PRACTICAL CONSIDERATIONS AND RESPONSES TO AGEING COASTAL STRUCTURES

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2. Pope (1992) presented on the challenges of maintaining the federal coastal structures (jetties, groins, breakwaters) and found:

that nearly 77% of the structures were built prior to the 1940's

and 40% of the structures were built prior to 1900.

Pope, J., "Our Ageing Coastal Infrastructure," Proceedings of the Coastal Engineering Practice '92 Conference, ASCE, pp.1055-1068.

1. PERFORM MONITORING AND MAINTENANCE

Coastal structures must be monitored and maintained over the long term to insure their performance (after Pope, 1992). While they can usually be designed for say 50 years, the practical life of these structures can be much longer, or shorter.

Delaware Bay breakwater at age ~100 years.

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Delaware Bay breakwater at age ~100 years.

Section of a Florida jetty at age 38 years

2. MONITOR COASTAL STRUCTURES (W)HOLISTICLY

Observations should focus on both the performance of the total structure and the performance of individual armor stones or units (after Pope, 1992).

Mullet Key, Pinellas County 2020

3. ACKNOWLEDGE THE EXISTENCE OF NONCONFORMING STRUCTURES

Select Examples of Nonconformance	
Too small armor stone	
One layer of armor stone	
Poor quality stone	
Concrete or other debris	
Poor or nonexistent foundation layers	
Weak soil conditions	

3. ACKNOWLEDGE THE EXISTENCE OF NONCONFORMING STRUCTURES

Select Examples of Nonconformance	Select Examples of Solutions
Too small armor stone	Rebuilt Structures
One layer of armor stone	Rock Overlays with designed armor stones
Poor quality stone	Overbuilding the structure elevations
Concrete or other debris	Convert concrete slabs to foundation stone
Poor or nonexistent foundation layers	
Weak soil conditions	

4. RECOGNIZE THE EFFECTS OF INCREASING MEAN SEA LEVEL

The performance of the coastal structure may decrease.
Increased overtopping may occur.
For shallow water structures, the maximum depth limited wave may increase.

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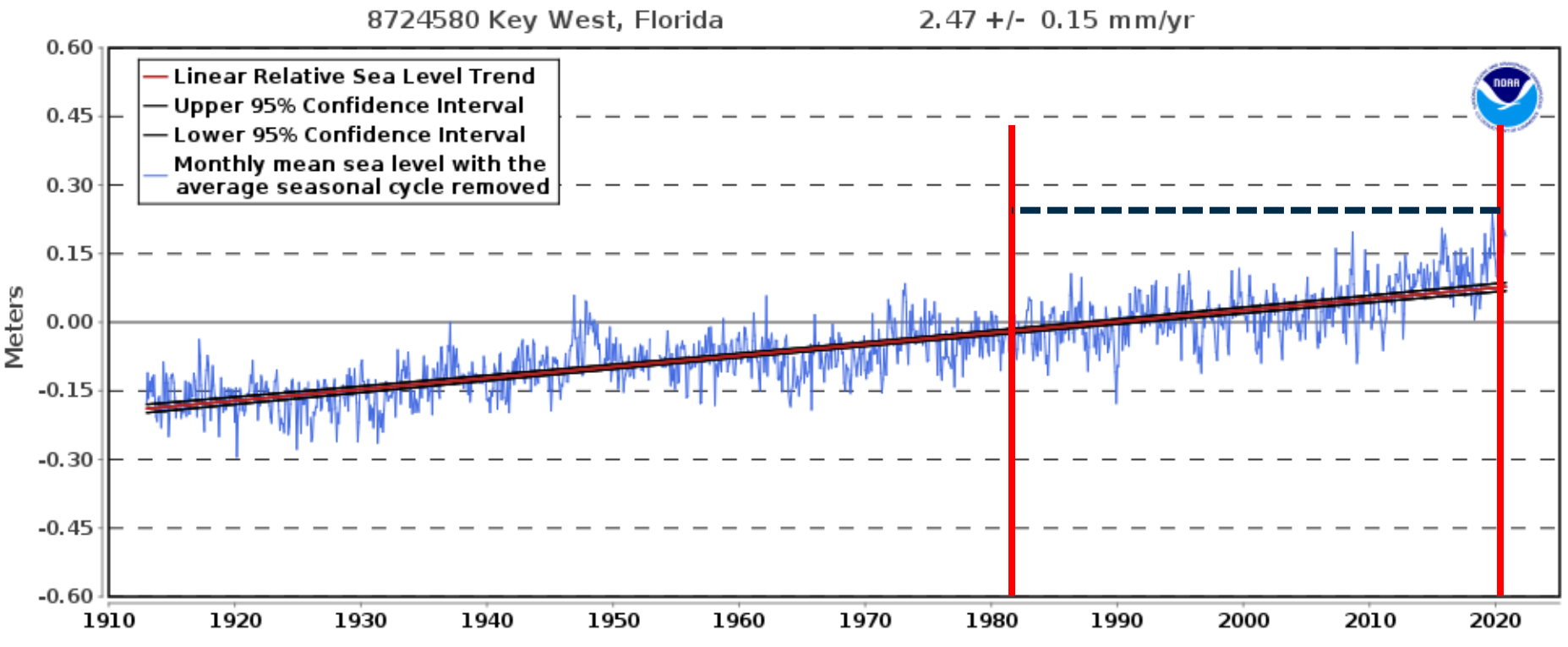
4. SEA LEVEL RISE EXAMPLE



