

The Challenge of Managing Great Lakes Shorelands

Richard K. Norton





1989 Storm
Grand Haven, MI



Actually – Two Challenges

1. Reconciling the public interests and private property rights given **background GL shoreline dynamics**
2. Planning for improved hazard mitigation and adaption given **climate change**

Private Shoreline
Development

~ Reasonable Use
Doctrines

Colliding Forces and Doctrines

Natural Shoreline
Dynamics

Public Trust
Doctrine

Reconciling Private and Public

Ordinary High Water Mark on a Great Lakes Shoreline

- * Unique Attributes of the Great Lakes:
 - * Non-tidal, *but*
 - * Fluctuating water levels (seasonal, *decadal*)
 - * Regional storm patterns
 - * Shoreline geomorphology
 - * Unconsolidated “accreting” shores during low water
 - * Isostatic rebounding of Great Lakes

Implications:

Shorelines fluctuate seasonally & *decadally*
Shorelines are moving landward

Marking OHW on the Great Lakes (in Theory)

Strong Public Ownership

	Fastland	Dry Sand	Wet Sand	Lake
Indiana New York Wisconsin	Private Ownership →			
				← Public Trust

Overlapping Ownership

	Fastland	Dry Sand	Wet Sand	Lake
Michigan Illinois Minnesota Pennsylvania	Private Ownership →			
				← Public Trust

Strong Private Ownership

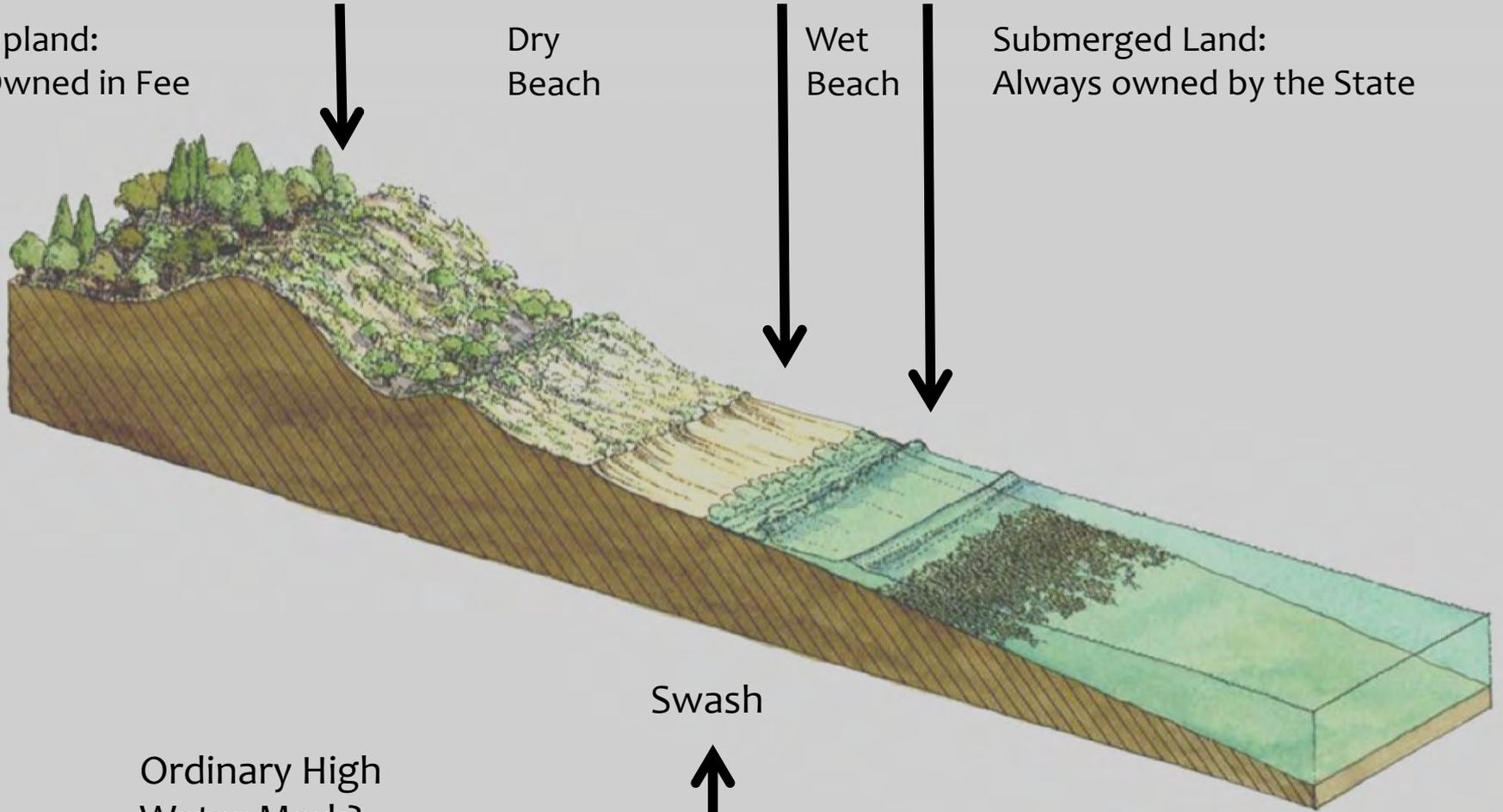
	Fastland	Dry Sand	Wet Sand	Lake
Ohio	Private Ownership →			
				← Public Trust

Upland:
Owned in Fee

Dry
Beach

Wet
Beach

Submerged Land:
Always owned by the State



Ordinary High
Water Mark?

Swash

“Public Trust Beach”
-- Right of public use
-- Duty to not impair

Non-Tidal Great Lakes Beach

Ordinary High Water Mark(s) in MI

▶ MI GLSLA (1955): **OWH Elevation:**

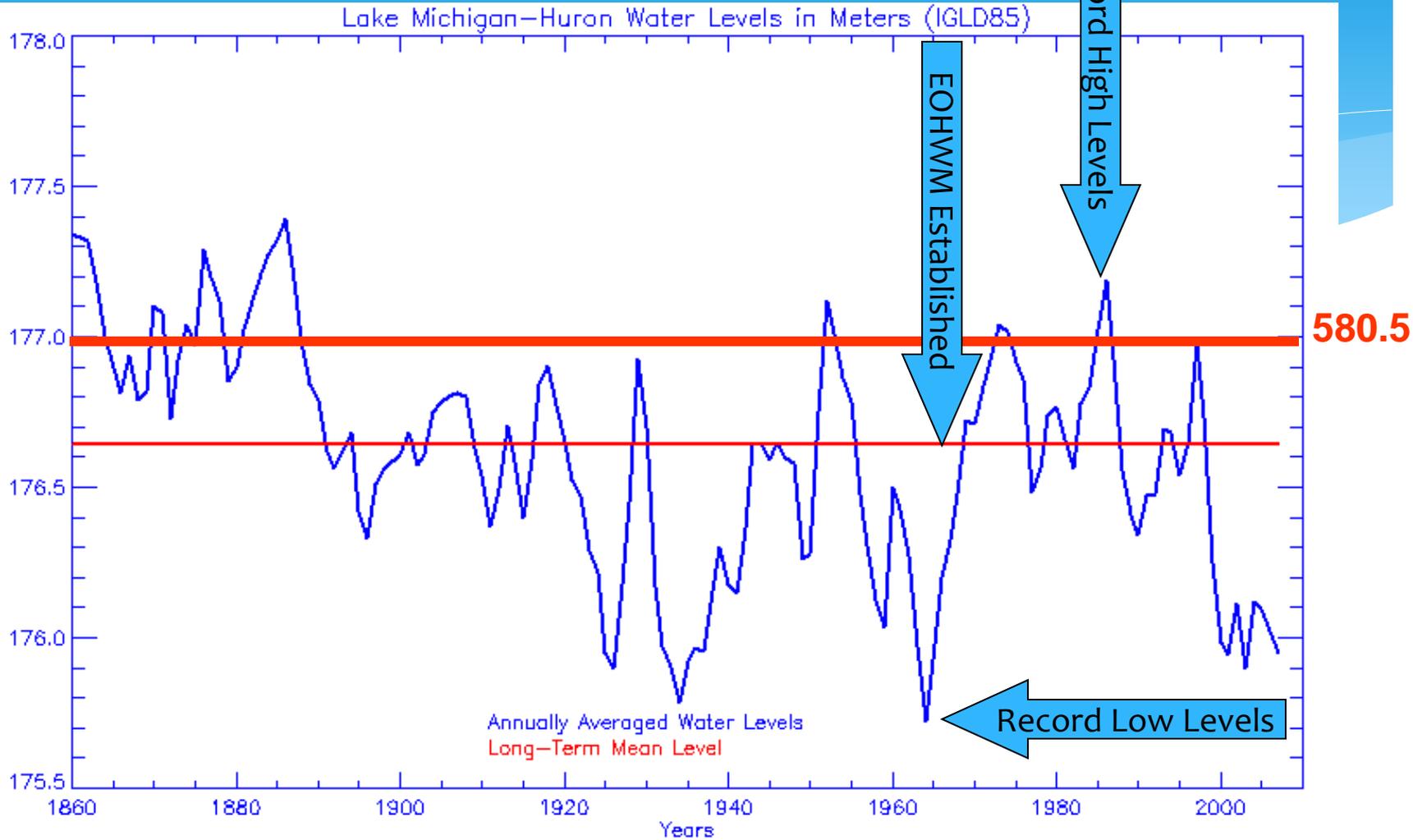
- Elevation-based mark set by statute for Lakes Michigan and Huron at 580.5 ft (IGLD 1985).

▶ *Glass v Goeckel* (MI S Ct 2005): **Natural OHWM:**

- “The point on the bank or shore up to which the presence and action of the water is so continuous as to leave a distinct mark either by erosion, destruction of terrestrial vegetation, or other easily recognized characteristic.”

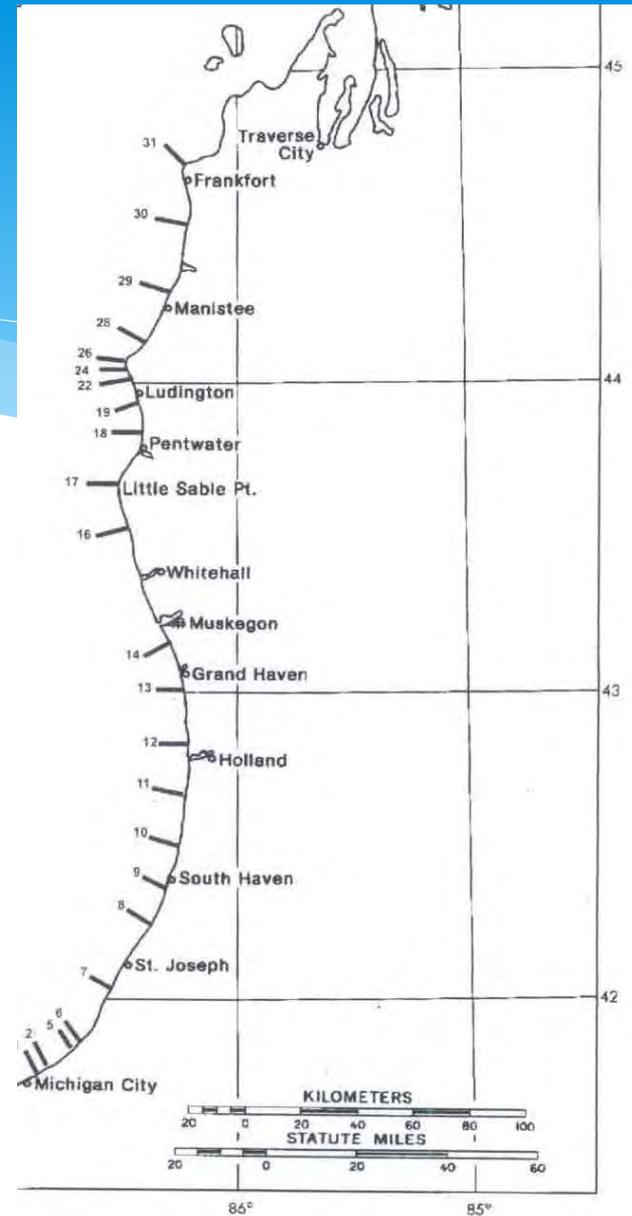
→ “PUBLIC TRUST BEACH”

Great Lakes Water Levels

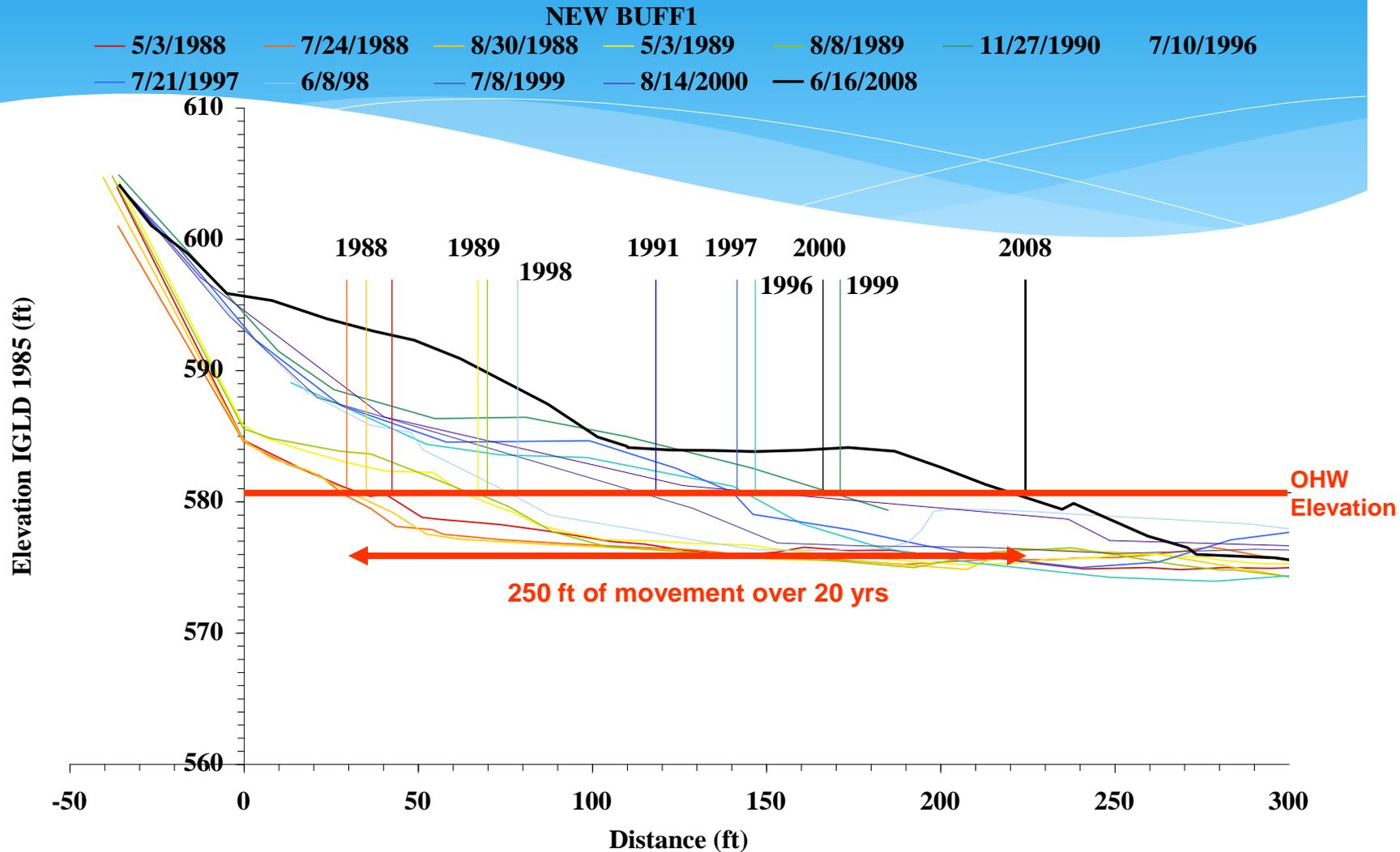


Meadows & Meadows Historic Survey Data

- * 45 Survey Sites
- * 31 on Lake Michigan
- * 1988–2008 (periodically)
- * Primarily MDEQ & U of M funded
- * Referenced to known bench marks (vertically and horizontally)



