ORDINARY HIGH WATER MARK (OHWM)

Prepared by Ramon Aberasturi

For Regulatory Program Workshop

27 January 2017

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WHAT IS THE ORDINARY HIGH WATER MARK?

It's a regulatory boundary

The OHWM demarcates the lateral extent of Federal jurisdiction for:

- Sections 9 and 10 of the Rivers and Harbors Act of 1899
  - Applies to Traditional Navigable WoUS (TNWs)
- Section 404 of the Clean Water Act
  - Applies to Non-tidal Waters of the United States, in the absence of adjacent wetlands

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WHAT IS THE ORDINARY HIGH WATER MARK?

"The term ordinary high water mark on non-tidal rivers is the line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank; shelving; changes in the character of soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas." [33 CFR 329.11(a)(1)]

33 CFR Part 329 - Definition of Navigable Waters

33 CFR Part 329.11 – Geographic and jurisdictional limits of rivers and lakes

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WHAT IS THE ORDINARY HIGH WATER MARK?

"The term ordinary high water mark means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." [33 CFR 328.3(e)]

33 CFR Part 328 - Definition of Waters of the US

33 CFR Part 328.3 - Definitions

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AQUATIC RESOURCE DELINEATION

MINIMUM STANDARDS FOR ACCEPTANCE OF AQUATIC RESOURCES DELINEATION REPORTS

OHWM Data Sheets

Please insure to include a map identifying the location of the data points.

Data forms may be modified from the Corps' standard form but must contain all essential information to make a decision.

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MINIMUM STANDARDS FOR ACCEPTANCE OF AQUATIC RESOURCES DELINEATION REPORTS

"A statement that the delineation has been conducted in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual and appropriate regional supplement(s). The regional supplement(s) used must be identified. **For ordinary high water mark (OHWM) delineations, a statement identifying the use of the OHWM field guide must be included."**

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DELINEATION MAP

SPD Map & Drawing Standards February 10, 2016

Plan View Map

Each type of boundary (for example, **ordinary high water mark**, **mean high water**, wetlands or other special aquatic sites, and high tide line) must be **clearly annotated** and/or **symbolized** to ensure they are differentiable on the map.

Cross Section Map

If there are tidal areas within the survey area, identify the location and elevation of **Mean High Water** and the **High Tide Line** on **all maps** and **cross-section drawings** when appropriate.

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DELINEATION MAP

SPD Map & Drawing Standards February 10, 2016

Plan View Maps

Include representative **ordinary high water mark (OHWM**) **widths** where measured in the field (**averages may be acceptable for uniform channel reaches**). **OHWM widths** must be shown with a transect/profile line (e.g., A-A') **labeled** with the corresponding width measurement in feet. In some cases, a corresponding cross section may be required, in which case the cross section must include the corresponding **OHWM elevations**.

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DELINEATION MAP

SPD Map & Drawing Standards February 10, 2016

If there are tidal areas within the survey area, identify the location and elevation of **Mean High Water** and the **High Tide Line** on all maps and cross-section drawings. Annotate boundaries with the corresponding elevation (ft) and the tidal (vertical) datum used (**NAVD88**, NGVD29, MLLW, etc.).

For plan view maps where specific elevations are shown, and for all cross sections, the **reference elevation datum** (e.g. **North American Vertical Datum of 1988**, National Geodetic Vertical Datum of 1929, etc.) must be indicated.