5. APPLY AVAILABLE REPAIR GUIDANCE

Shore Protection Manual (1977,1984)

Coastal Engineering Manual (2002)

provide excellent design guidance on (new) rubble mound structures. Most of the design guidance can be applied to repairing structures with engineering judgement.

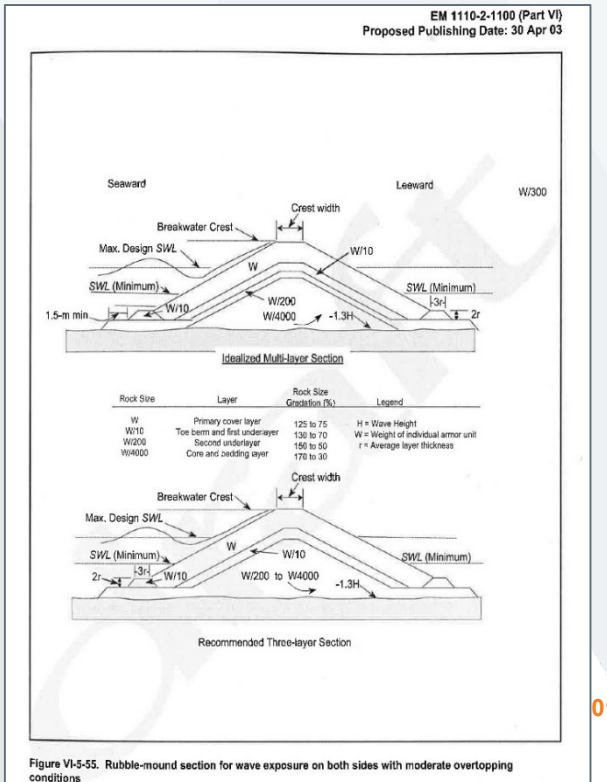


Figure VI-5-55. Rubble-mound section for wave exposure on both sides with moderate overtopping conditions