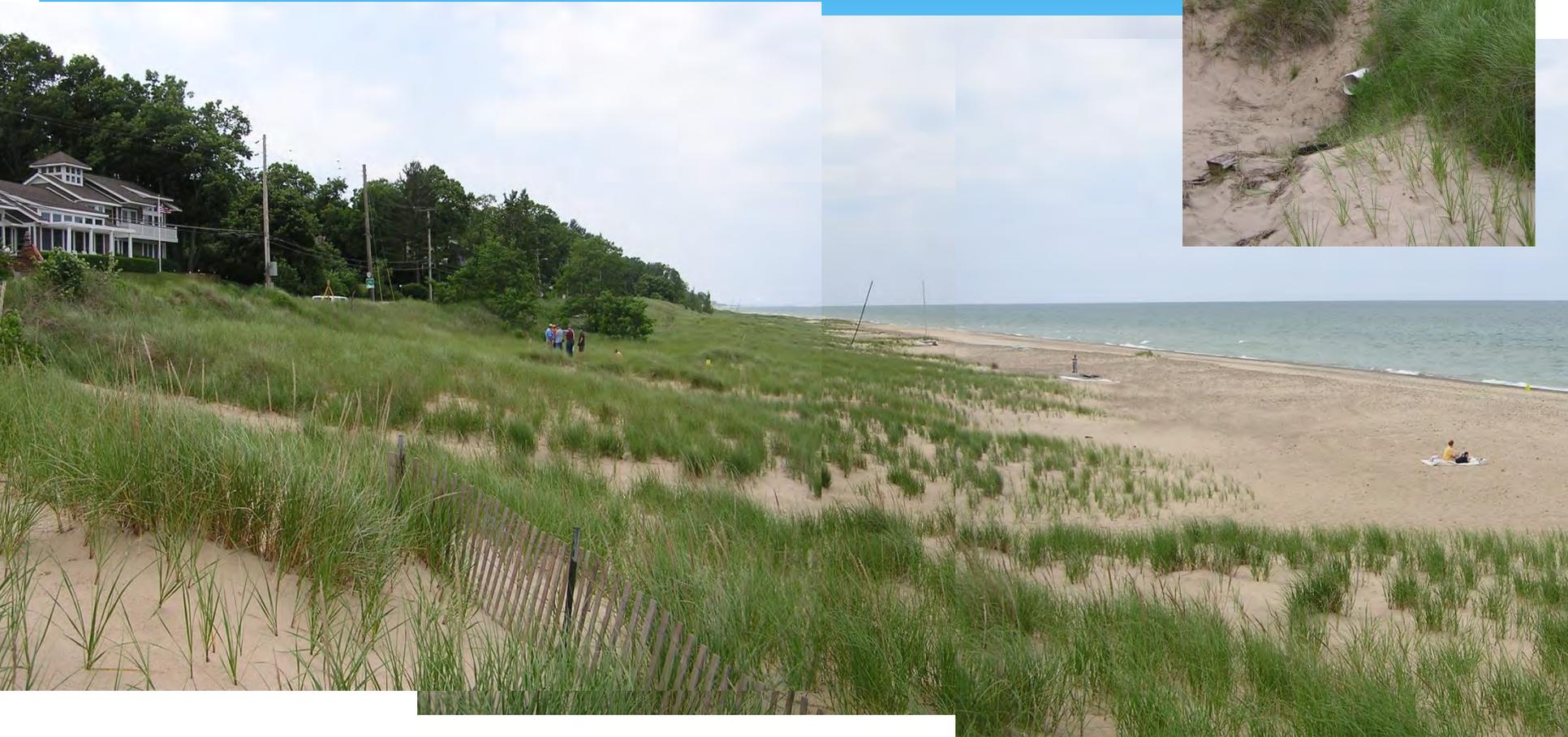
UM 01



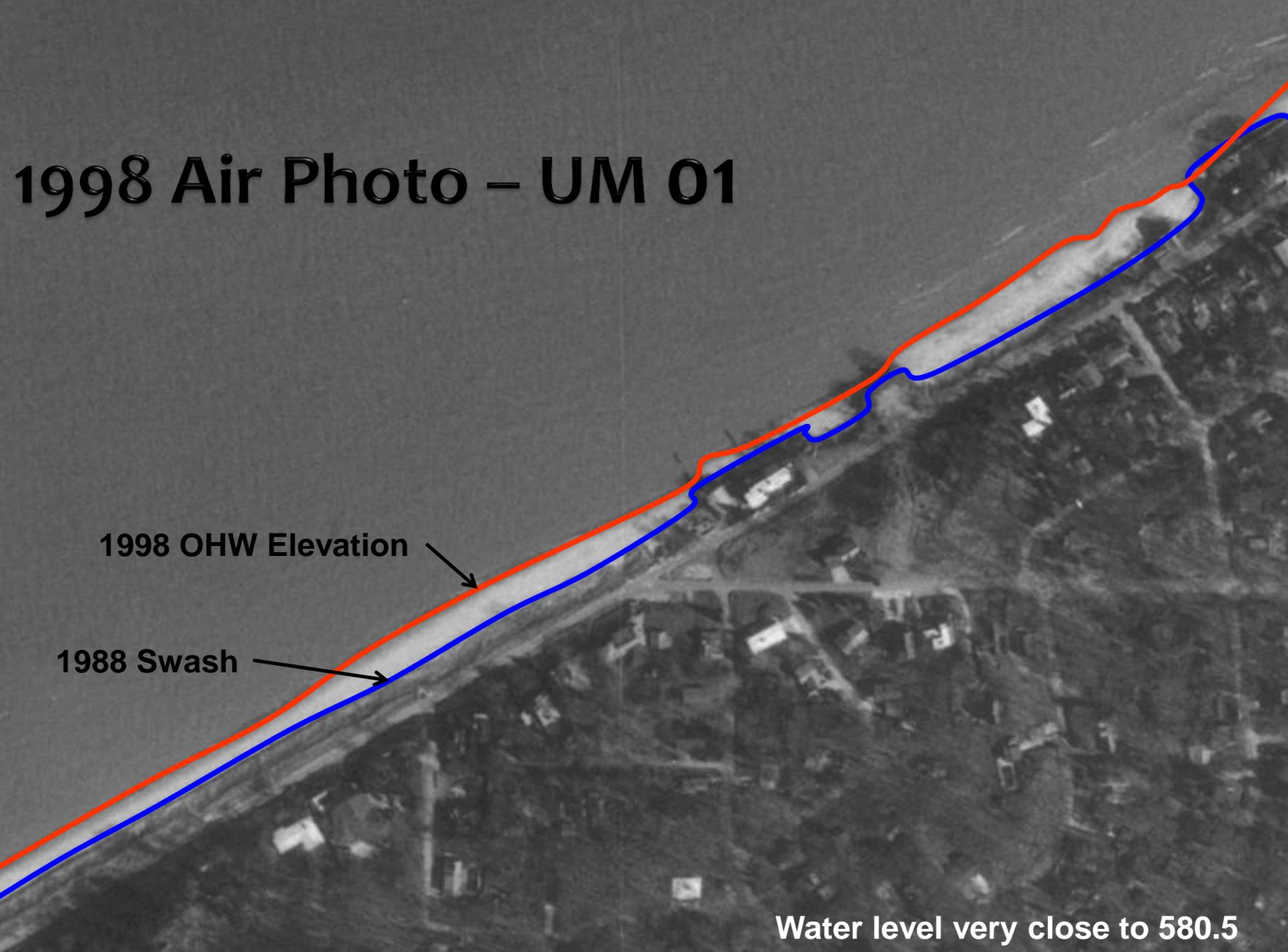
UM 01 - 1988 Beach



UM 01 – 2008 Beach



1998 Air Photo – UM 01



1998 OHW Elevation



1988 Swash



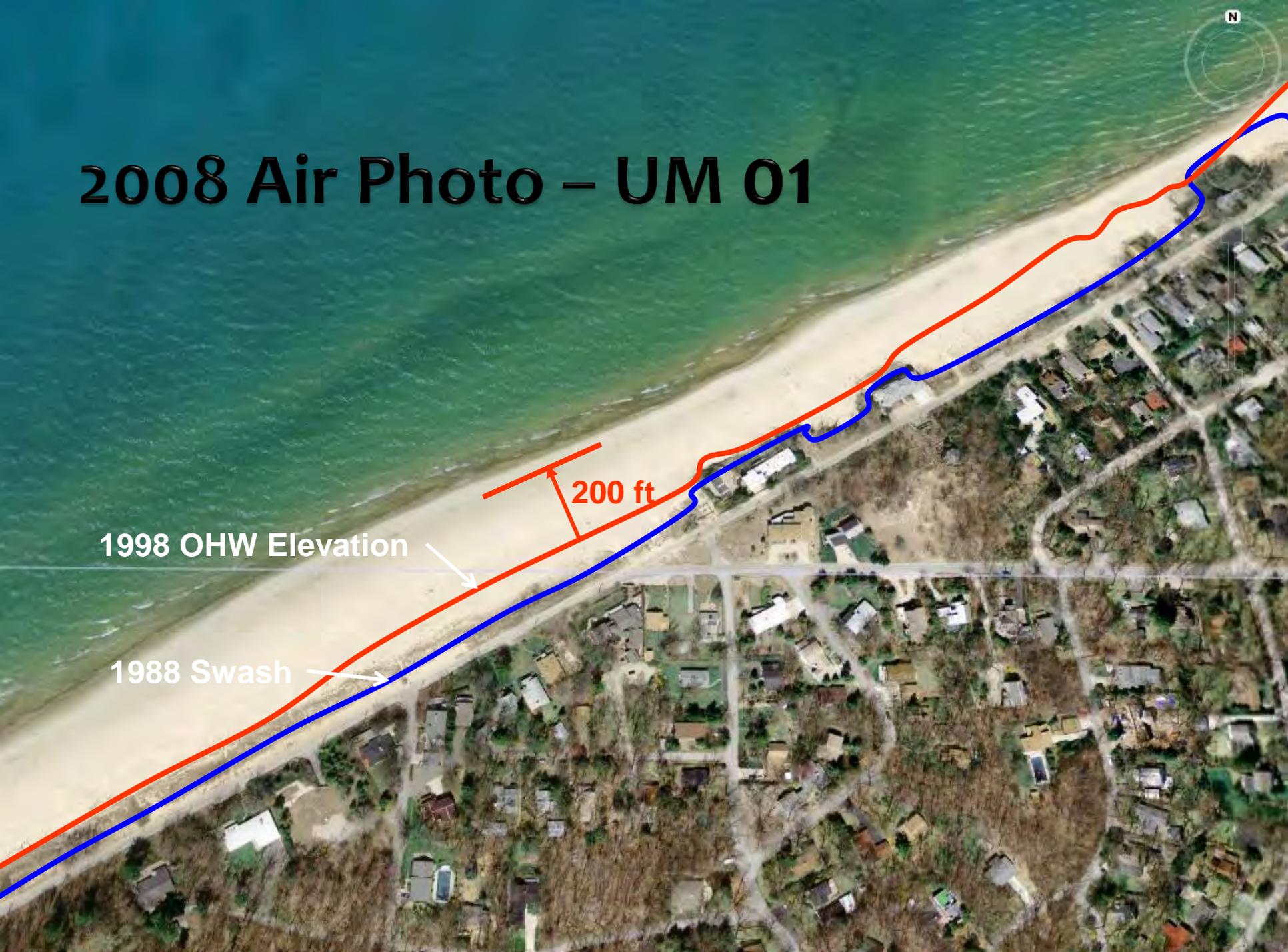
Water level very close to 580.5

2008 Air Photo - UM 01

1998 OHW Elevation

1988 Swash

200 ft

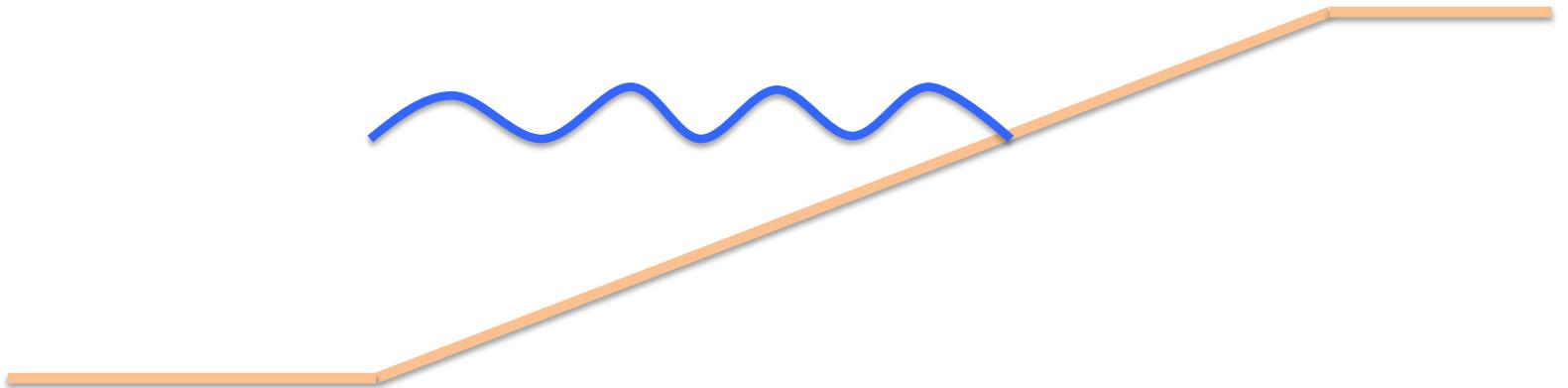


2008 Air Photo – UM 01



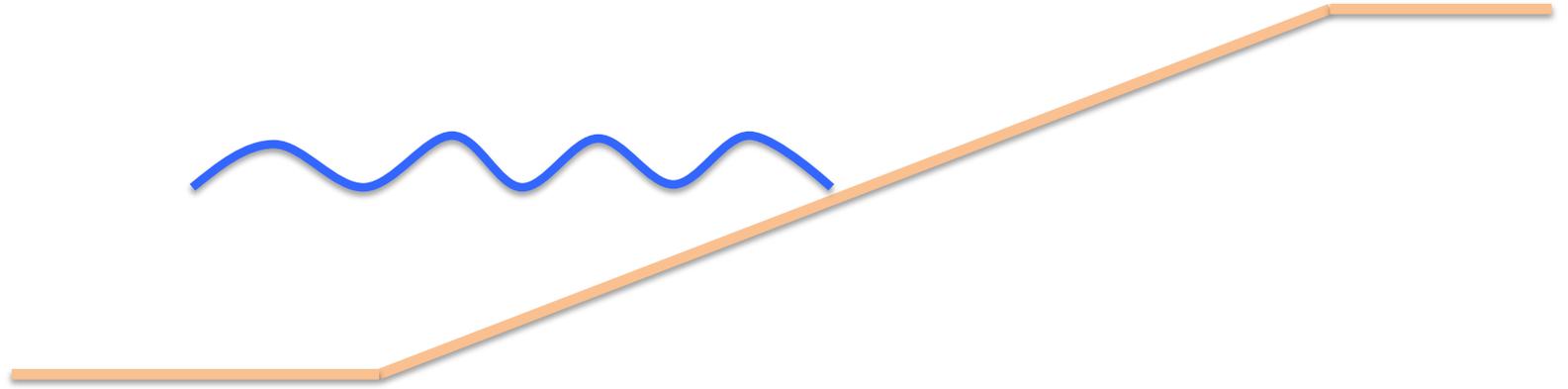
Hypothetically

1



2

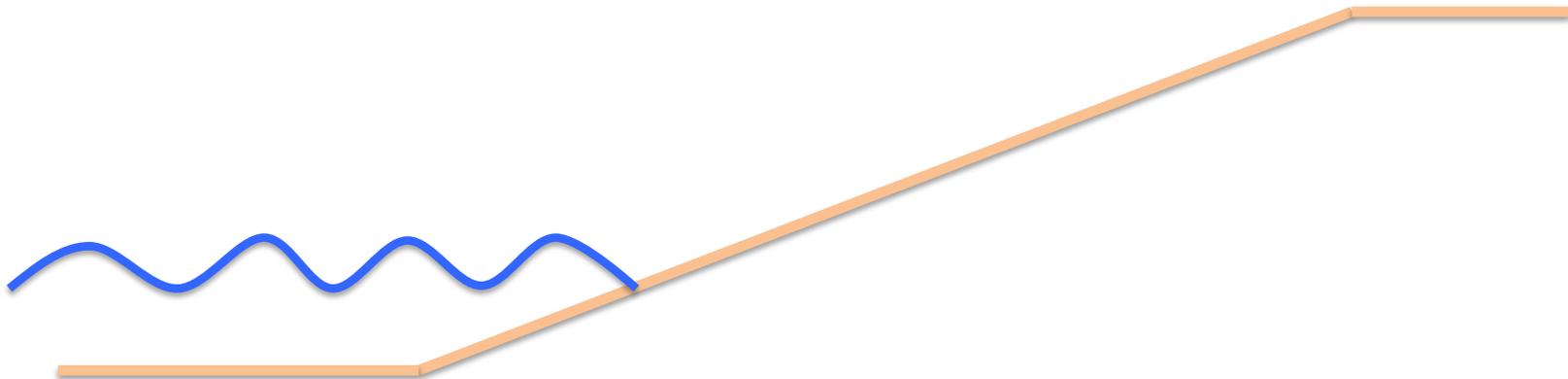
1



3

2

1

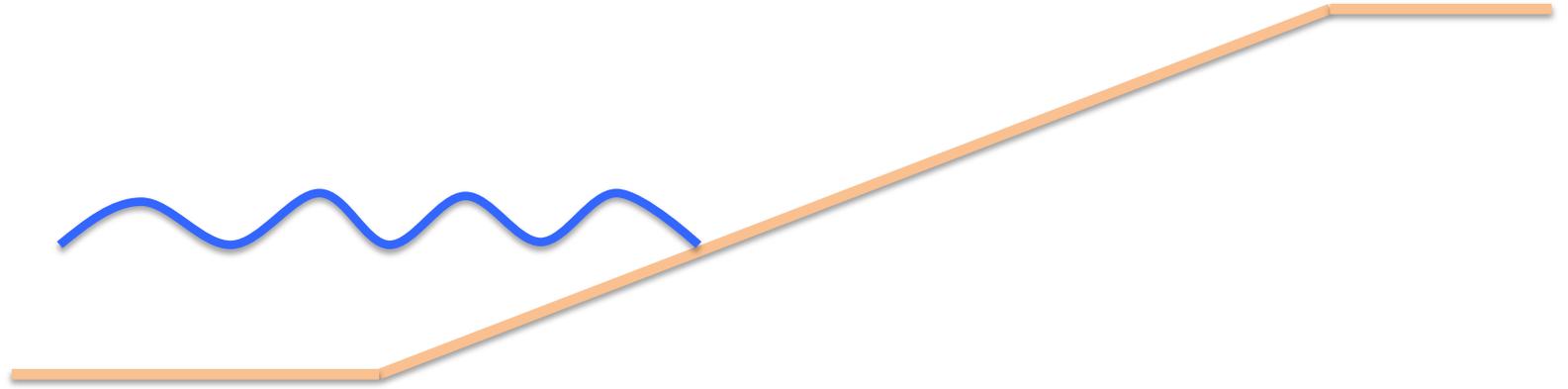


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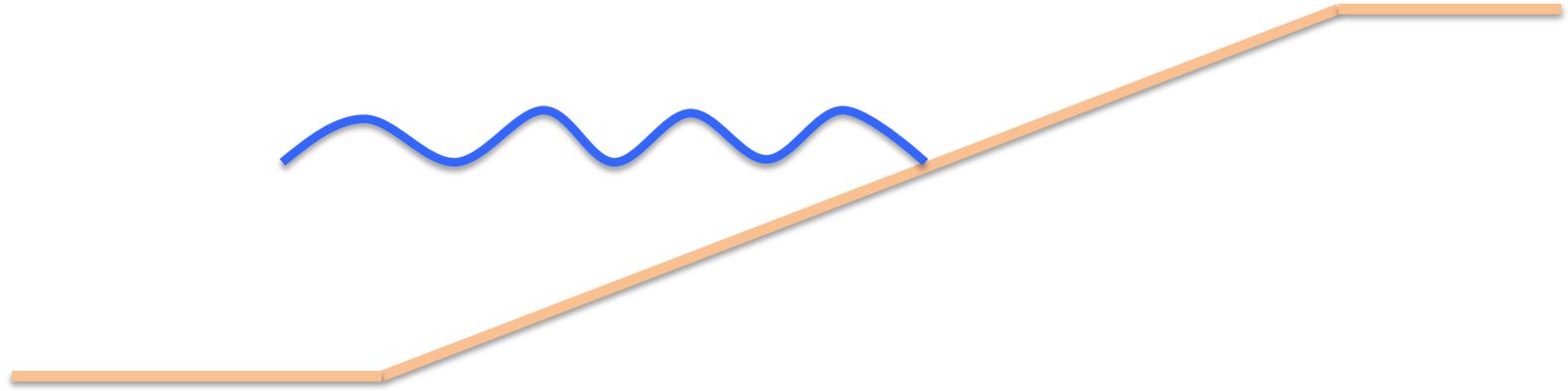
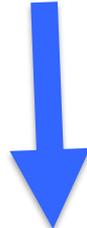
4