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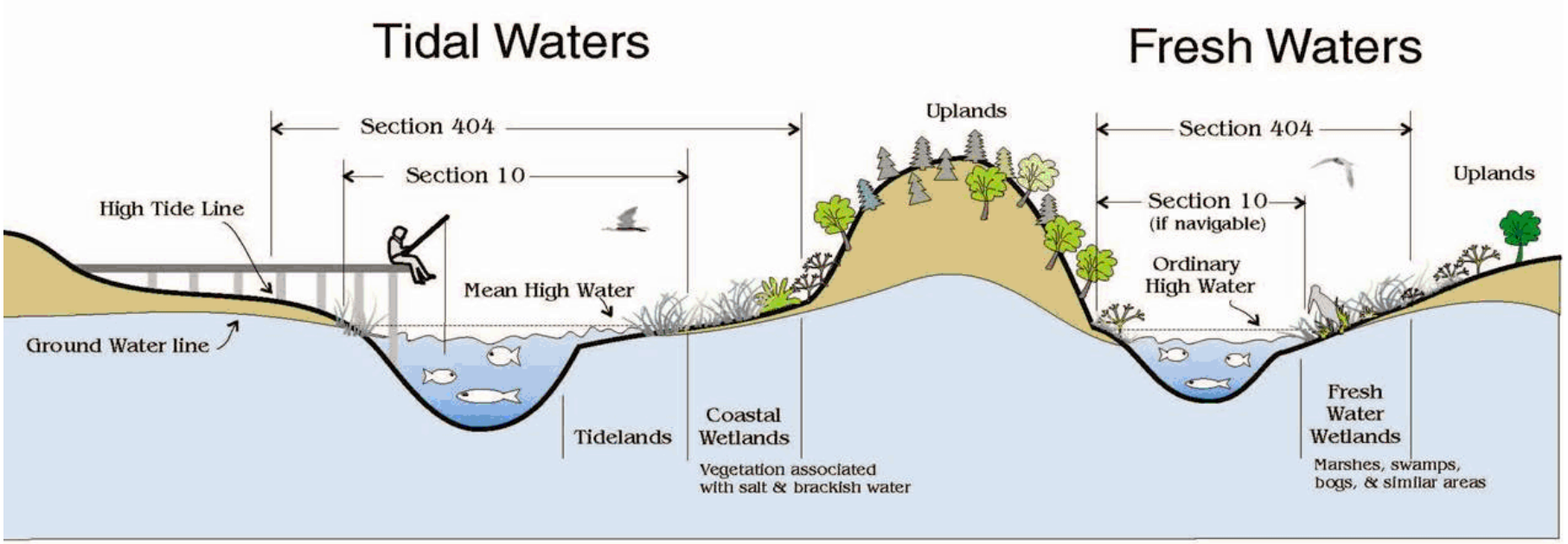
CORPS OF ENGINEERS REGULATORY JURISDICTION



	Section 103 Ocean Disposal of Dredged Material	Section 404 Discharge of Dredged or Fill Material (all waters of the U.S.)	Section 10 All Structures and Work (navigable waters)
Typical examples of regulated activities	Ocean discharges of dredged material	All filling activities, utility lines, outfall structures, road crossings, beach nourishment, riprap, jetties, some excavation activities, etc.	Dreding, marinas, piers, wharves, floats, intake / outtake pipes, pilings, bulkheads, ramps, fills, overhead transmission lines, etc.