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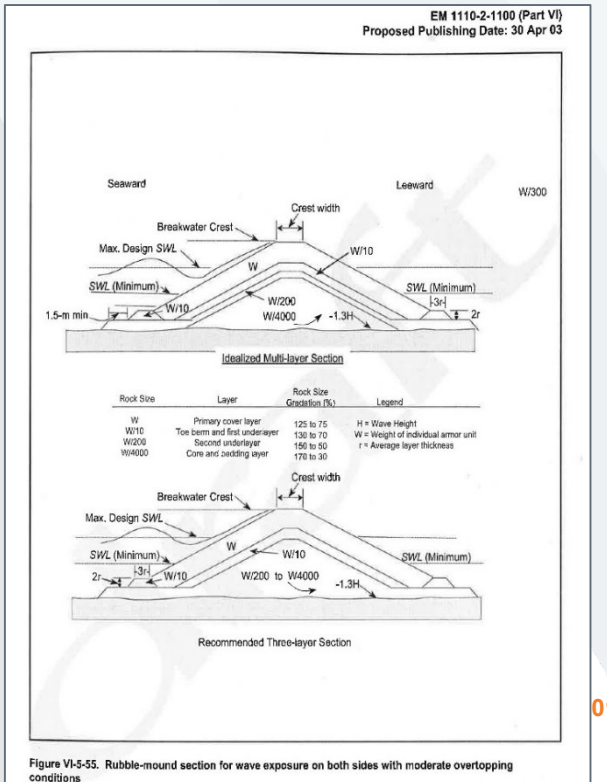
The USACE Repair Evaluation Maintenance and Rehabilitation Program (circa 2000) also provides a source of guidance for infrastructure management.



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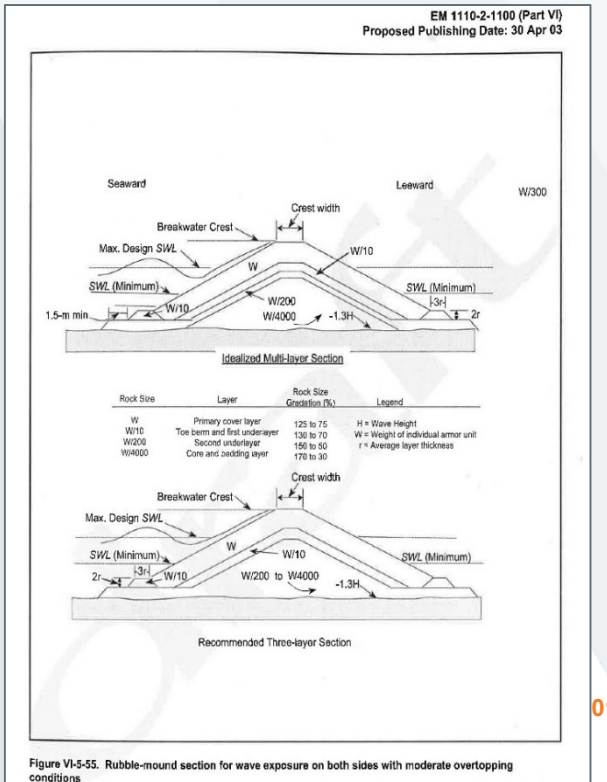

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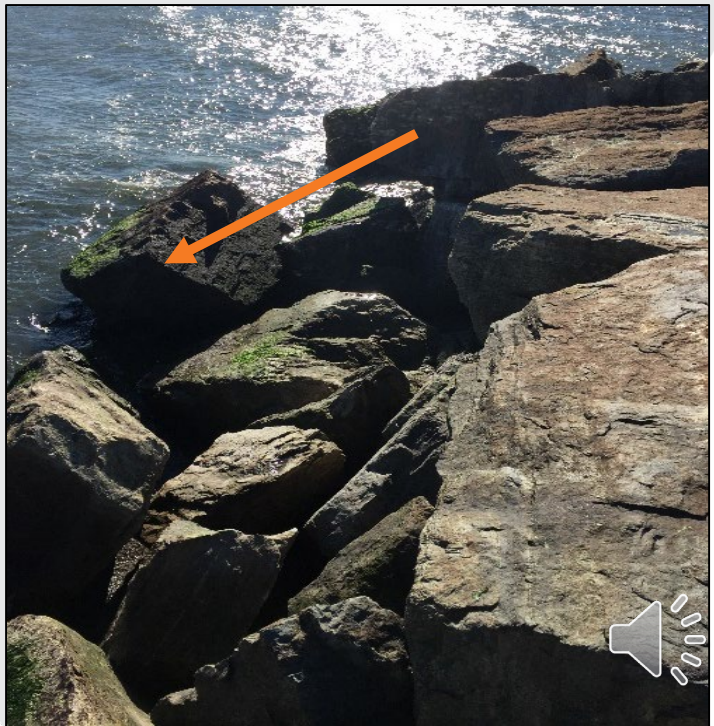

6. EXPECT THE UNEXPECTED IN ADDRESSING NONCONFORMING STRUCTURES

7. APPLY AVAILABLE TECHNOLOGY

Fred Howard Park, Pinellas County, FL

Advantages:

Qualitative stone size identification.