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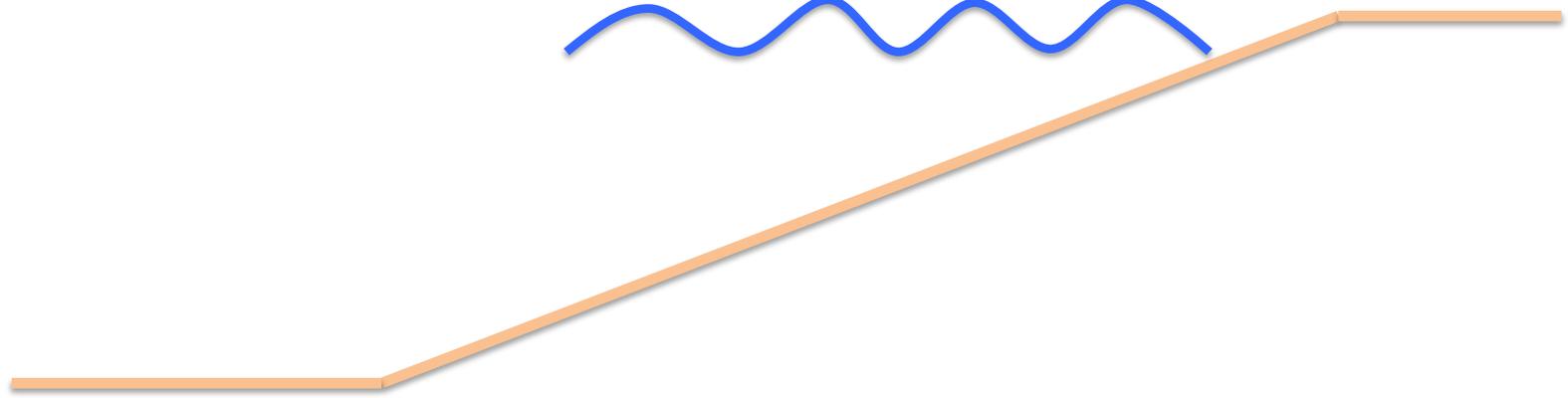
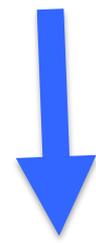
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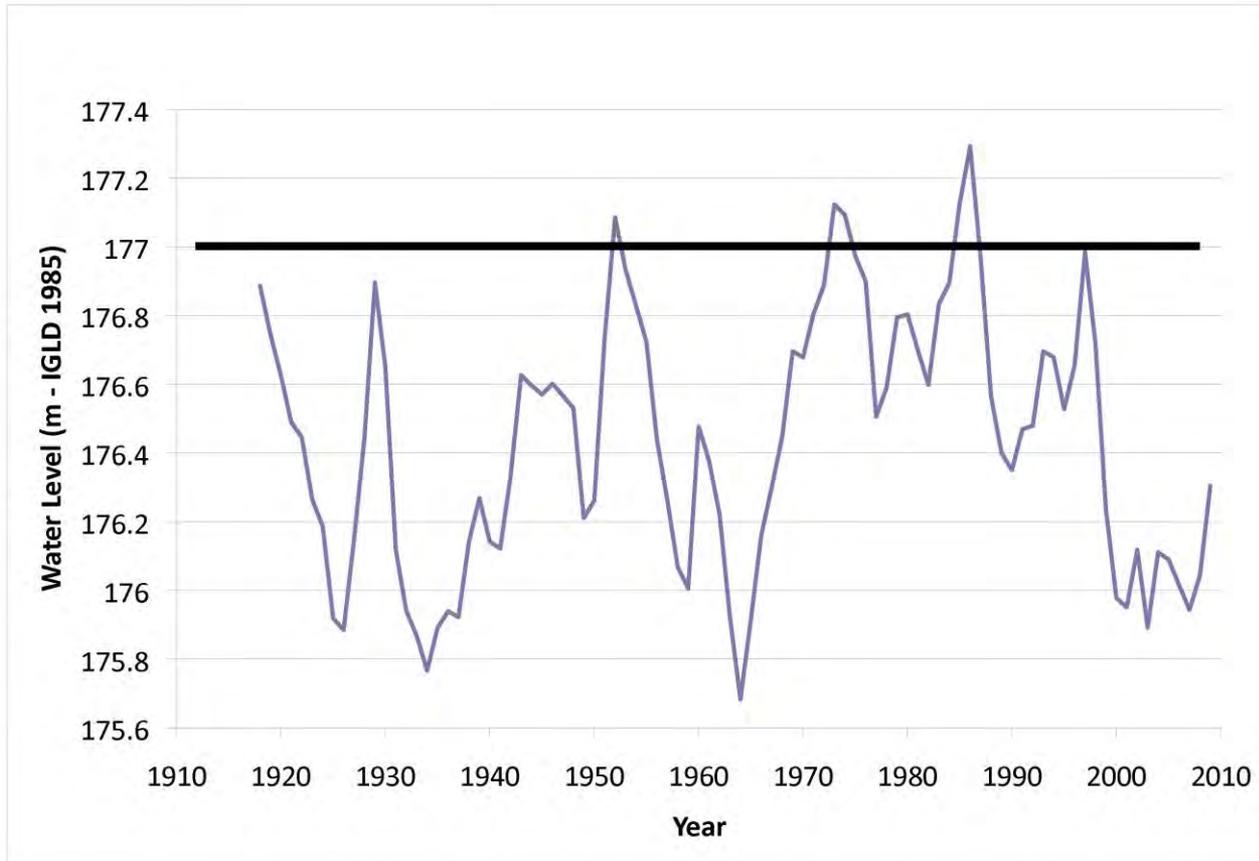
3 4 2 5 1