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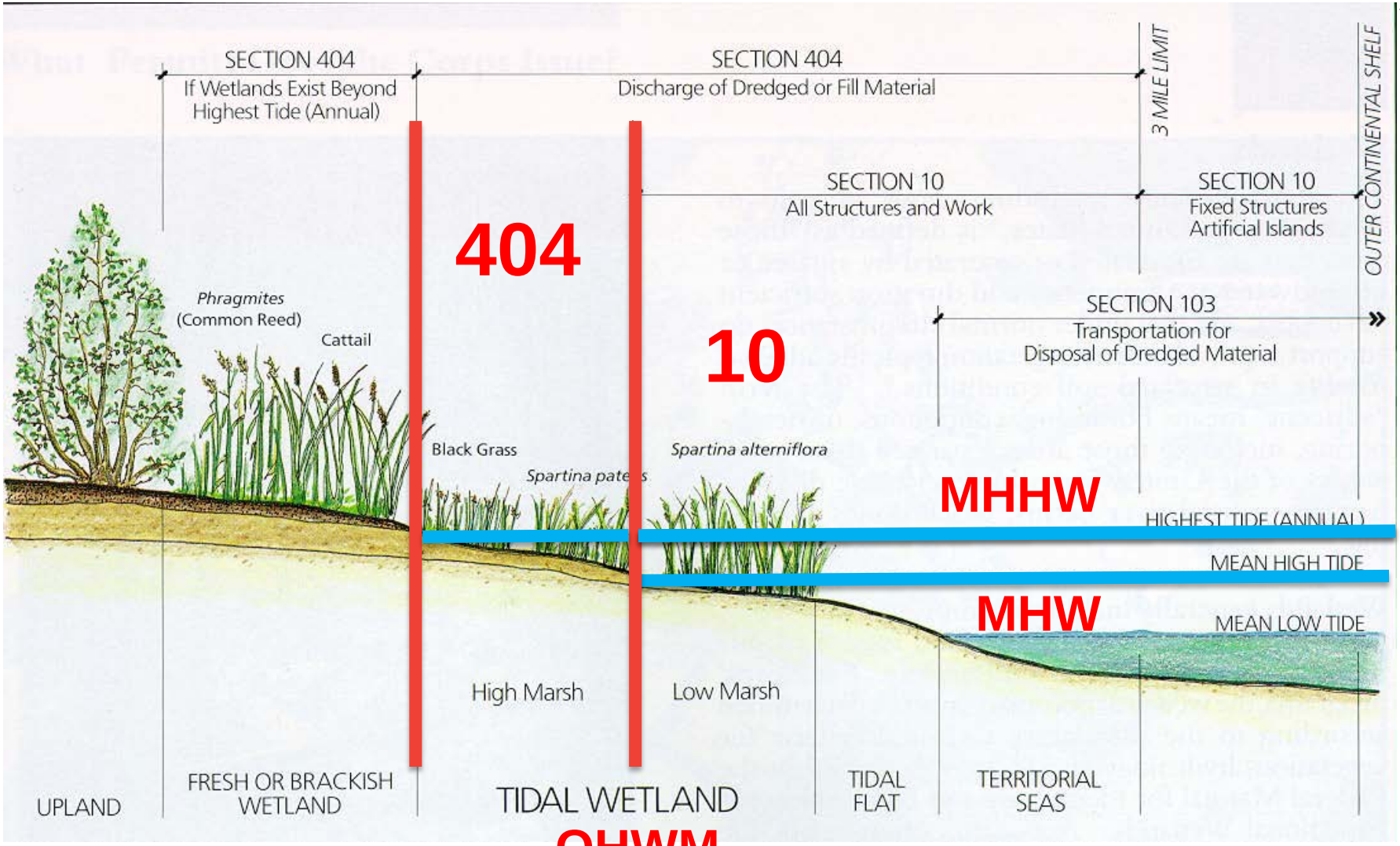