Evidence of stone displacement.

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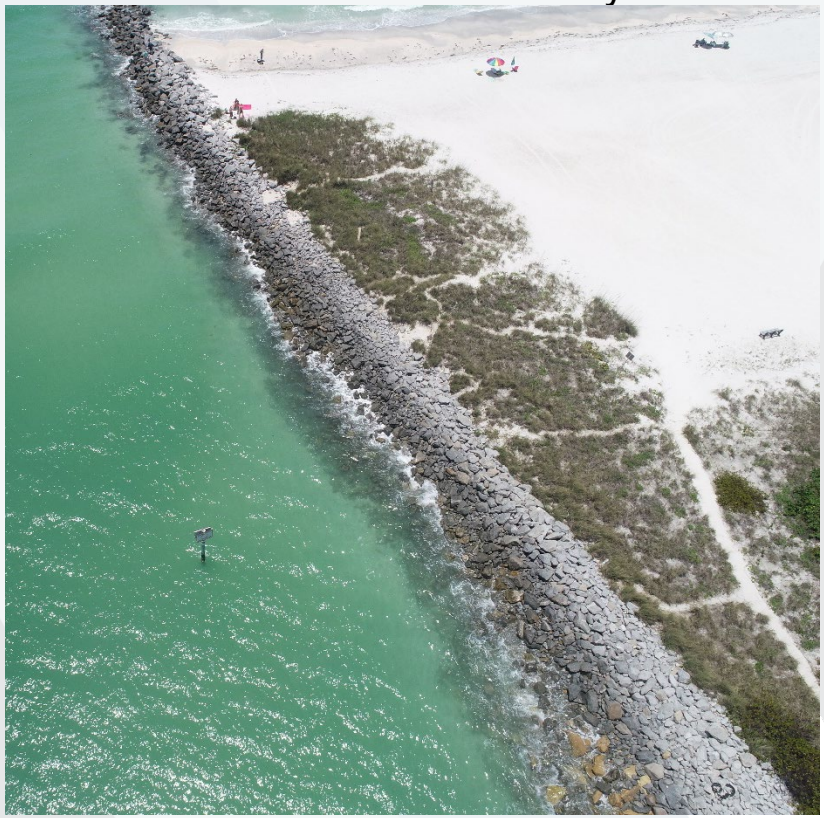
North Jetty at Blind Pass, Pinellas County



Advantages:

Visualization of toe stone uniformity across large spatial distances.

Identification of specific areas that may warrant u/w inspection.

8. RECALL THAT CONCRETE IS INHERENTLY PERMEABLE

This results in a finite design life.