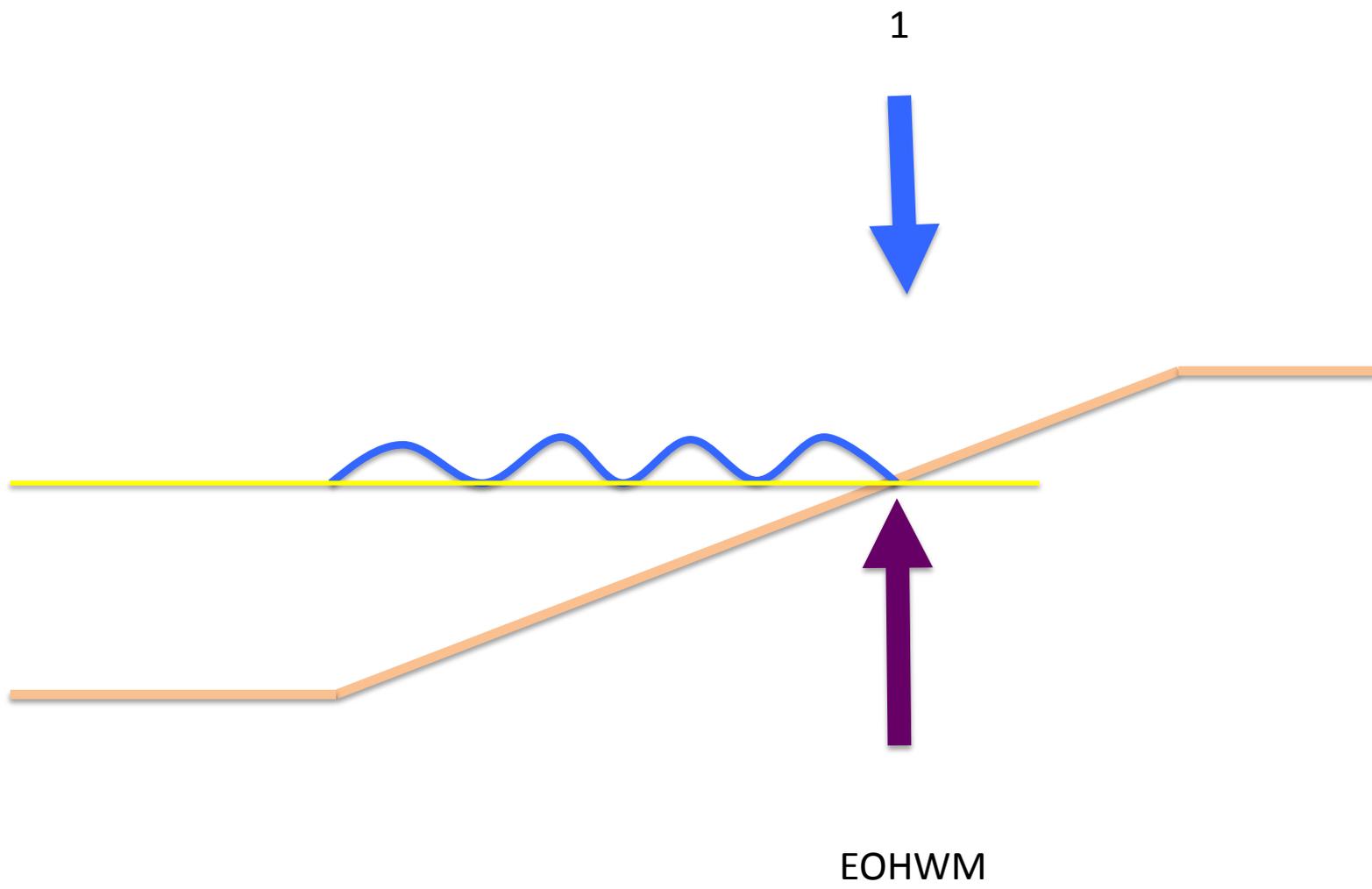


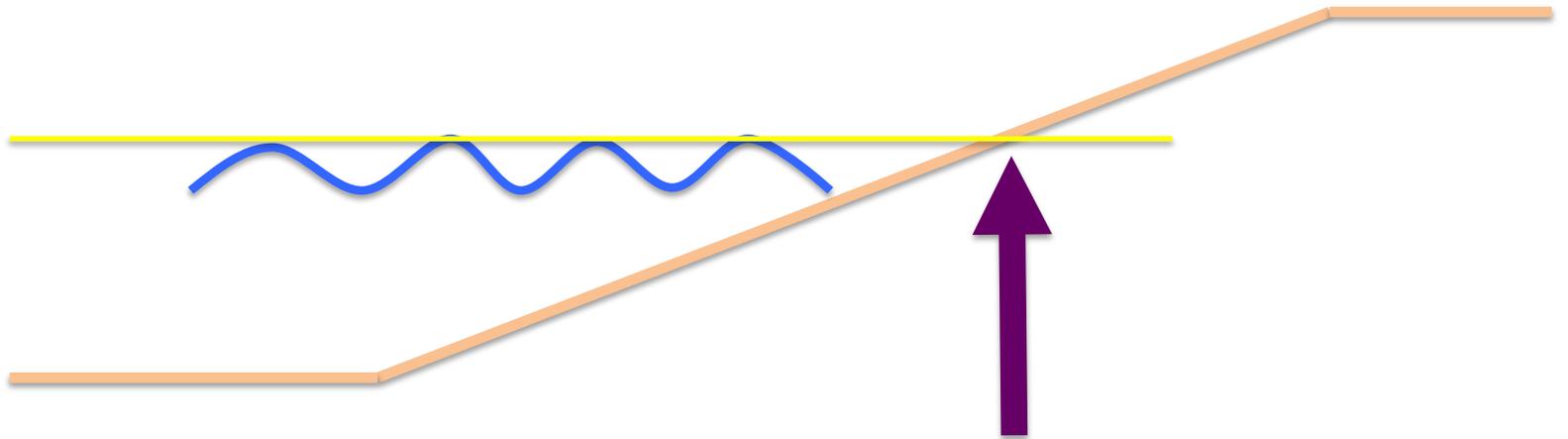
3 4 2 5 1 6



Lake Michigan Water Levels

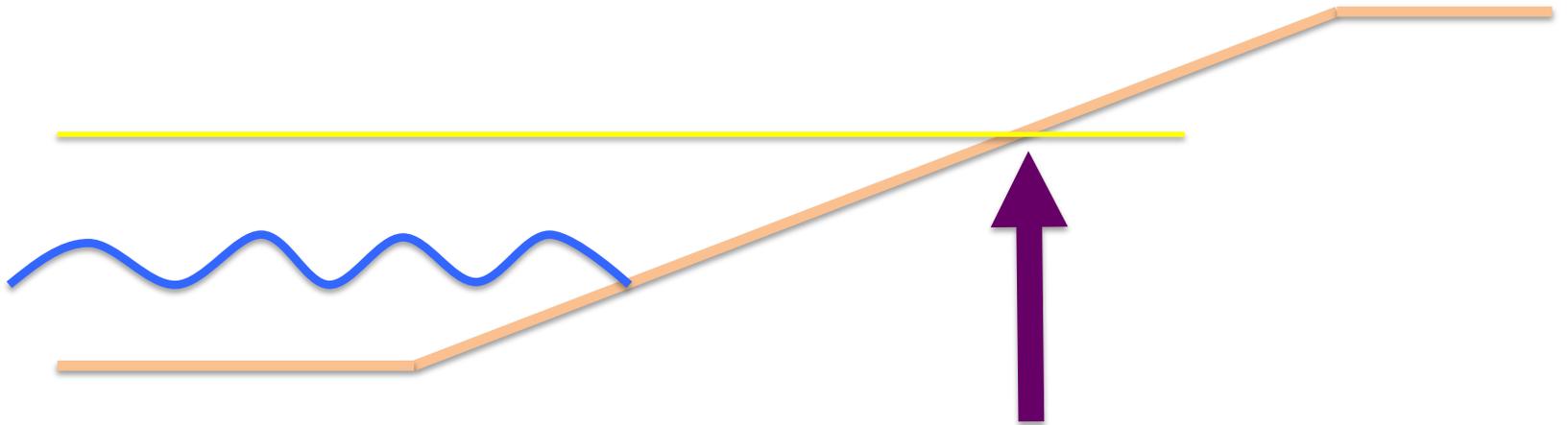




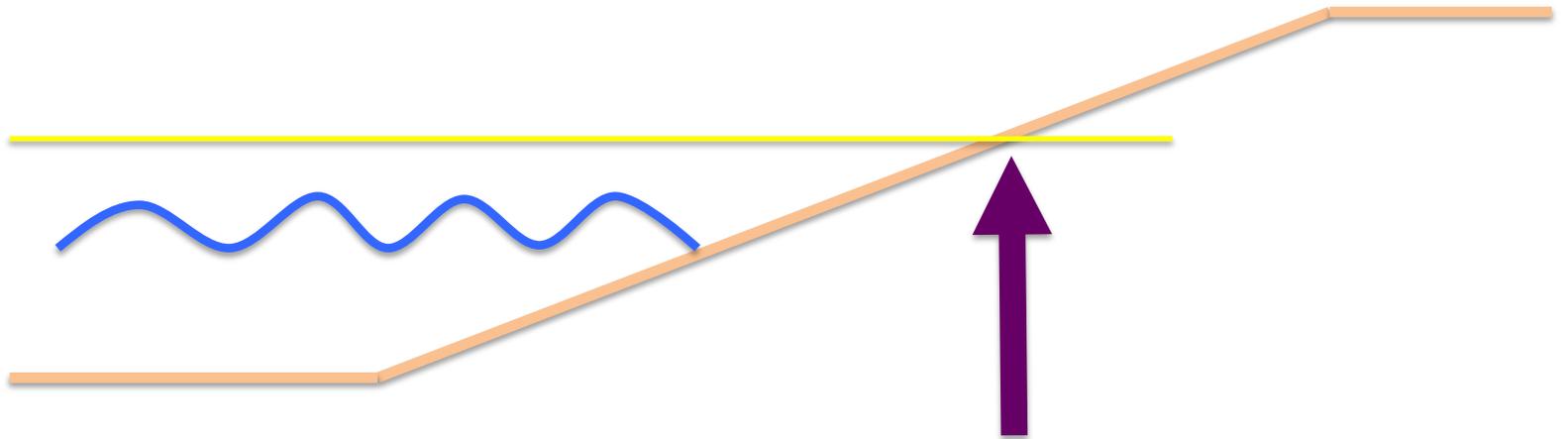


EOHWM

3

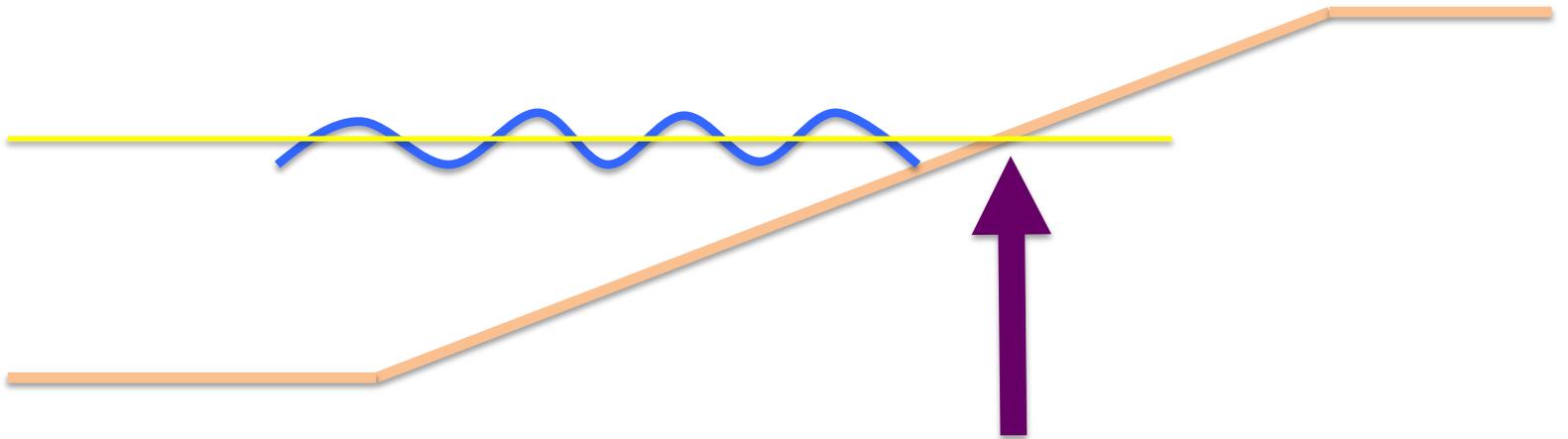


EOHWM

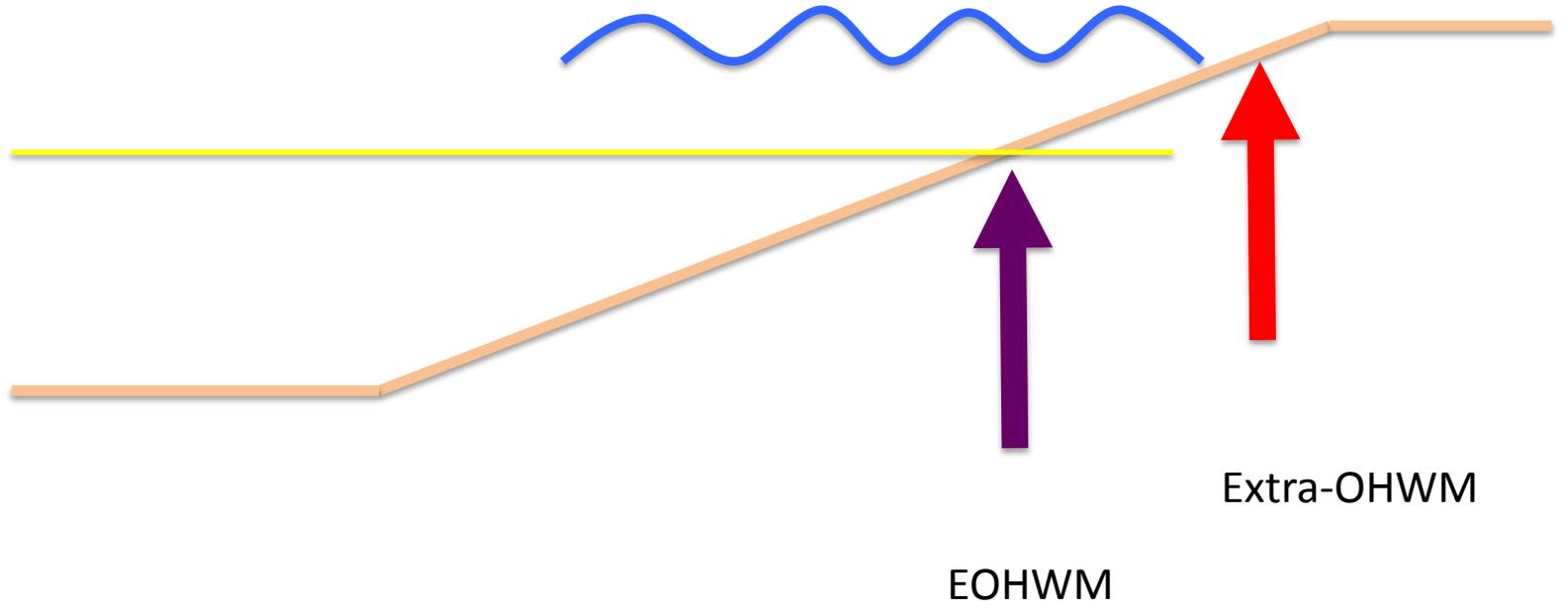


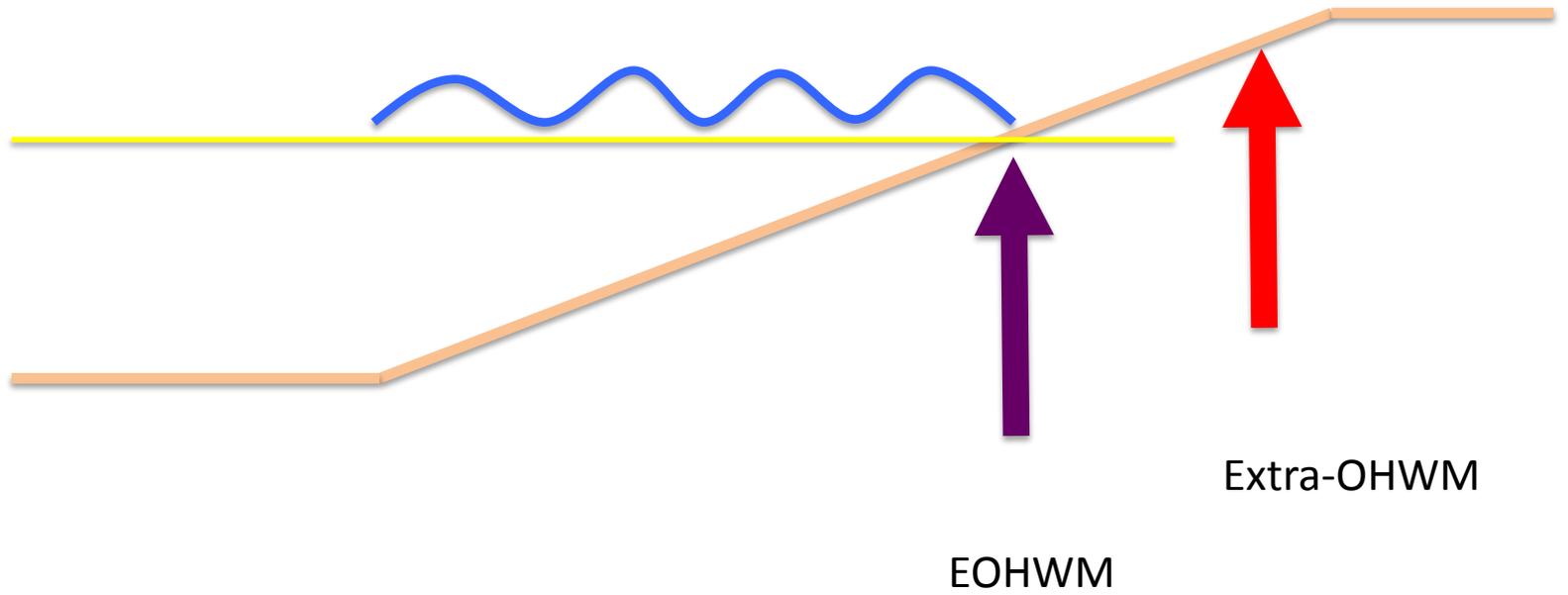
EOHWM

5



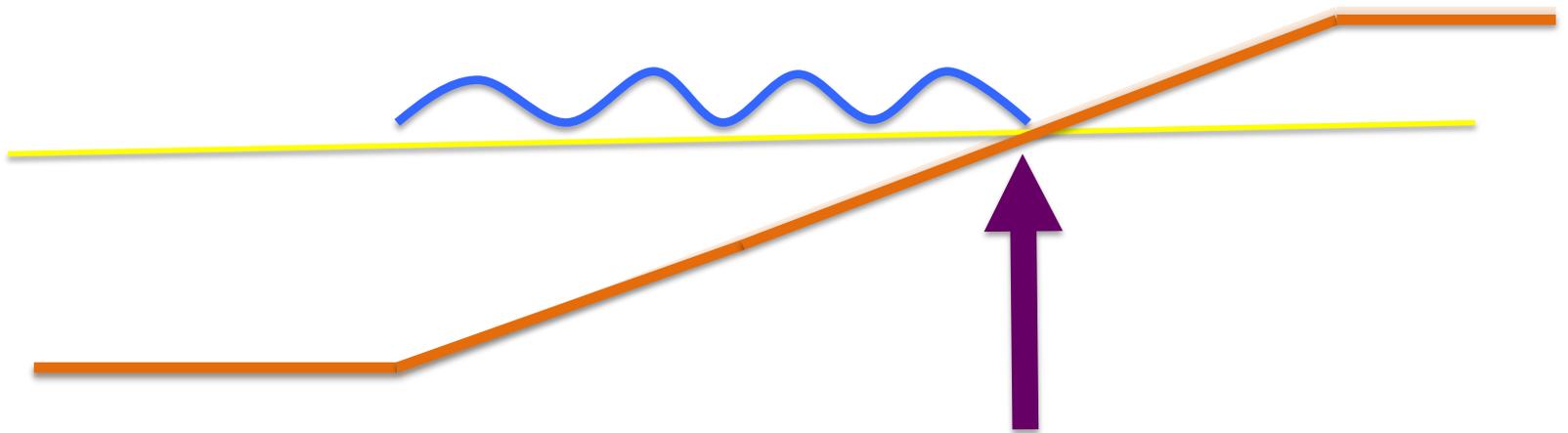
EOHWM



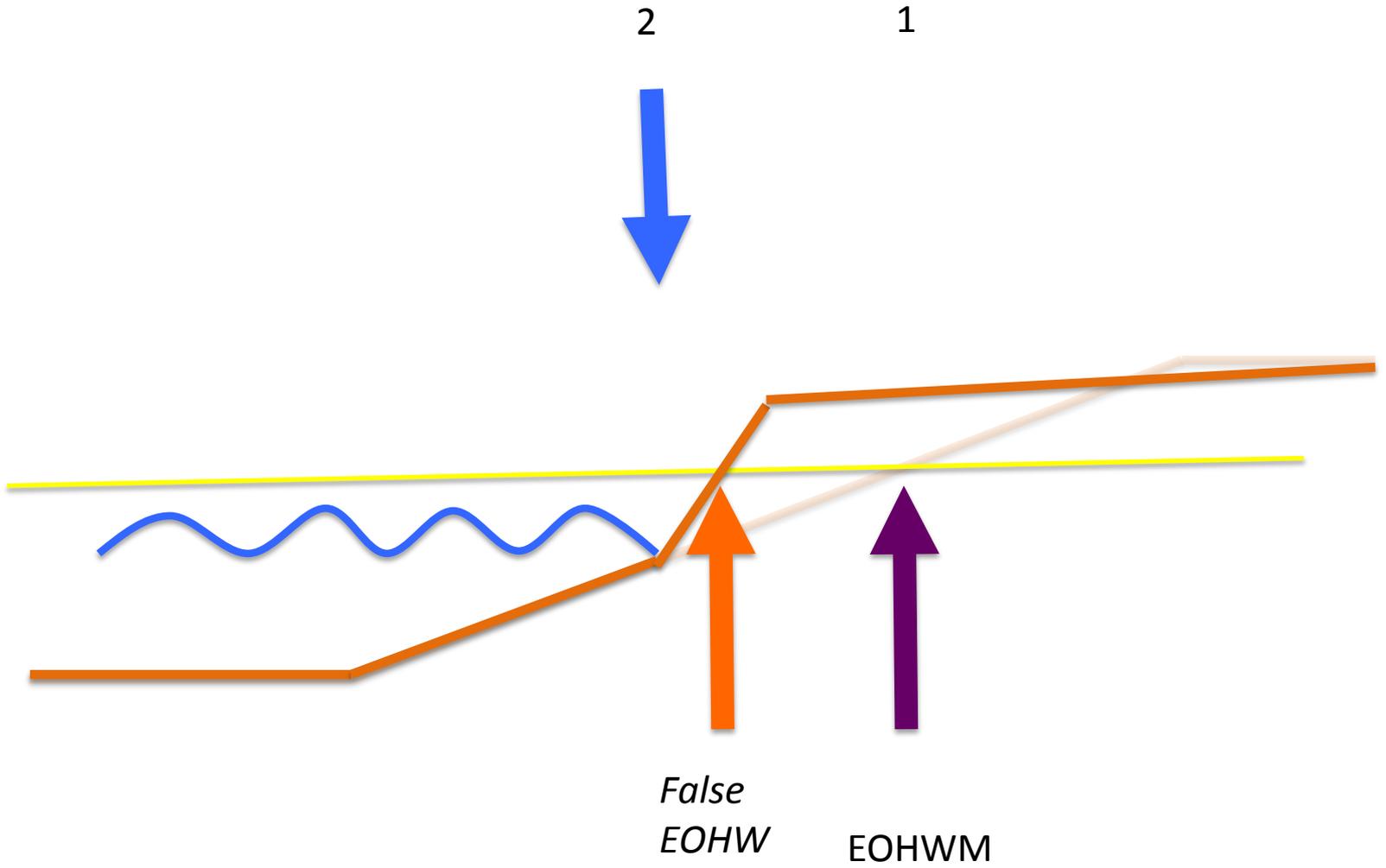


In Reality

1



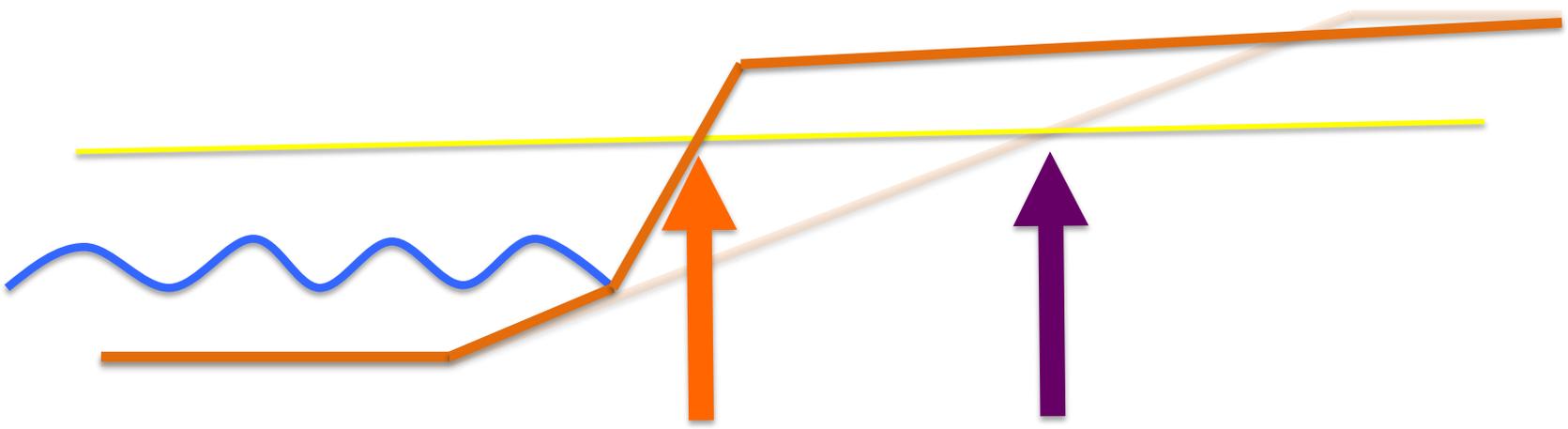
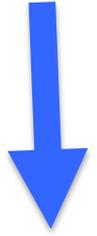
EOHWM



3

2

1



*False
EOHW*

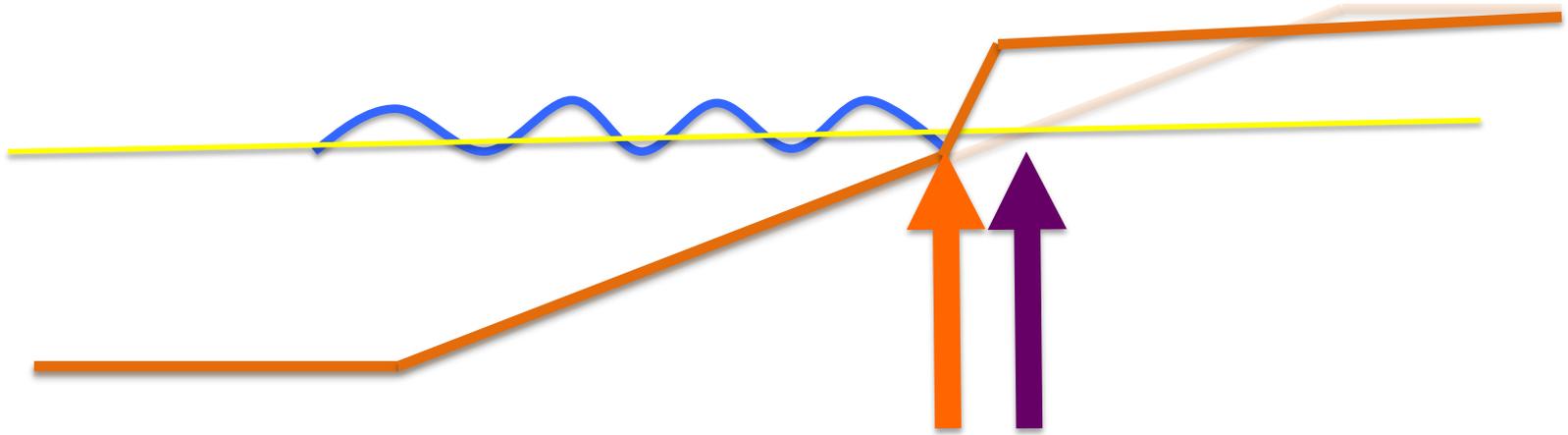
EOHWM

3

2

4

1



*False
EOHW*

EOHWM

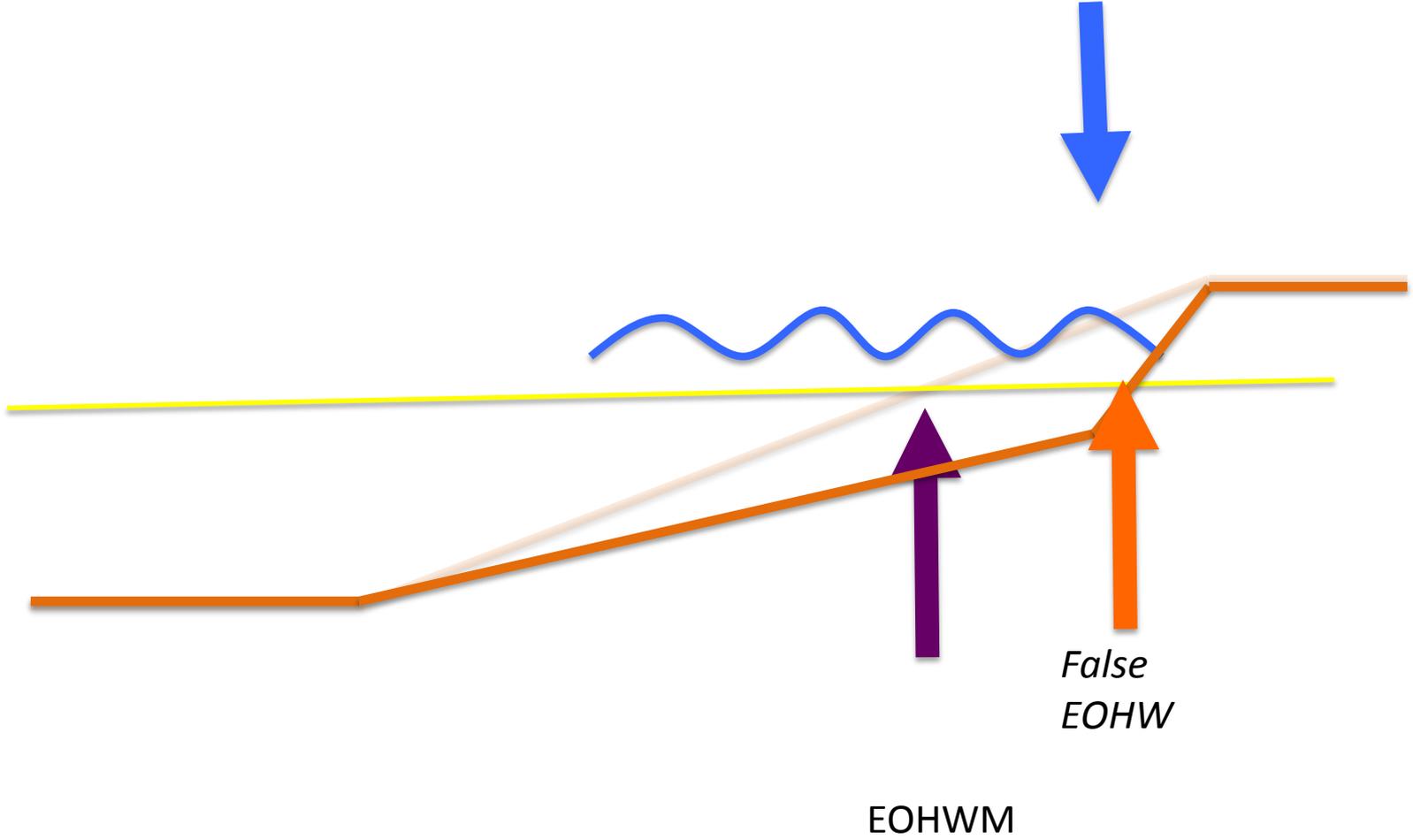
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4

1

5



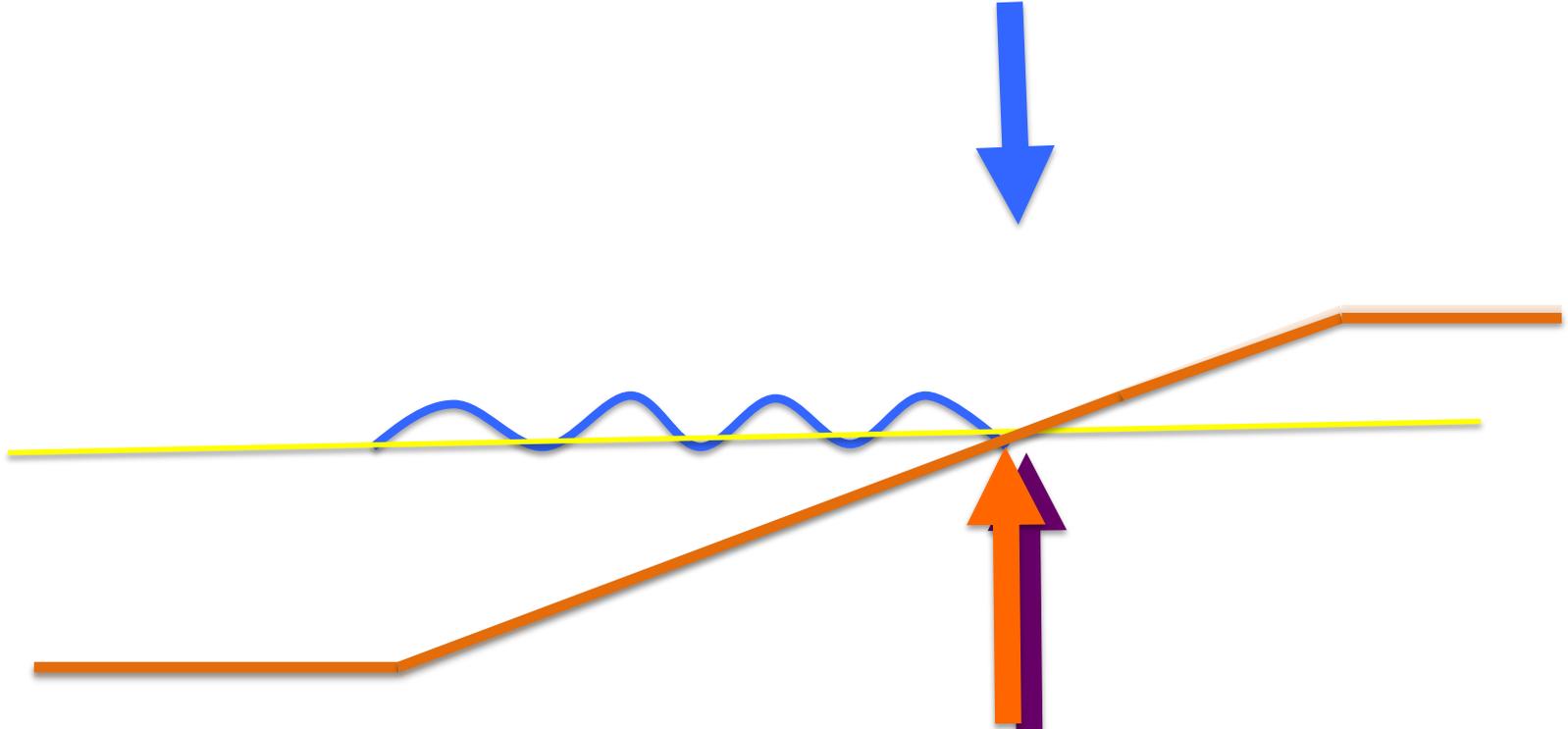
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2