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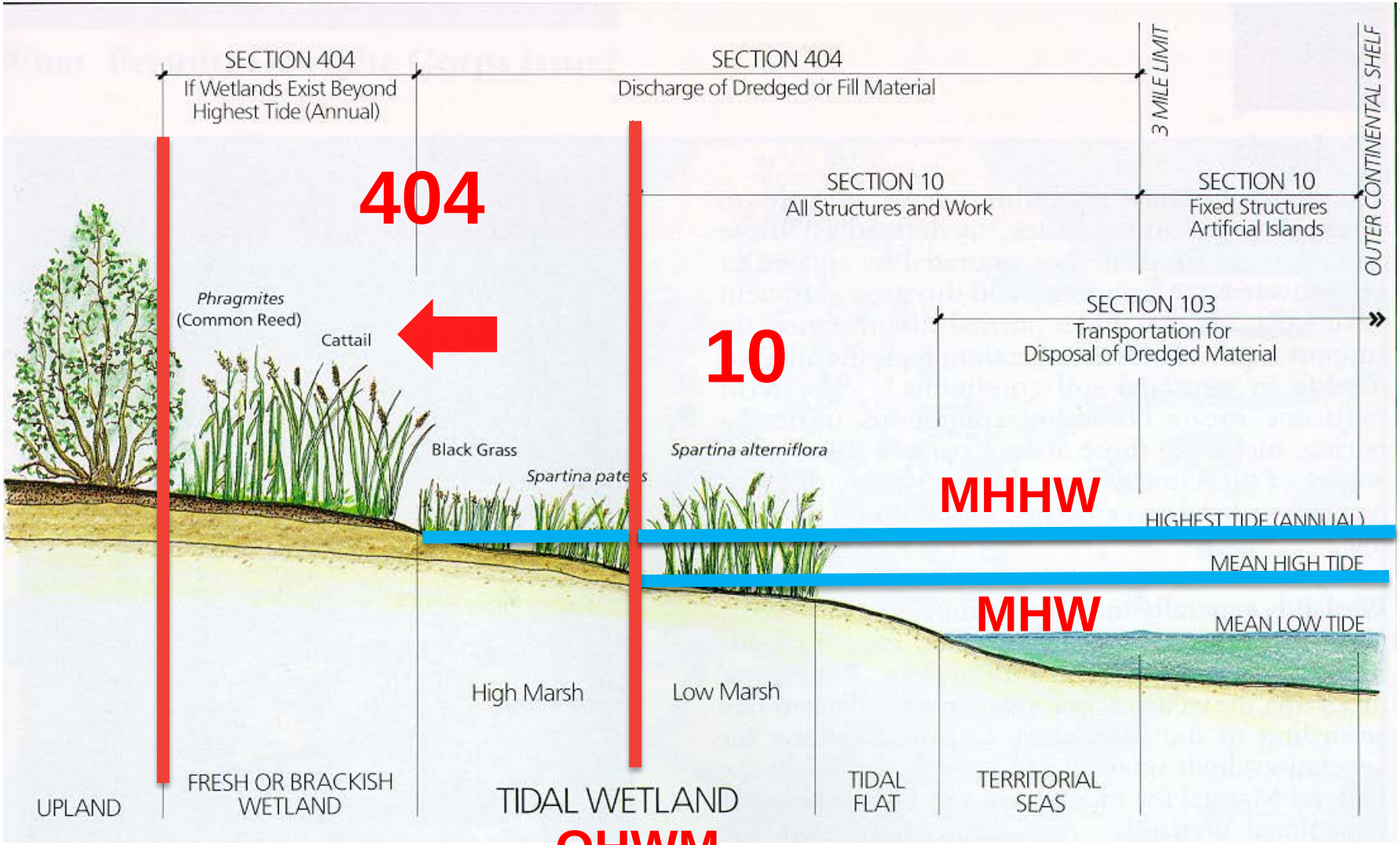

Wetland Boundary

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TIDAL HIGH WATER MARK??