South Florida Seawall

Gulf Coast Seawall

9. TRAIN COASTAL ENGINEERS WELL

Current coastal engineering academic programs tend to focus on

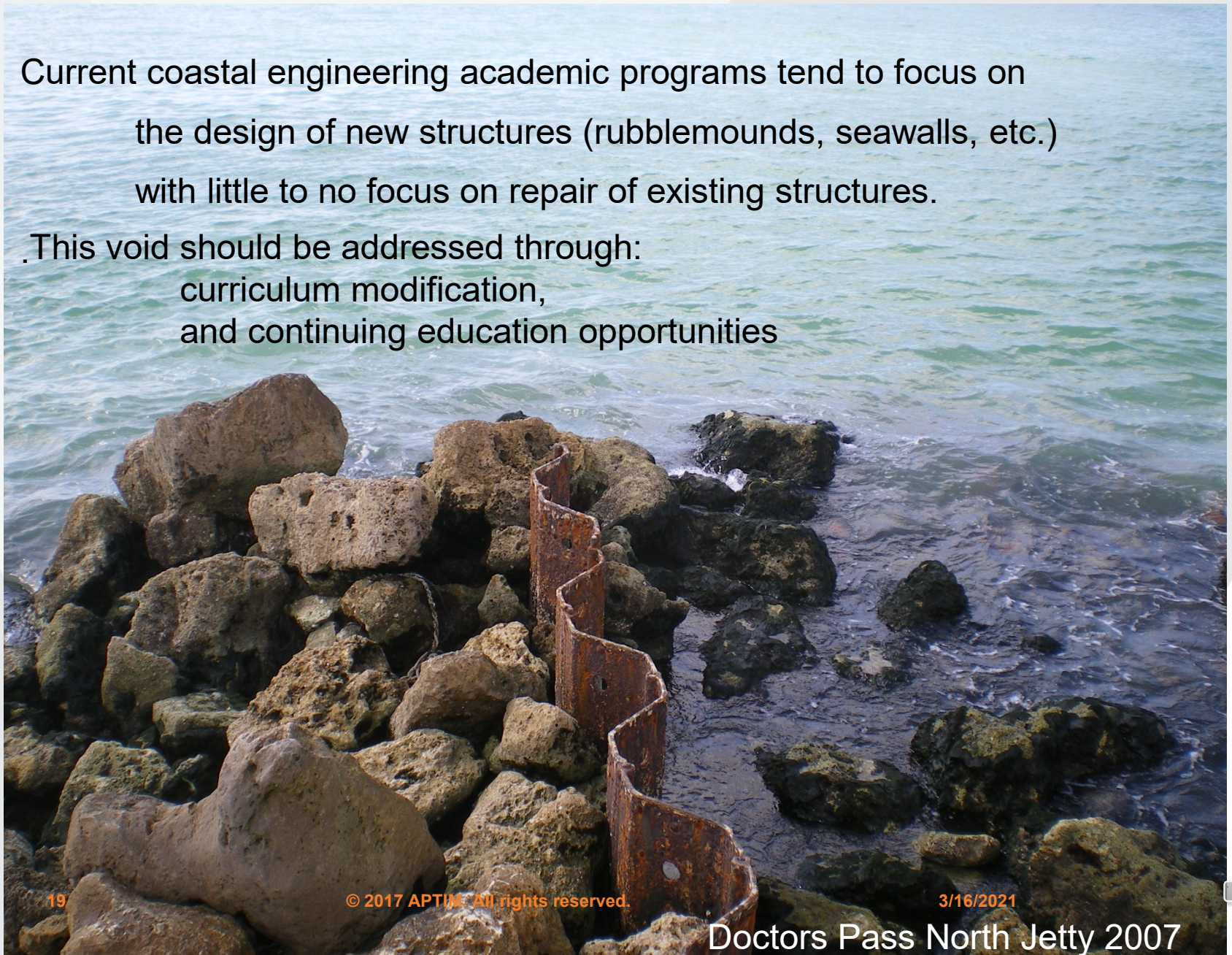
the design of new structures (rubblemounds, seawalls, etc.)

with little to no focus on repair of existing structures.

This void should be addressed through:

curriculum modification,

and continuing education opportunities



Doctors Pass North Jetty 2007

10. UNDERSTAND HISTORICAL COASTAL STRUCTURE TECHNOLOGIES

This requires research or knowledge of the historical technology in order to repair or replace them effectively.

Mullet Key, Pinellas County 2020

Jachowski, R. 1964. “Interlocking Precast Concrete Block Seawall”. International Conference on Coastal Engineering, pp. 504-517.

11. DESIGN FOR THE BUDGET/CIRCUMSTANCES

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12. TREAT COASTAL STRUCTURES AS PUBLIC INFRASTRUCTURE

Requires regular monitoring.

Usually has a long design life.

In many cases, performance degrades slowly over time.

Long design life allows for funding through capital improvement programs.

May require maintenance from time to time.

ACKNOWLEDGEMENTS

Recent (2019-2020) APTIM investigations for:

Pinellas County

Martin County

Discussions with:

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Nicole Elko, PhD.

THANK YOU

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