4

6 1

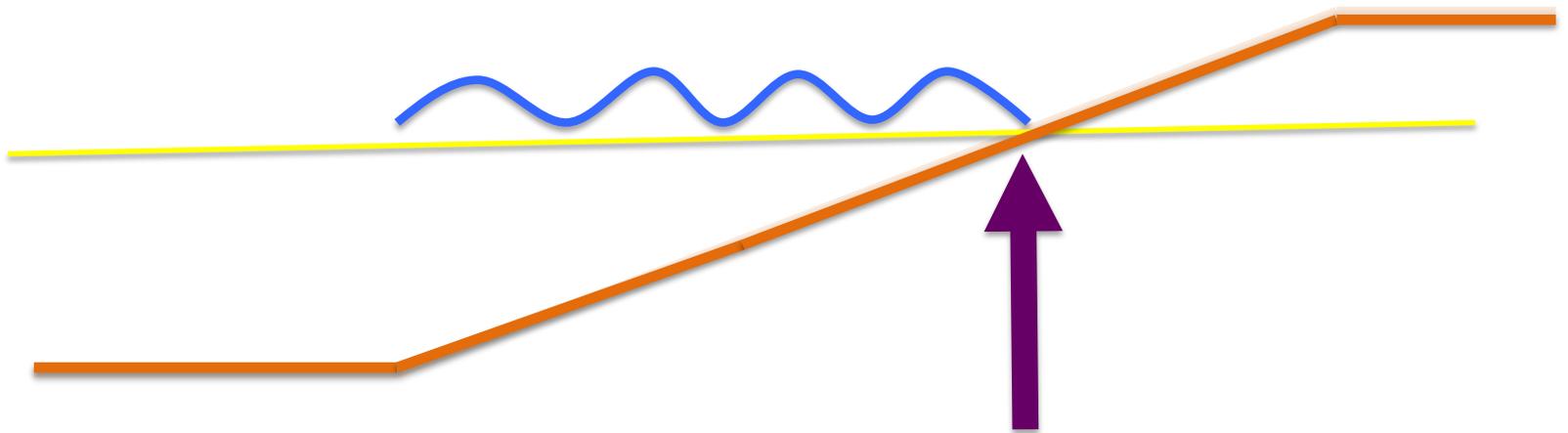
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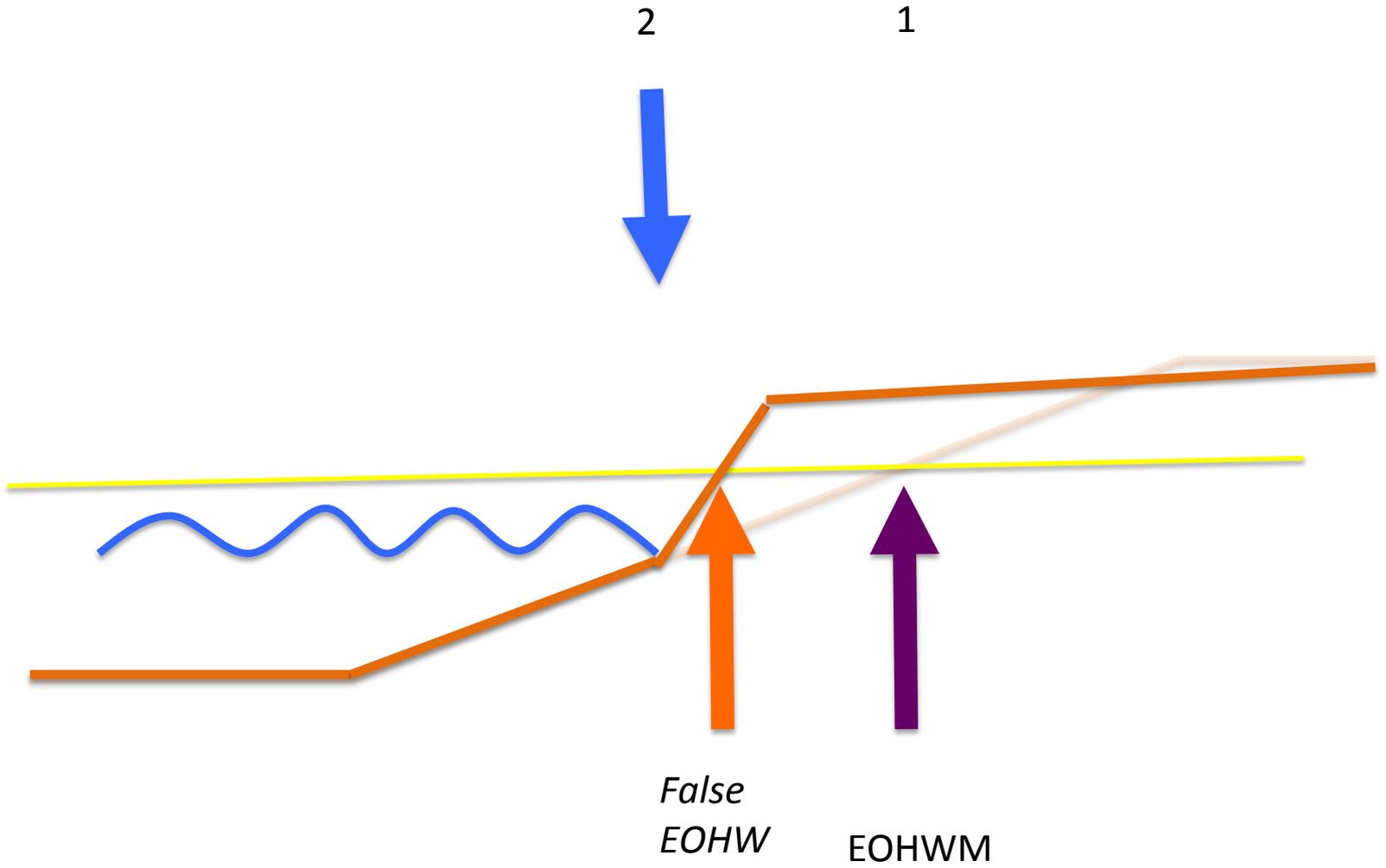
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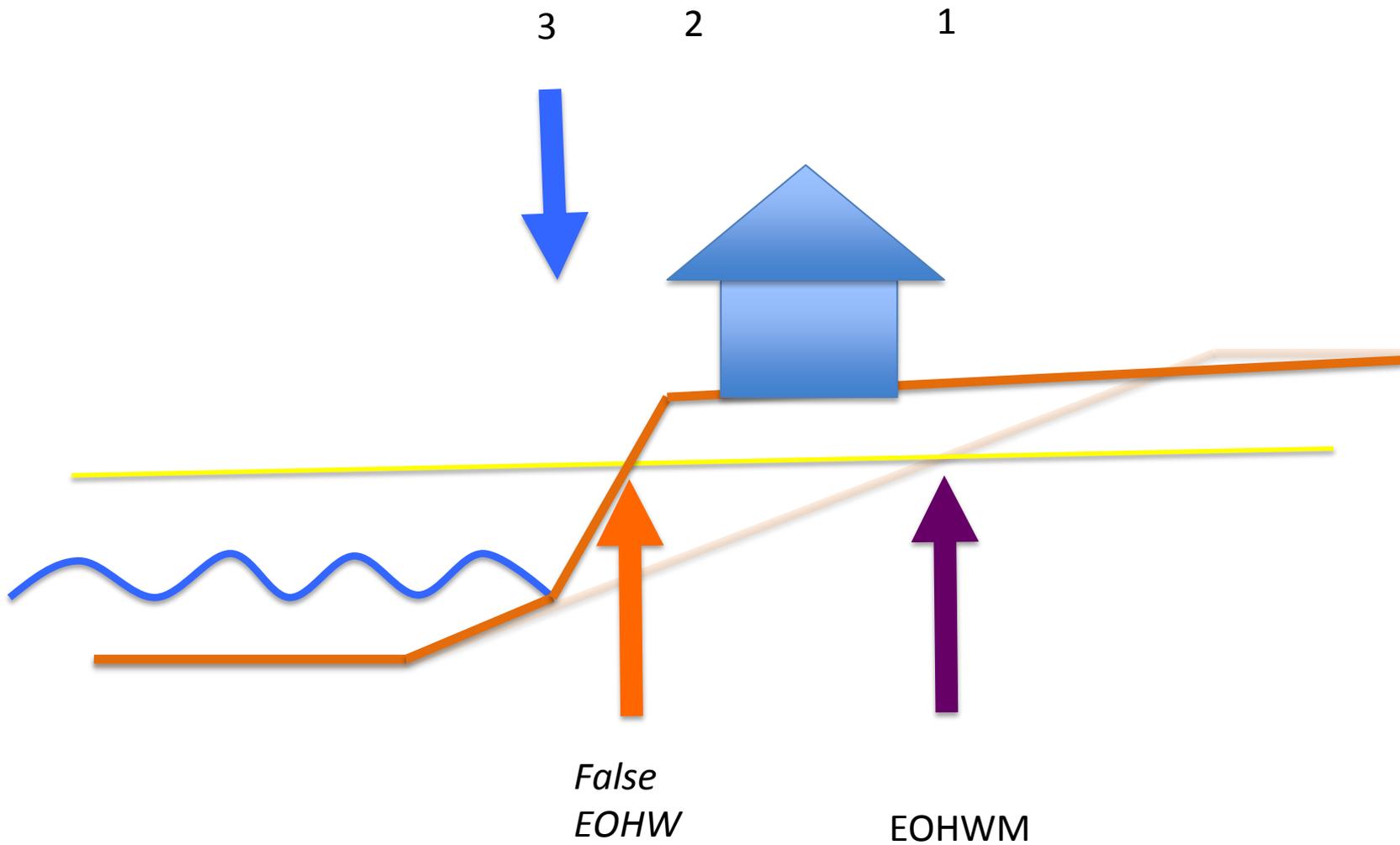
OR, In Reality

1

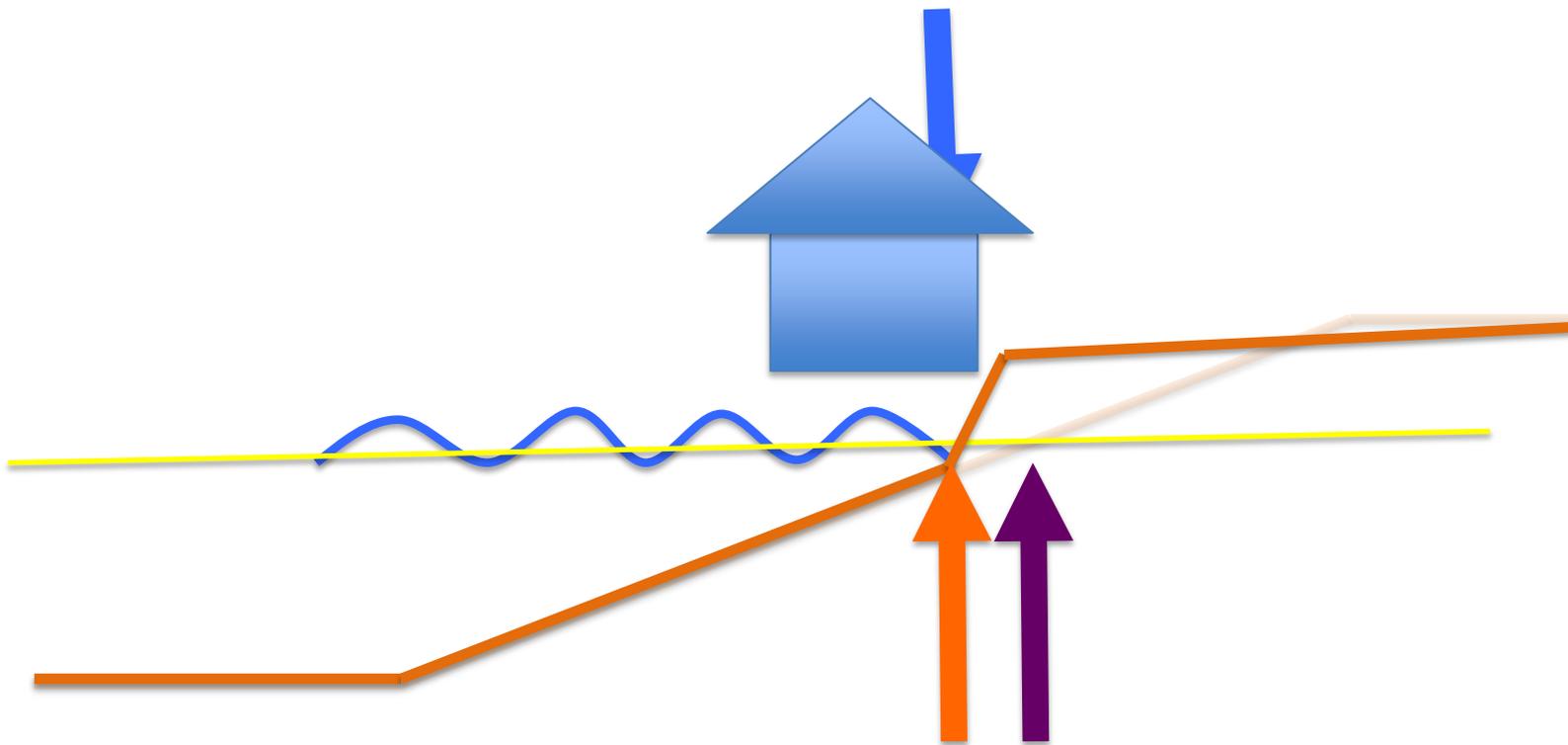


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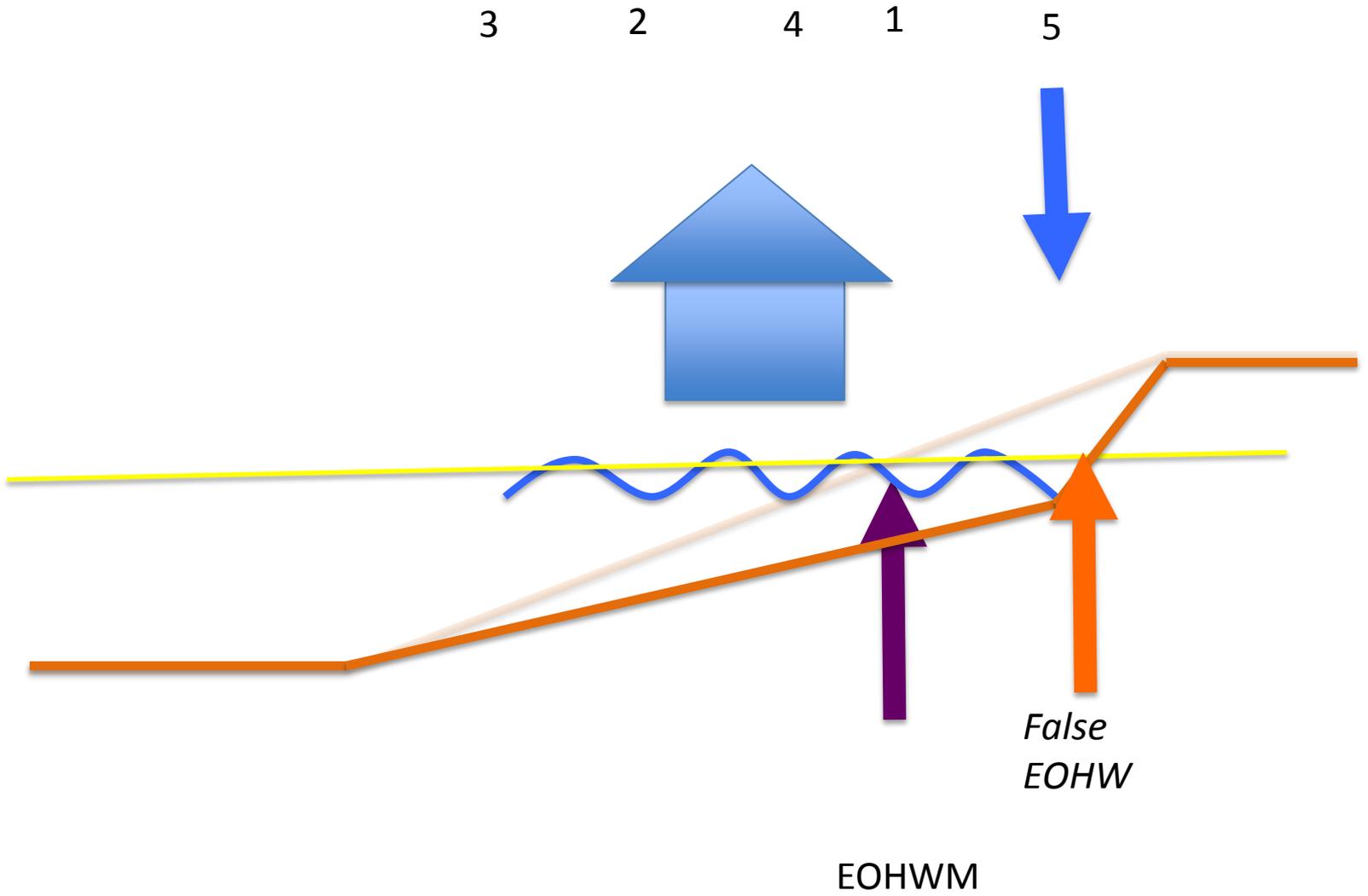


3 2 4 1



*False
EOHW*

EOHWM



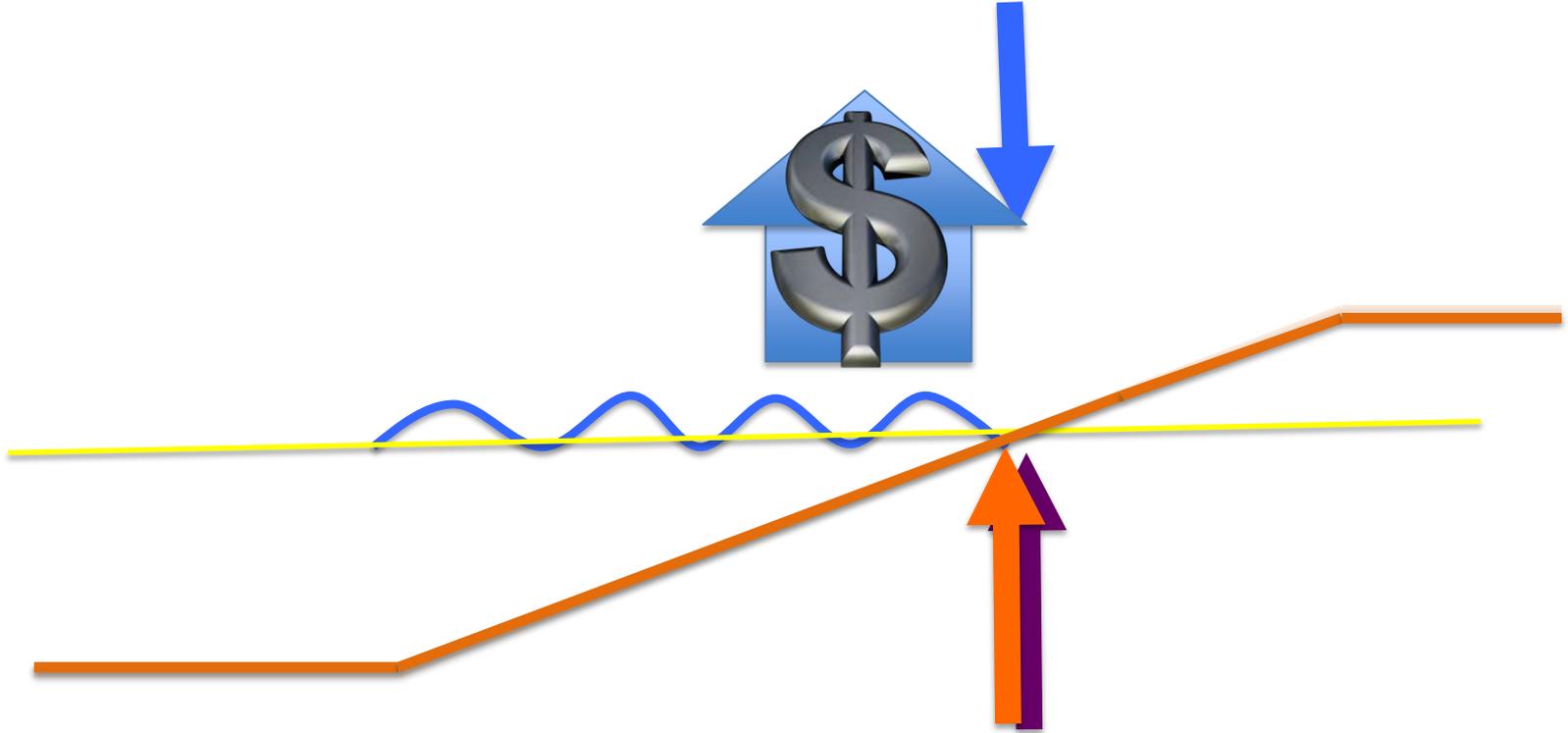
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6 1