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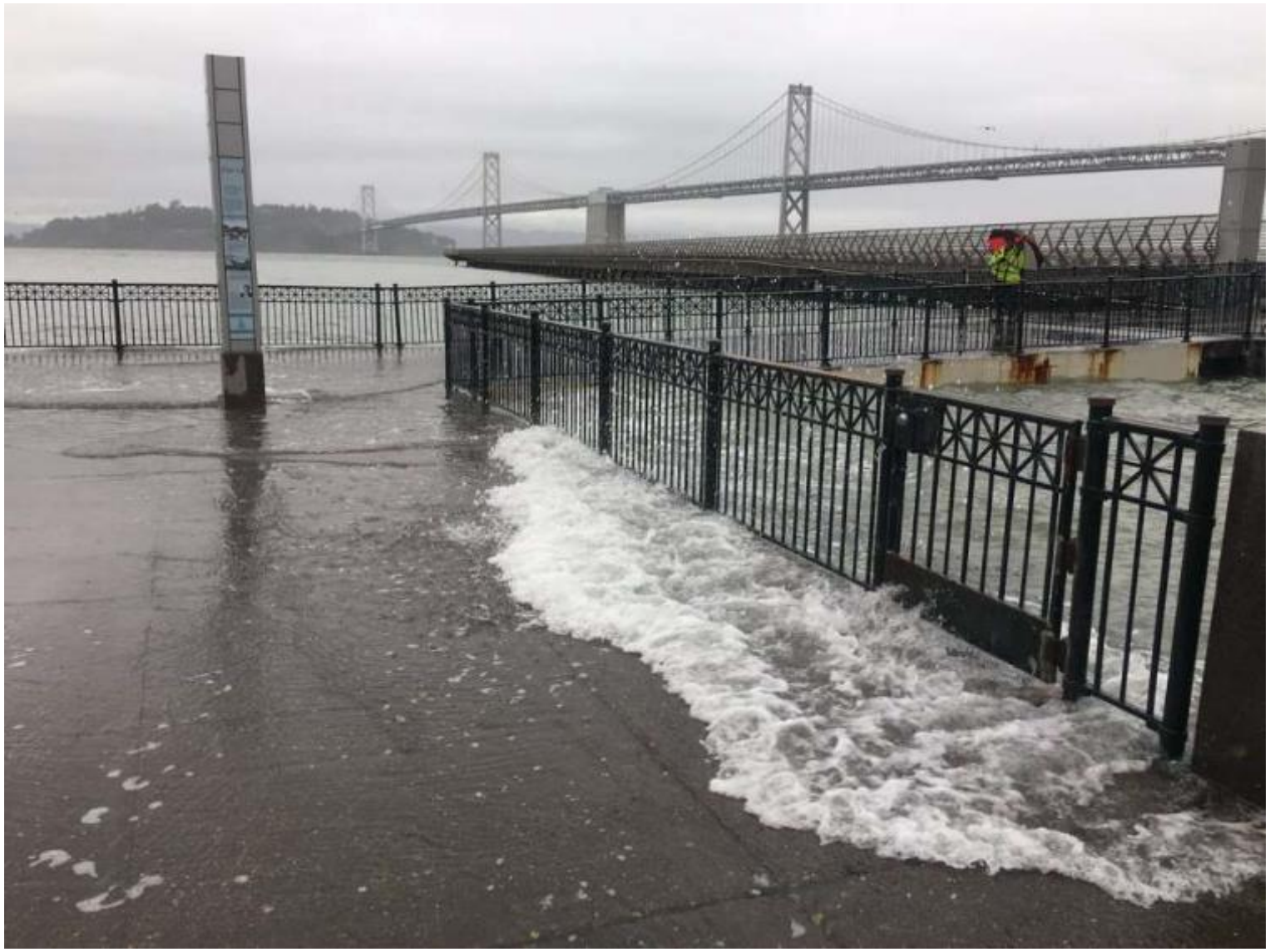

