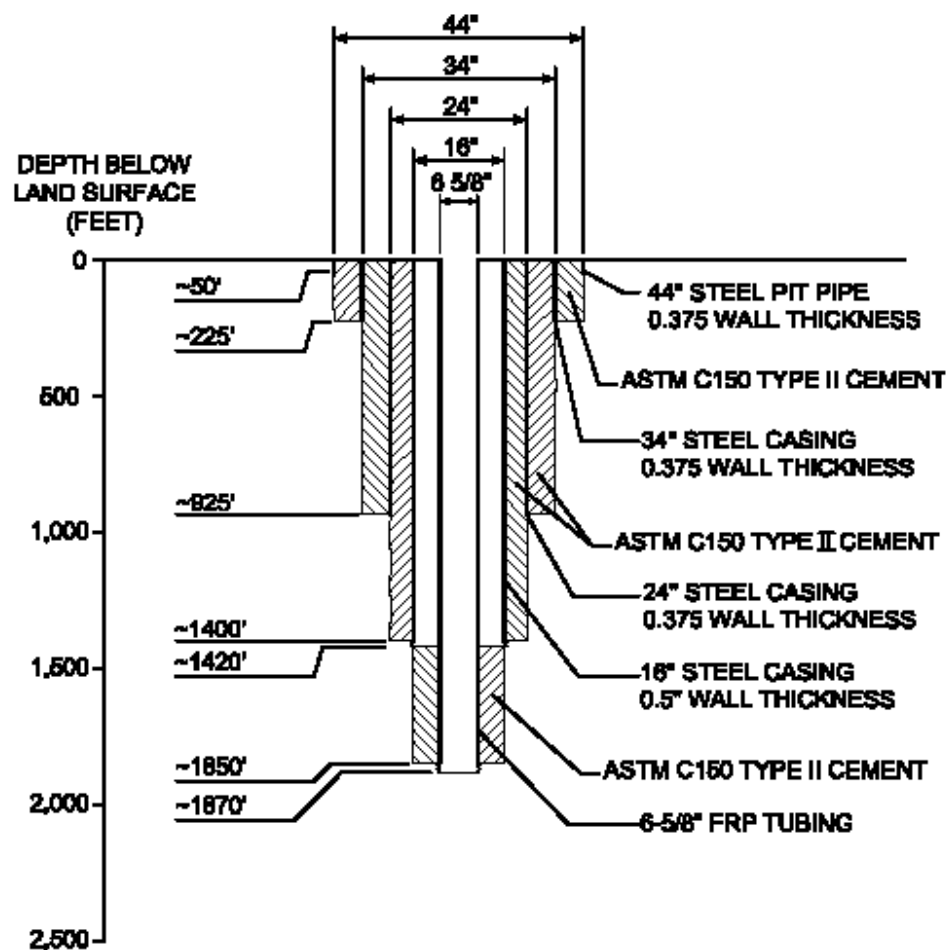


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Monitor Well Design

- **Multiple concentric casings**
 - 34-, 24-, 16-, and 6.625-inch diameter casings
 - 16-inch diameter casing is 0.5-inch wall thickness steel, 34- and 24-inch diameter casings are 0.375-inch wall thickness steel
 - 6.625-inch diameter casing is FRP to provide corrosion protection
- **Monitors two separate zones**
 - Upper zone monitors just above or at the base of the USDW
 - Lower zone monitors below base of the USDW and just above the primary confining unit – typically a few hundred feet below the base of the USDW to provide early warning system

DUAL-ZONE MONITOR WELL



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FPL TURKEY POINT
 EXPLORATORY WELL
 UNITS 6 & 7

DUAL-ZONE MONITOR WELL
 DZMW-1
 DESIGN DIAGRAM

FIGURE 3



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Injection Well Drilling Rig



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12.25-Inch Diameter Pilot Hole Bit



Turkey Point Units 6 & 7 – Underground Injection Control

58-Inch Diameter Reaming Bit



Turkey Point Units 6 & 7 – Underground Injection Control Casing Installation



Turkey Point Units 6 & 7 – Underground Injection Control FRP Injection Tubing Installation



Turkey Point Units 6 & 7 – Underground Injection Control Class I Injection Wellhead



Turkey Point Units 6 & 7 – Underground Injection Control Class I Injection Wellhead



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Confinement Characterization

- **Geophysical logs**
- **Rock Cores**
 - Laboratory Analysis of core samples
- **Straddle Packer Testing**
 - Hydraulic and water quality data

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Vertical Fluid Migration Detection

- **Monitor well is located less than 150 feet from injection well**
- **Monitor well sample collection**
 - Weekly during operational testing
 - Monthly thereafter
 - Total dissolved solids, conductivity, chloride, phosphorus, sulfate, sodium, calcium, magnesium, potassium, carbonate, bicarbonate, temperature, pH, gross alpha, radium-226, radium-228
- **Monitor well water level monitoring**
- **Changes in monitor zone water quality and level can indicate vertical migration**



Closing Questions & Comments