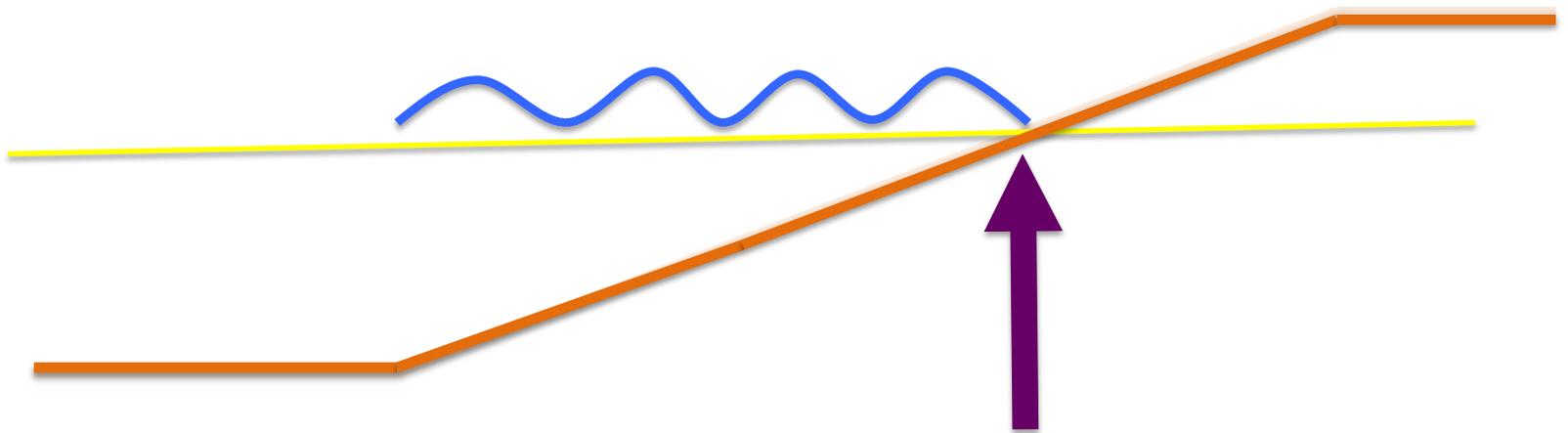
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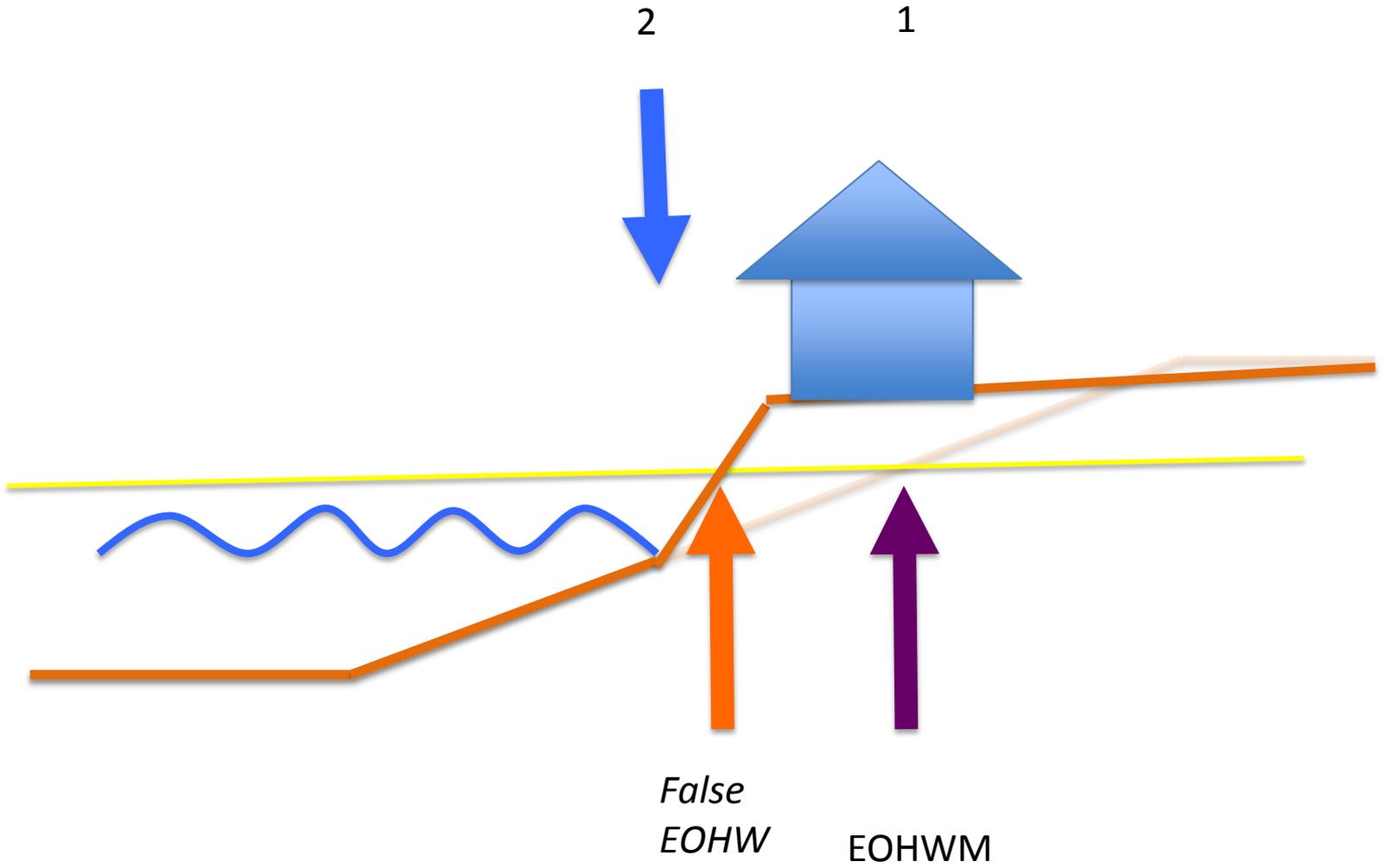
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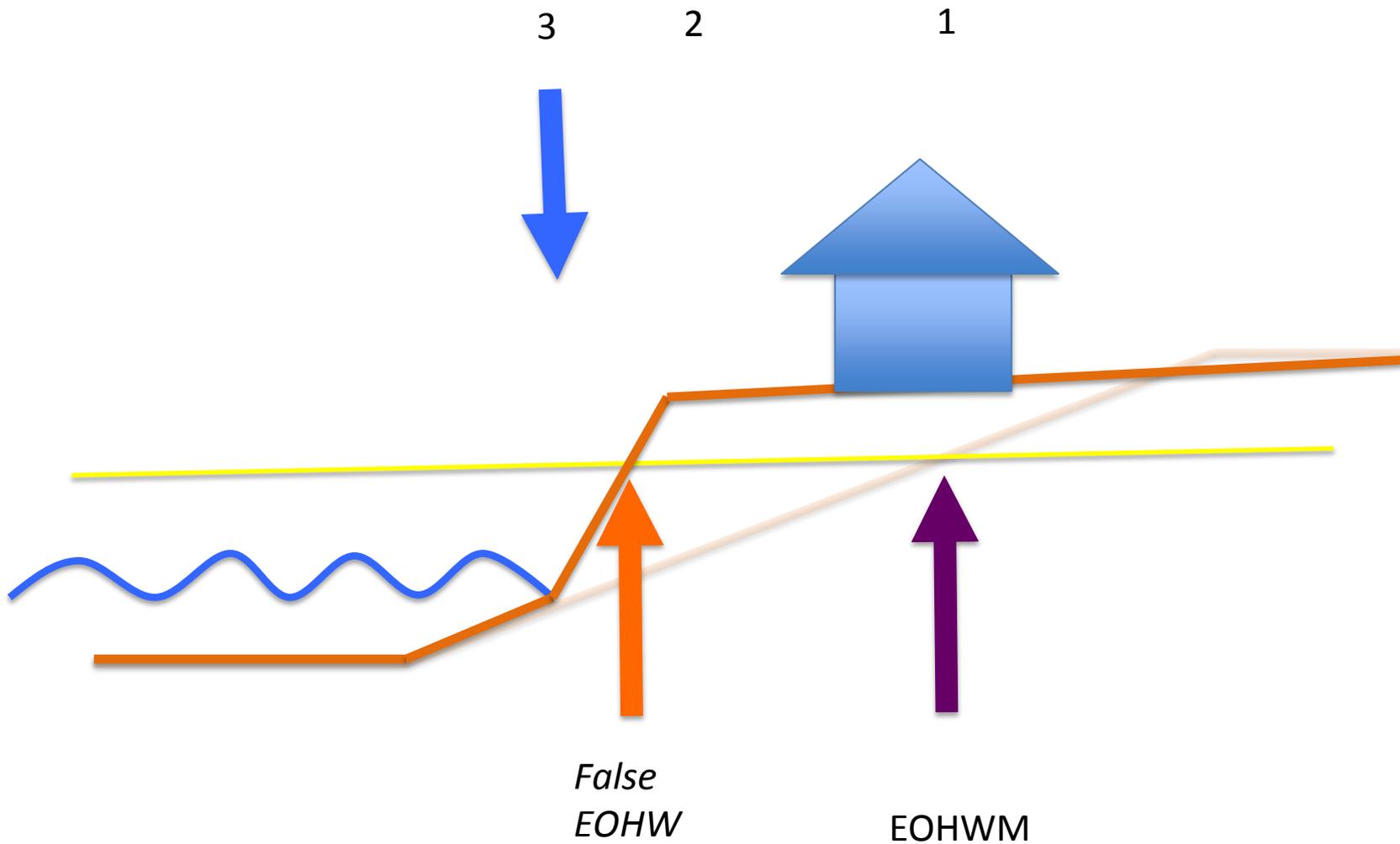
OR, In Reality

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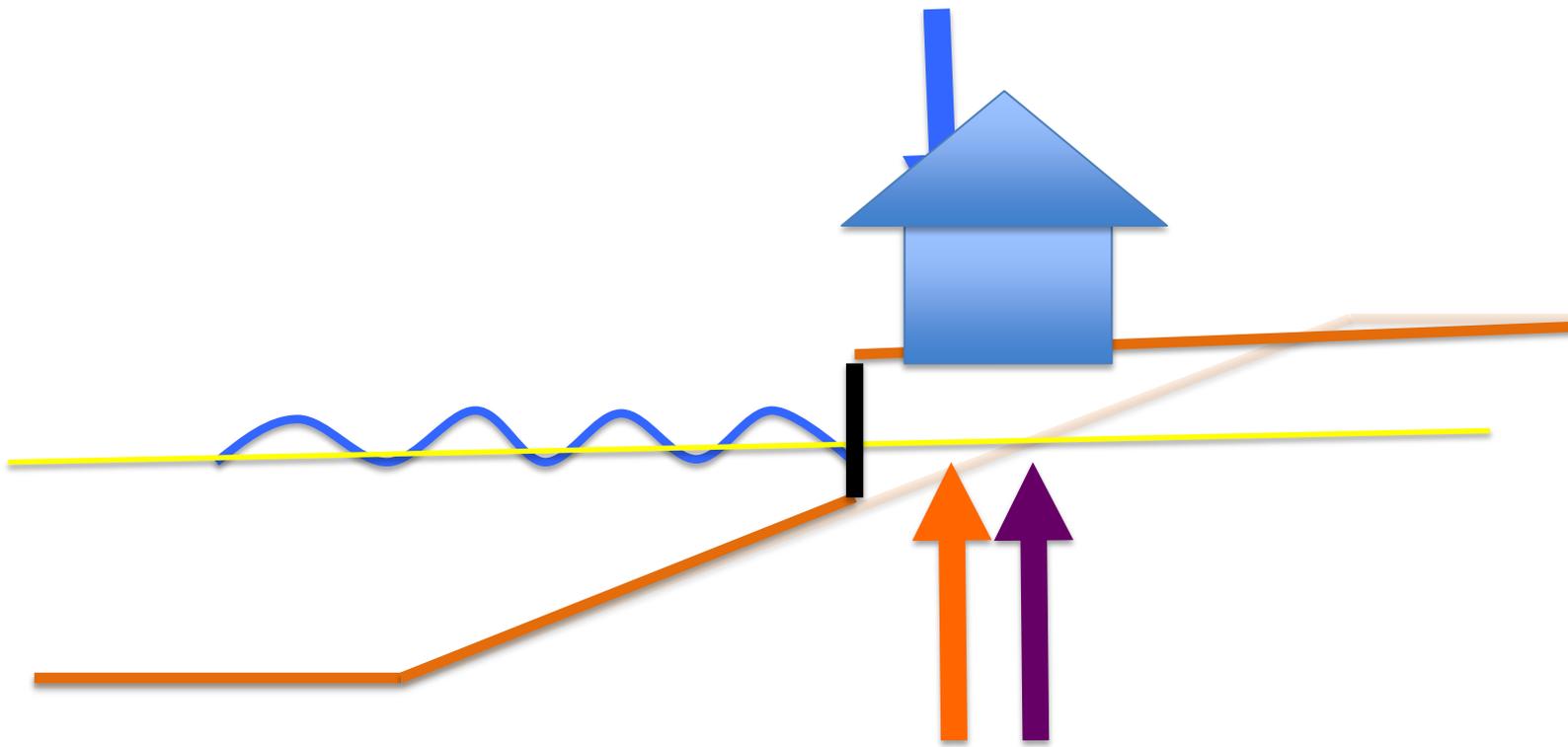


EOHWM



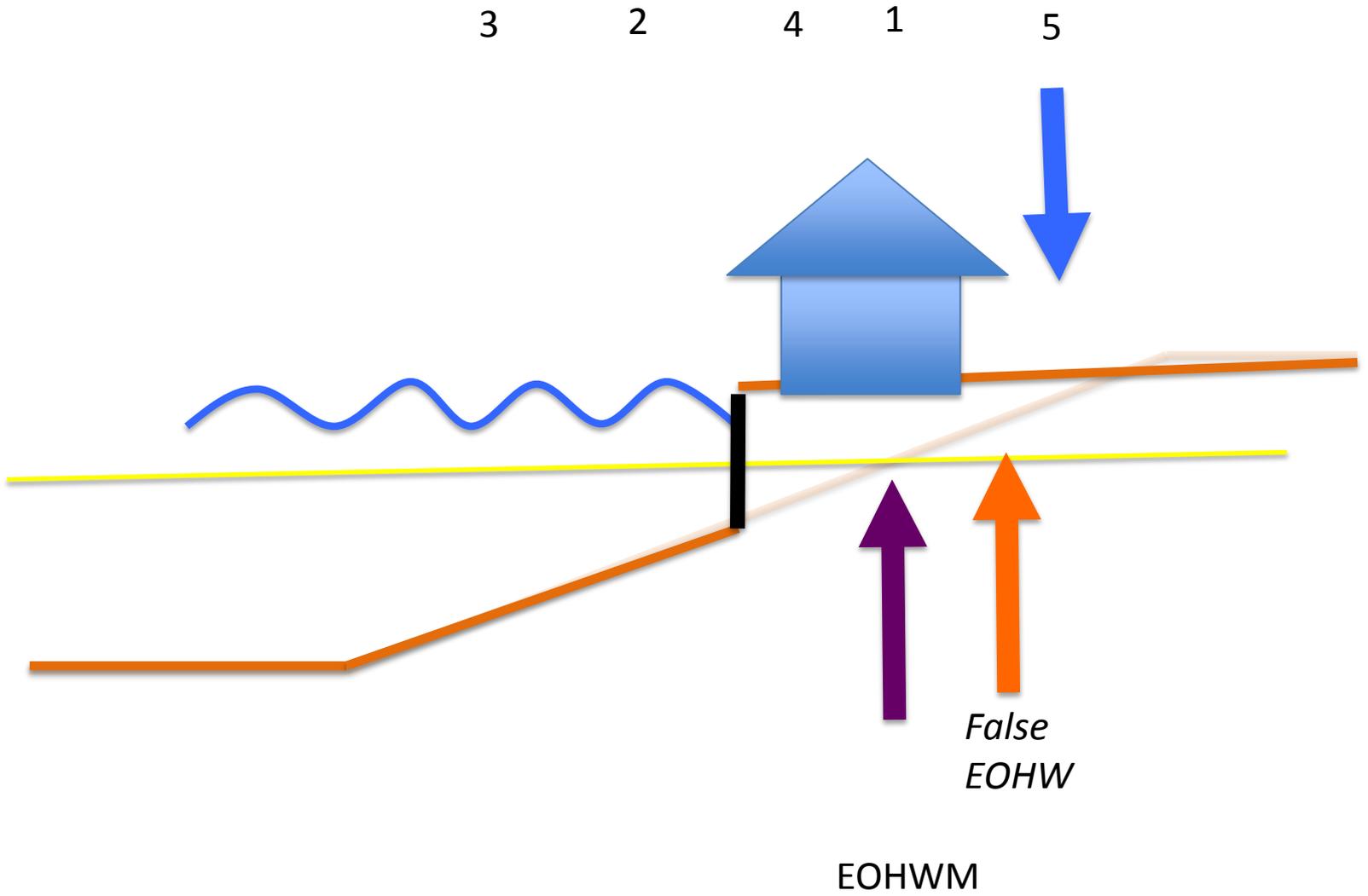


3 2 4 1



*False
EOHWM*

EOHWM



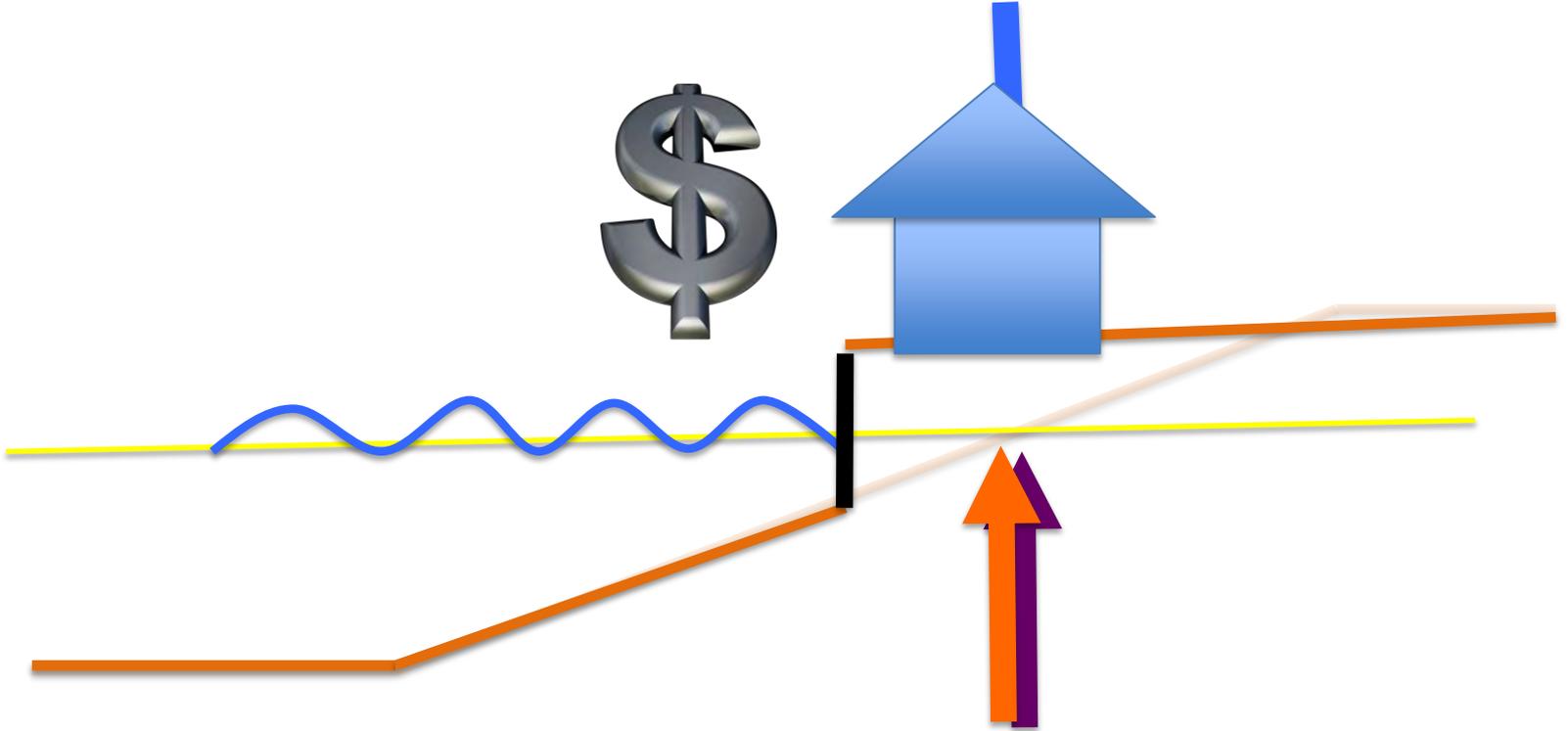
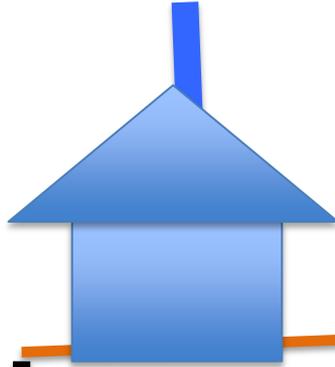
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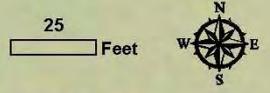
6 1