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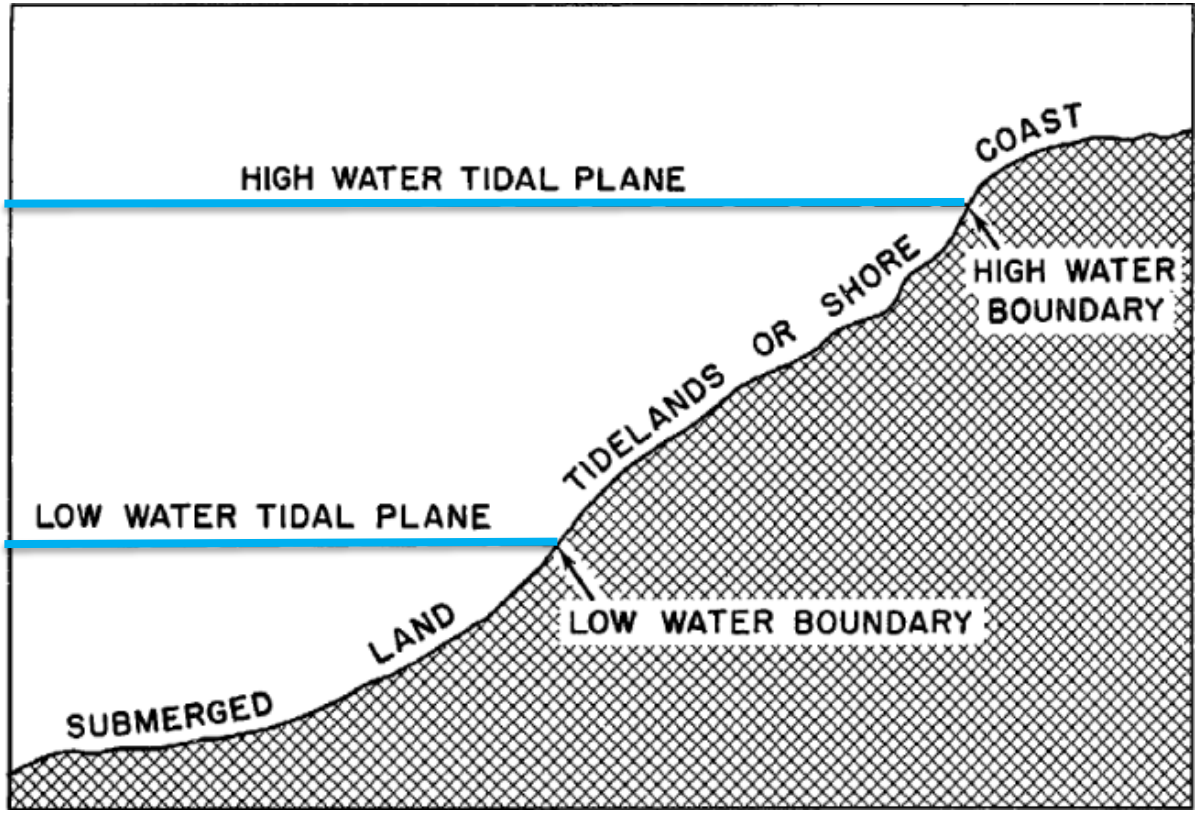
TIDAL INFLUENCE - MEAN HIGH WATER



§329.12 Geographic and jurisdictional limits of oceanic and tidal waters.

"Regulatory jurisdiction in coastal areas extends to the shore reached by the plane of the mean (average) high water" [33 CFR 329.12(a)(2)]

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DELINEATION MAP

SPD MAP & DRAWING STANDARDS FEBRUARY 10, 2016

If there are tidal areas within the survey area, identify the location and elevation of **Mean High Water** and the **High Tide Line** on all maps and cross-section drawings. Annotate boundaries with the corresponding elevation (ft) and the tidal (vertical) datum used (**NAVD88**, NGVD29, MLLW, etc.).

For plan view maps where specific elevations are shown, and for all cross sections, the **reference elevation datum** (e.g. **North American Vertical Datum of 1988**, National Geodetic Vertical Datum of 1929, etc.) must be indicated.

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TIDAL DATUMS

National Ocean Service (NOS) of the National Oceanic and Atmospheric Administration (NOAA) has statutory responsibility for **tidal measurements**, analysis, predictions and **datum determinations**.

Mean High Water (MHW) Tidal Datum

Average of all the high water heights observed over the National Tidal Datum Epoch (about 19-years).