5



EOHWM

Berrien County
Michigan/Indiana Stateline
New Buffalo Township
LWMD File # 70-11-0169-P

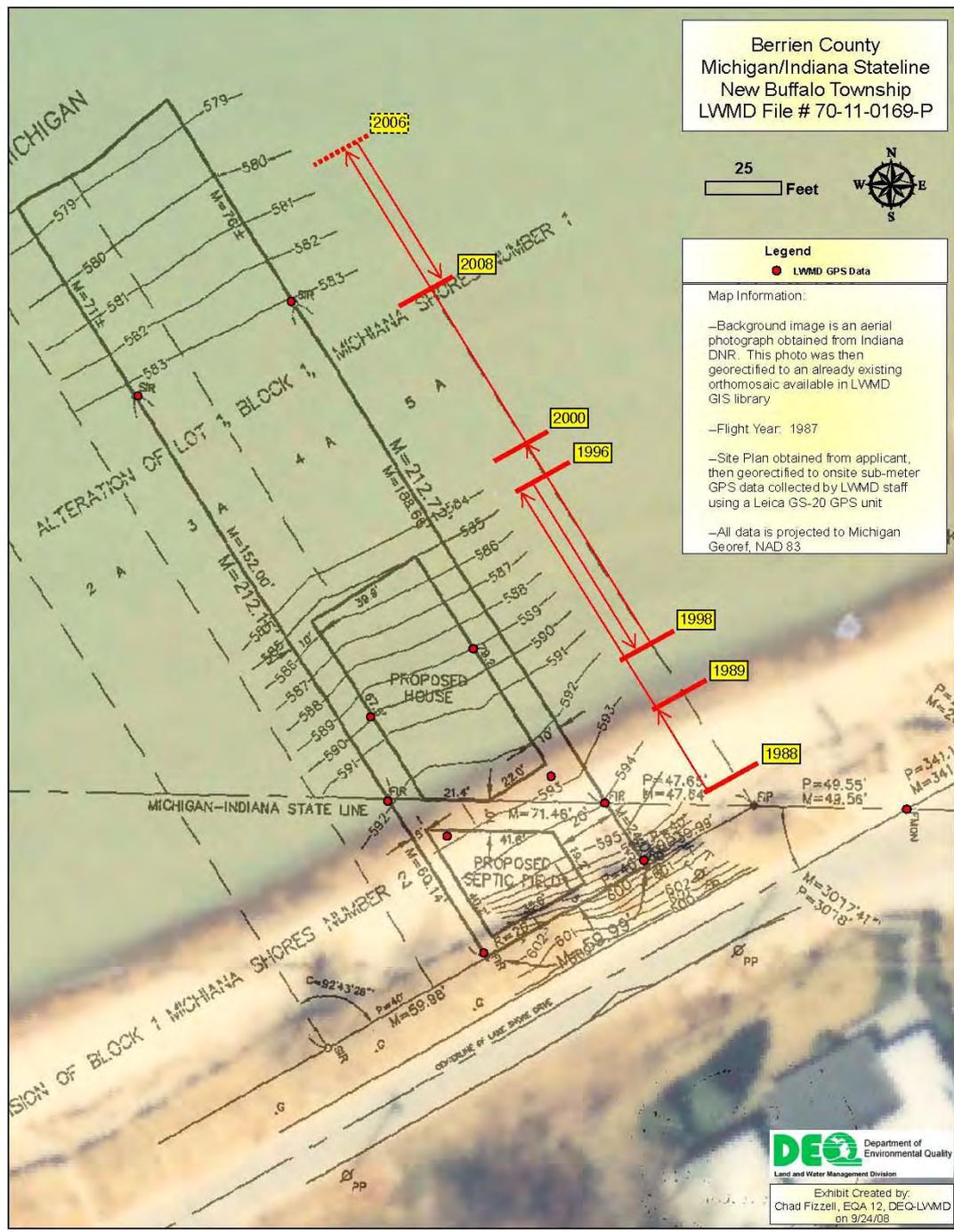


Legend

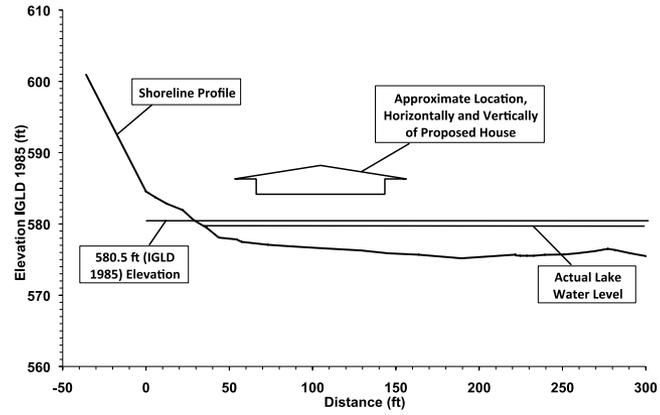
- LWMD GPS Data

Map Information:

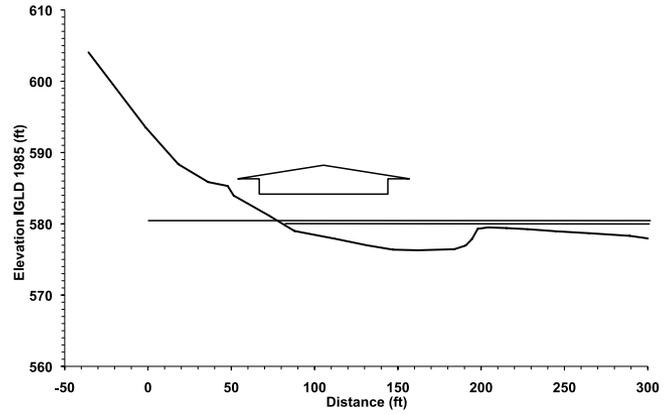
- Background image is an aerial photograph obtained from Indiana DNR. This photo was then georectified to an already existing orthomosaic available in LWMD GIS library
- Flight Year: 1987
- Site Plan obtained from applicant, then georectified to onsite sub-meter GPS data collected by LWMD staff using a Leica GS-20 GPS unit
- All data is projected to Michigan Georef, NAD 83



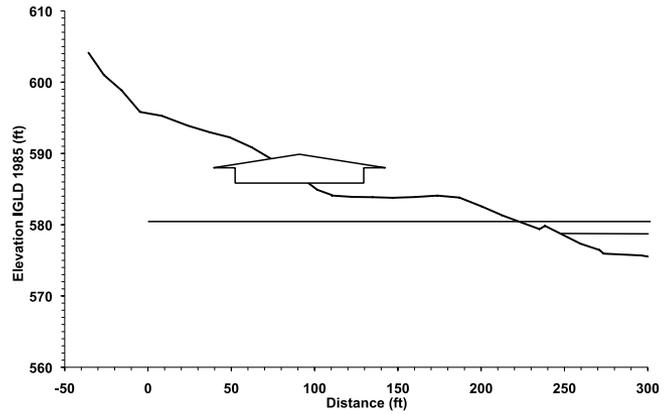
1988

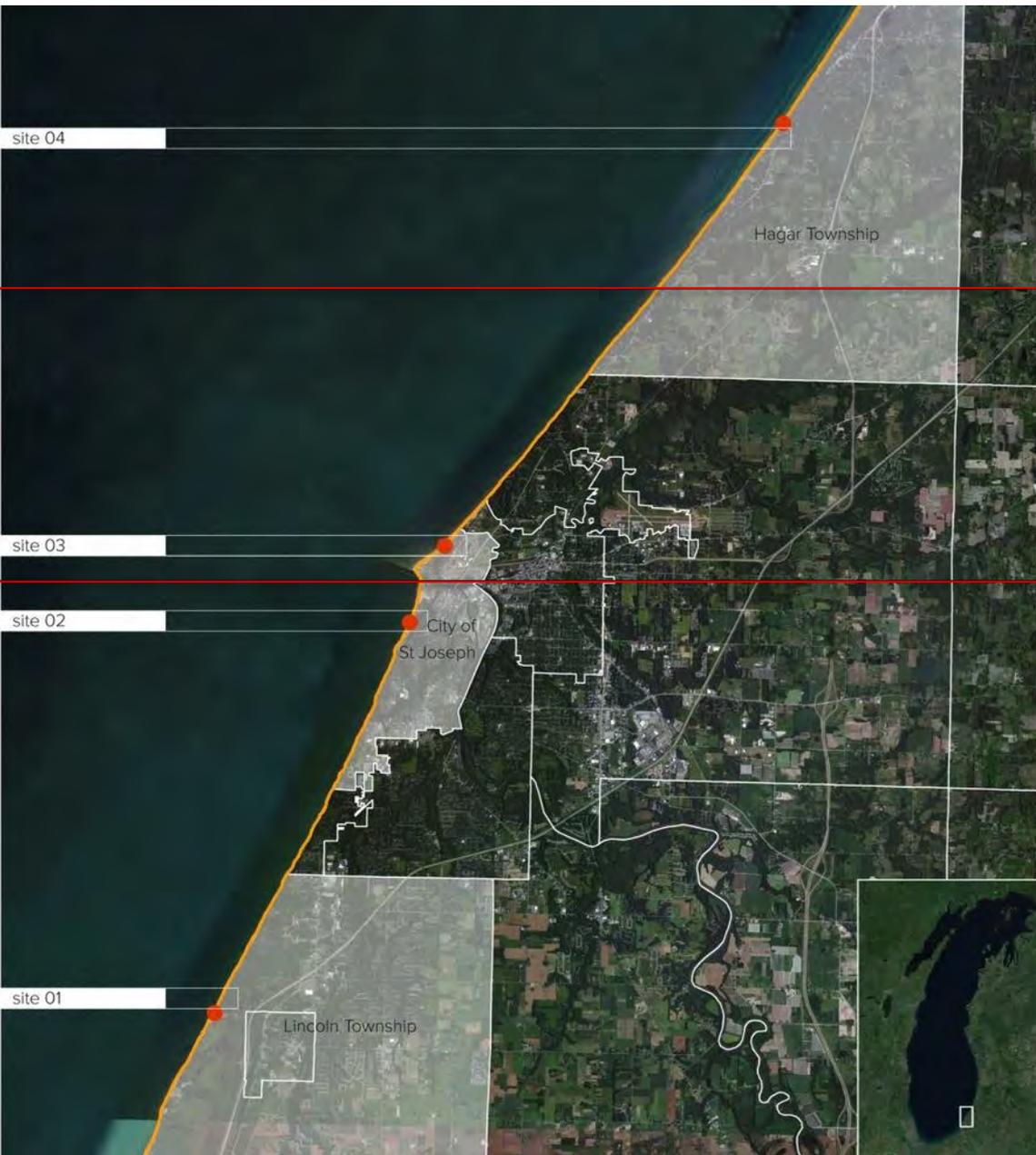


1998



2008





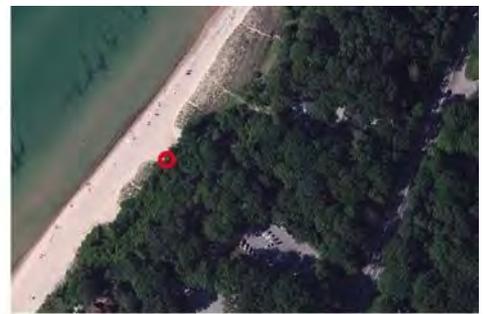
site 04

Hagar Township

SITE 04

Hagar Township

LATITUDE: 42° 12.687'
LONGITUDE: 86° 23.395'



site 03

City of
St Joseph

SITE 03

City of St Joseph

LATITUDE: 42° 7.242'
LONGITUDE: 86° 28.89'



site 02

SITE 02

City of St Joseph

LATITUDE: 42° 6.264'
LONGITUDE: 86° 29.442'



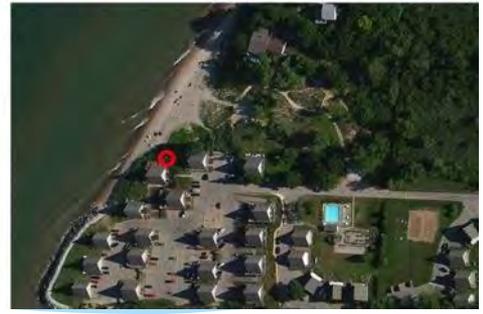
site 01

Lincoln Township

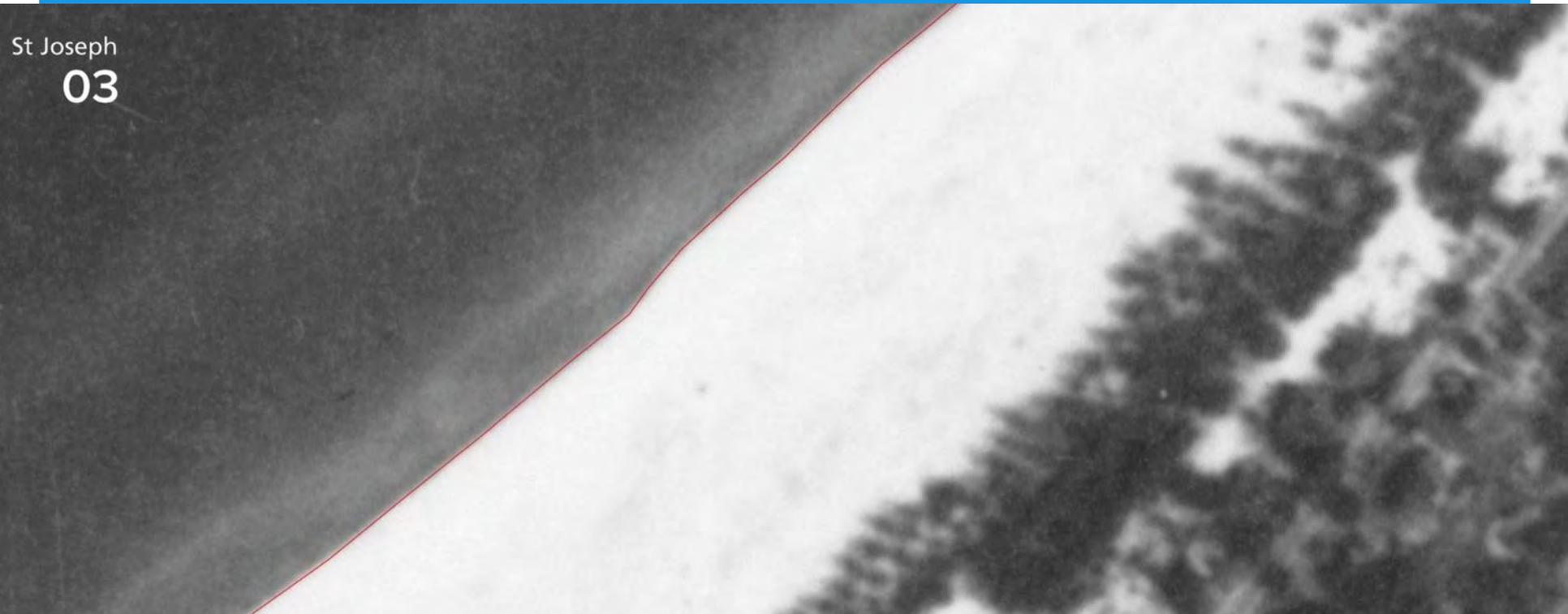
SITE 01

Lincoln Township

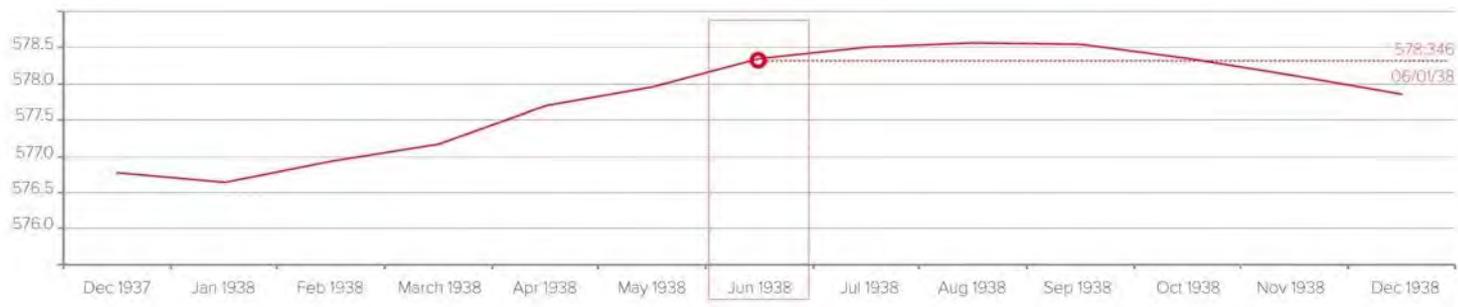
LATITUDE: 42° 01.266'
LONGITUDE: 86° 32.532'