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A List of Tidal Datums

Approximate Lowest Astronomical Tide
Approximate Mean Low Water Springs
Approximate Mean Low Water Tide
Approximate Mean Low Water
Approximate Mean Sea Level
Equinoctial Spring Low Water
Half Tide
Highest Astronomical Tide
Higher High Water Large Tide
Highest Normal High Water
Higher High Water
Highest High Water
High Water
High Water Springs
Indian Spring High Water
Indian Spring Low Water
Lowest Astronomical Tide
Lower Low Water Large Tide
Lowest Low Water Springs
Lower Low Water
Lowest Low Water
Low Water
Low Water Springs Low Water Springs
Mean Higher High Water
Mean Higher Water
Mean High Water
Mean High Water Neaps
Mean High Water Springs
Mean Lower Low Water Springs
Mean Lower Low Water
Mean Low Water
Mean Low Water Neaps
Mean Low Water Springs
Mean Sea Level
Mean Tide Level
Nearly Lowest Low Water
Neap Tide
Spring Tide

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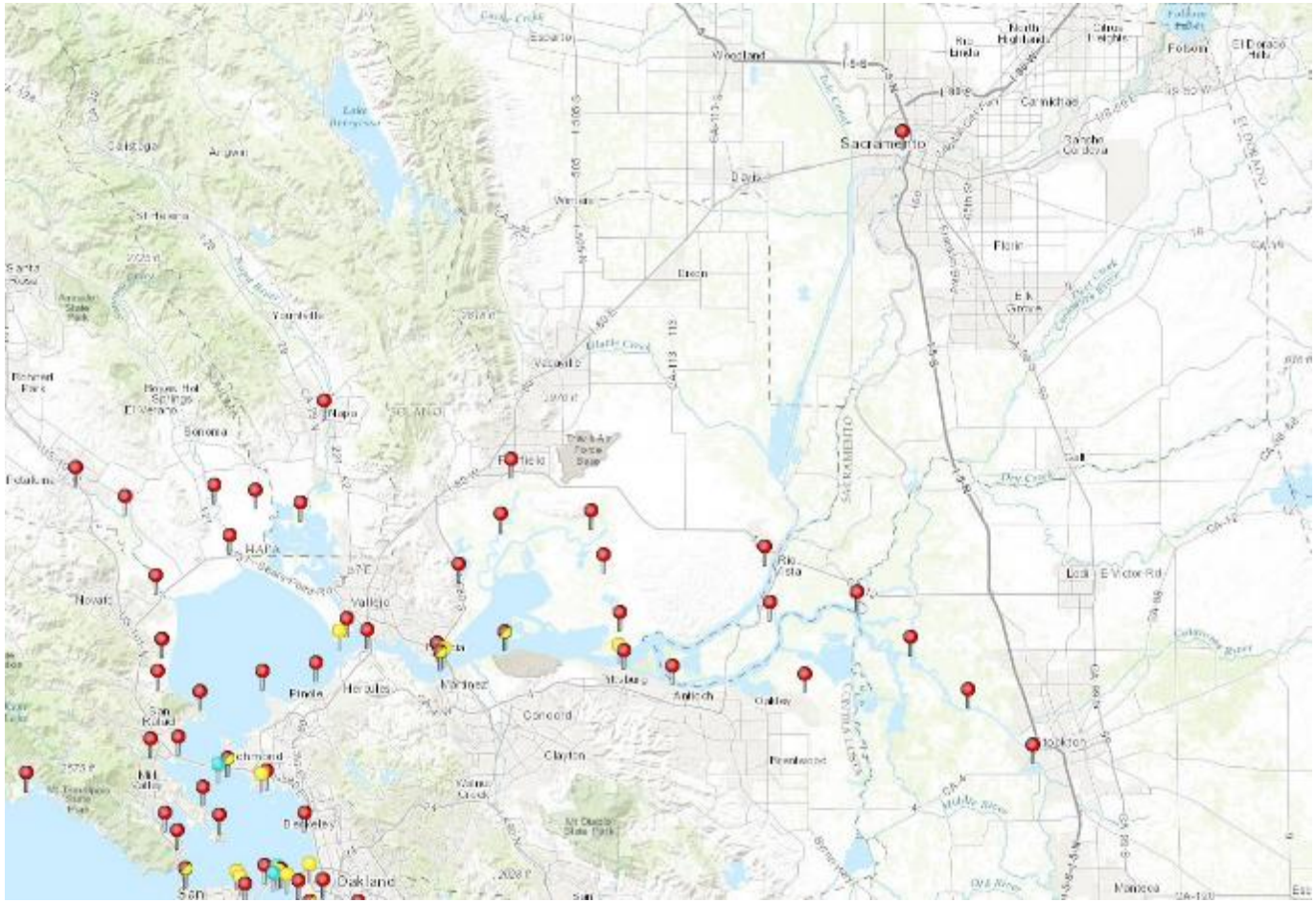
TIDAL DATUMS
HTTPS://TIDESANDCURRENTS.NOAA.GOV/MAP/