St Joseph
03



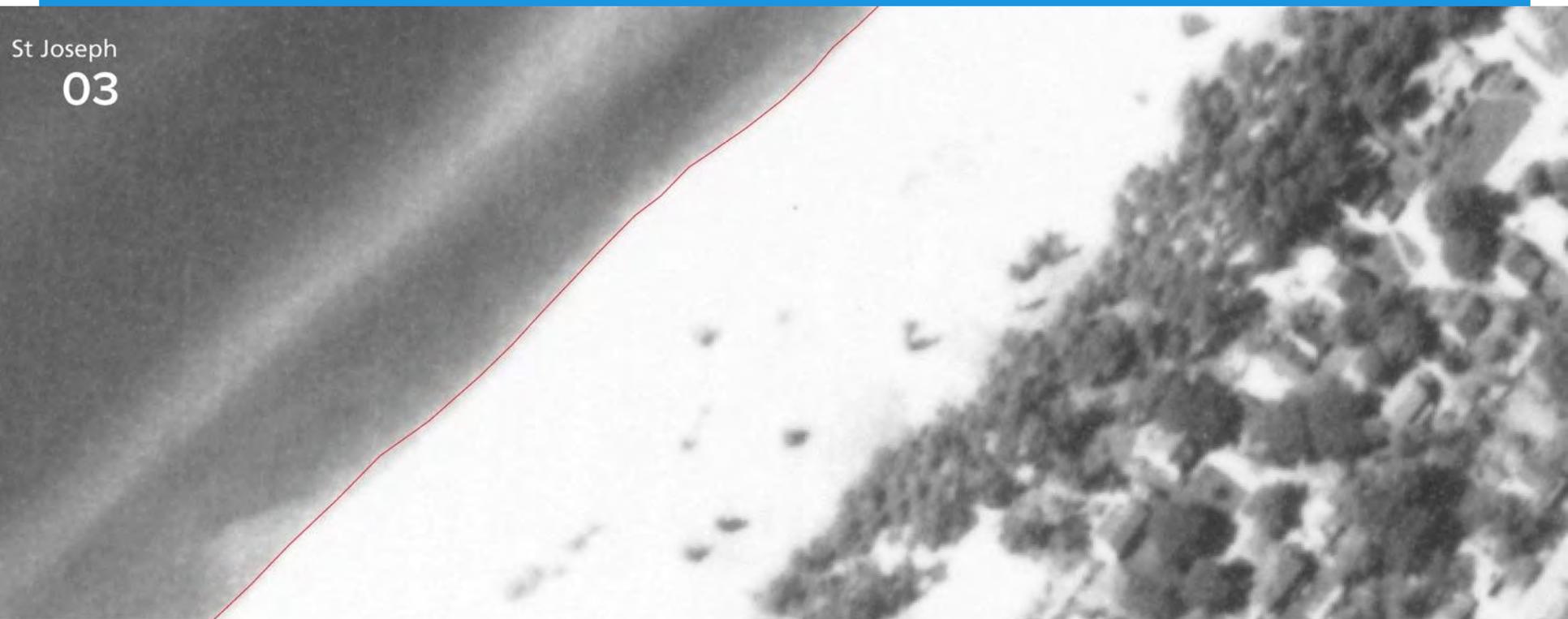
1938



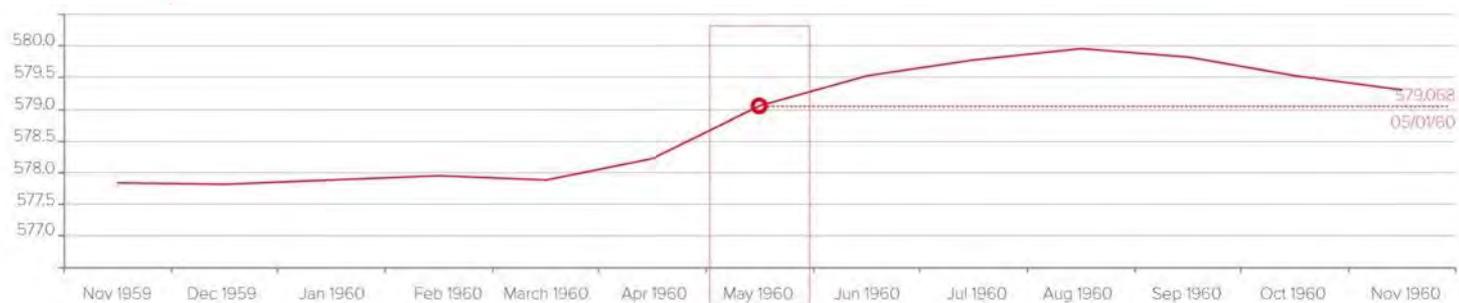
JUNE 1938 AERIAL PHOTO

GRAPH: LAKE LEVELS
in the 6 months before and
after the survey

St Joseph
03



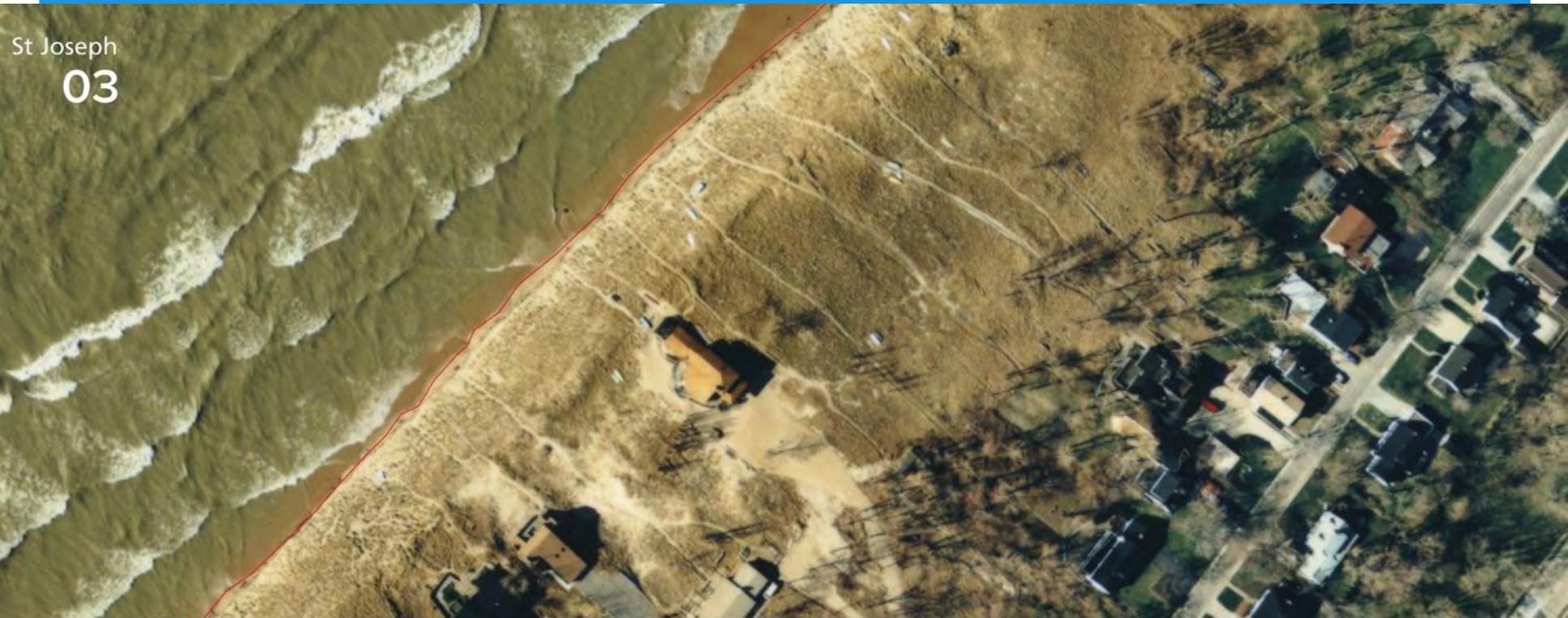
1960



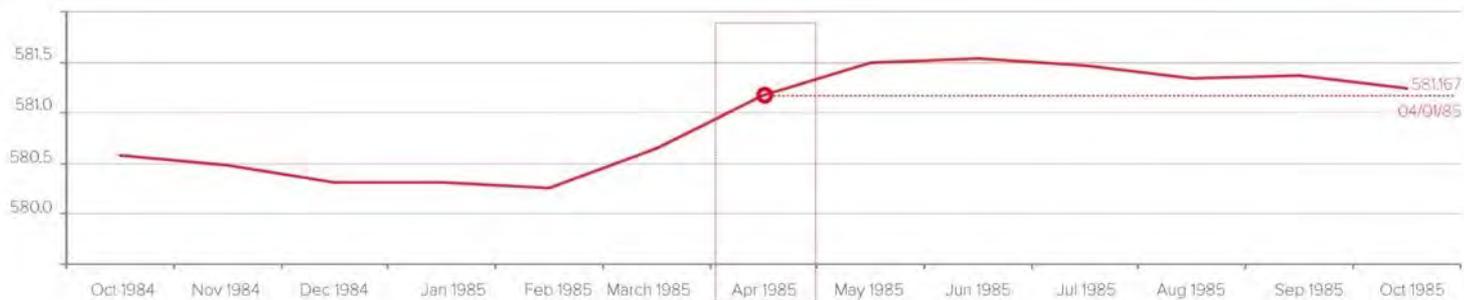
MAY 1960 AERIAL PHOTO

GRAPH: LAKE LEVELS
in the 6 months before and
after the survey

St Joseph
03



1985



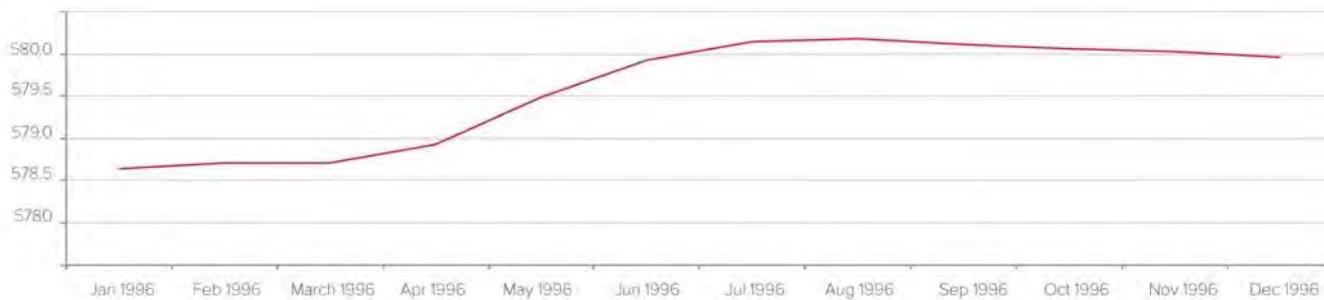
**APRIL 1985
AERIAL PHOTO**

GRAPH: LAKE LEVELS
in the 6 months before and
after the survey

St Joseph
03



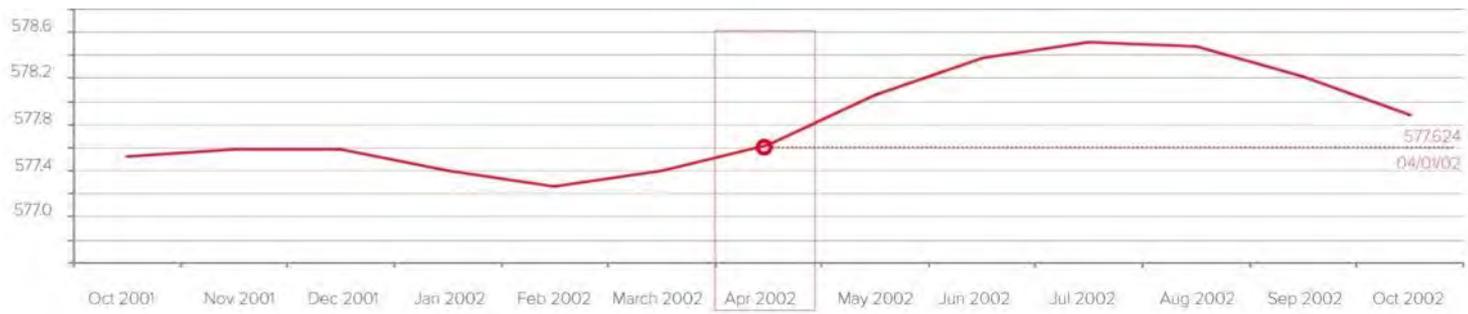
1996



1996 (12530195)
AERIAL PHOTO

GRAPH: LAKE LEVELS
during the year

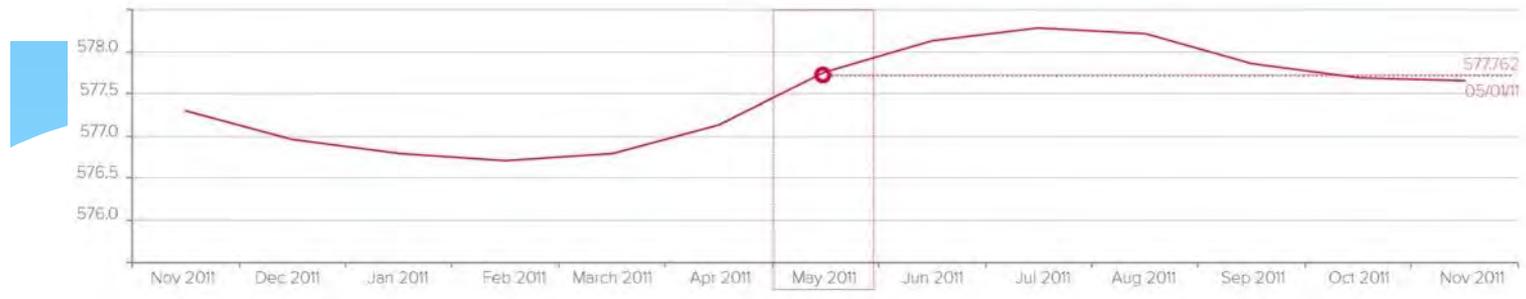
St Joseph
03



APRIL 2002 AERIAL PHOTO

GRAPH: LAKE LEVELS
in the 6 months before and
after the survey

St Joseph
03



**MAY 2011
AERIAL PHOTO**

GRAPH: LAKE LEVELS
in the 6 months before and
after the survey

St Joseph
03



June 1938

future scenario:
projected conditions 1938



St Joseph
03



May 1960

future scenario:
projected conditions 1960

St Joseph
03



April 1985

future scenario:
projected conditions 1985

St Joseph
03



1996

future scenario:
projected conditions 1996

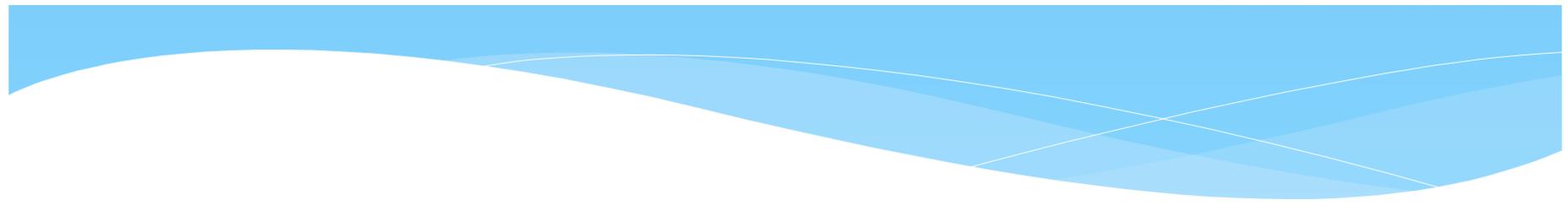


St Joseph
03



water line 2011
water line 2002
April 2002

**future scenario:
projected conditions 2002**



St Joseph
03



1996
April 1985
May 1960
June 1938

**future scenario:
under past conditions**





WSJM FM
94.9
News • Talk • Sports
WEEK IN REVIEW

WSJM FM
94.9
News • Talk • Sports
WEEK IN REVIEW



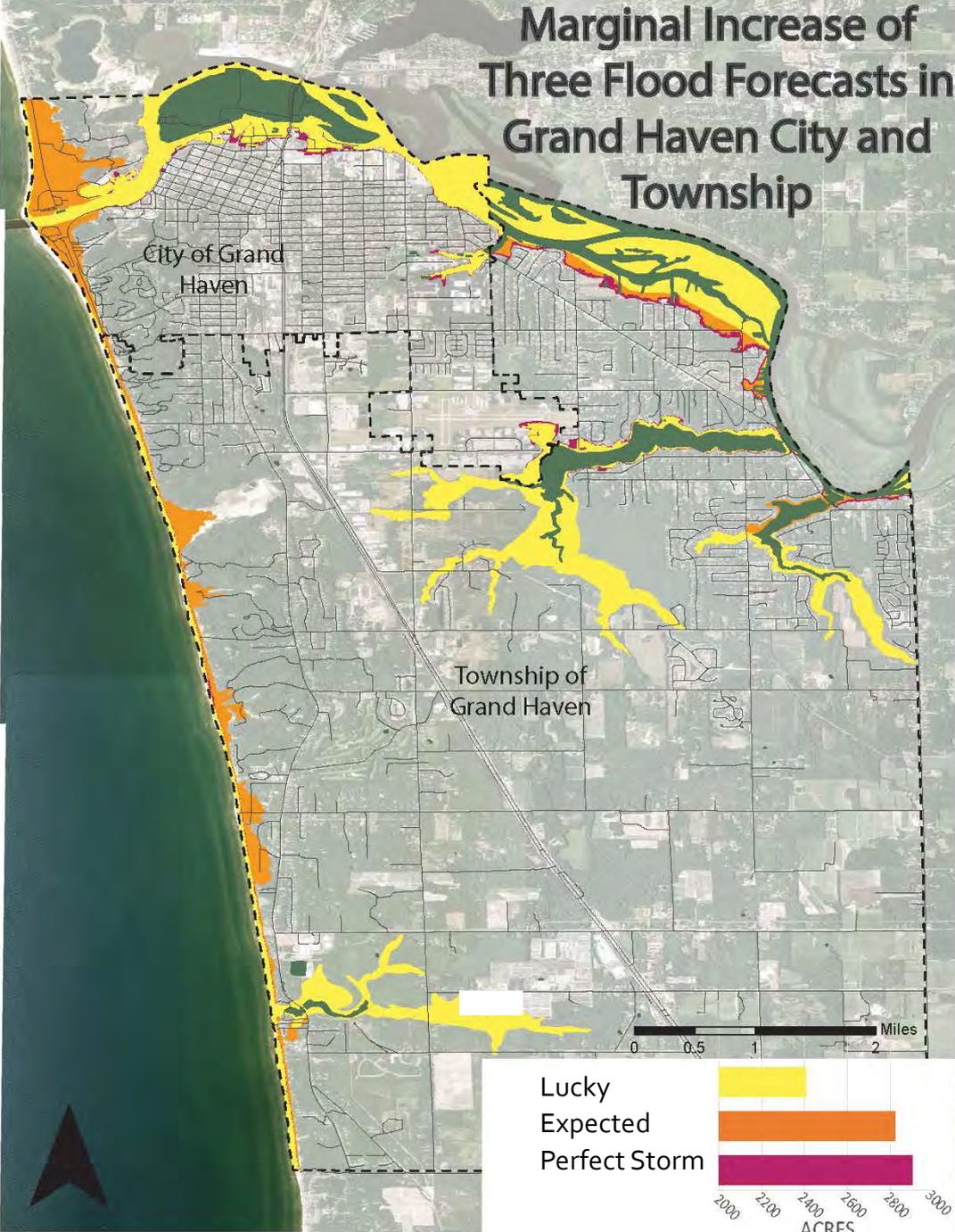
Climate Change

<http://www.epa.gov/glnpo/image/vbig/191.jpg>

Shoreland Area Planning & Climate Change: Scenario Planning

Future Condition	Lucky	Expected	Perfect Storm
Mgt Options			
Current Infrastructure	Scenario 1A Land Use Environmental Fiscal	Scenario 1B	Scenario 1C
Full Build-Out Currently Allowable	Scenario 2A	Scenario 2B	Scenario 2C
Build-Out with Best Management Practices: Setbacks	Scenario 3A	Scenario 3B	Scenario 3C

Marginal Increase of Three Flood Forecasts in Grand Haven City and Township



Grand Haven Land Use Example

Acres Impacted:

	Lucky	Expected	Perfect Storm
City of Grand Haven	336	565	606
Grand Haven Township	1,195	1,381	1,418

Structures Impacted:

City of Grand Haven	Current	Build-Out	BMPs
Lucky	78	+150	+2
Expected	239	+202	+48
Perfect Storm	256	+241	+49

Grand Haven Township	Current	Build-Out	BMPs
Lucky	46	+163	+6
Expected	96	+251	+49
Perfect Storm	119	+266	+52

DANGER

**SEVERE
EROSION**

**ENTER AT
OWN RISK**