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BORDEN HIGHWAY BRIDGE TIDAL DATUM

T I D A L D A T U M S

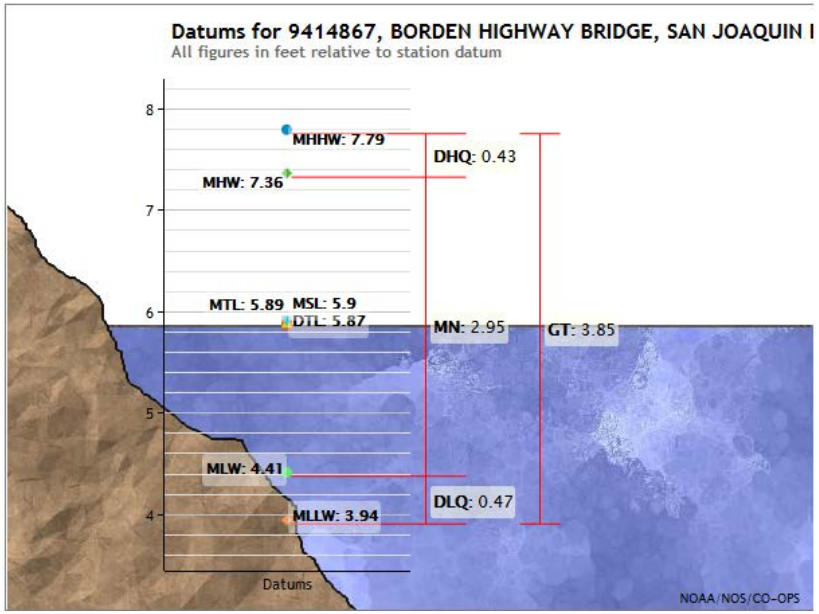
Tidal datums at BORDEN HIGHWAY BRIDGE, SAN JOAQUIN RIVER based on:

LENGTH OF SERIES:	1 YEAR
TIME PERIOD:	December 1978 - November 1979
TIDAL EPOCH:	1983-2001
CONTROL TIDE STATION:	9415144 PORT CHICAGO, SUISUN BAY

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

MEAN HIGHER HIGH WATER	MHHW	=	1.174
MEAN HIGH WATER	MHW	=	1.043
MEAN SEA LEVEL	MSL	=	0.598
MEAN TIDE LEVEL	MTL	=	0.593
MEAN LOW WATER	MLW	=	0.143
MEAN LOWER LOW WATER	MLLW	=	0.000
North American Vertical Datum	NAVD88	=	-0.646

North American Vertical Datum (NAVD88)



Benchmark Sheet

NAVD88 height at MLLW

Add 0.646m to 1.043m

MHW = 1.689m NAVD88

= 5.541ft NAVD88

Values are relative to the station datum

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SACRAMENTO RIVER TIDAL DATUM

T I D A L D A T U M S

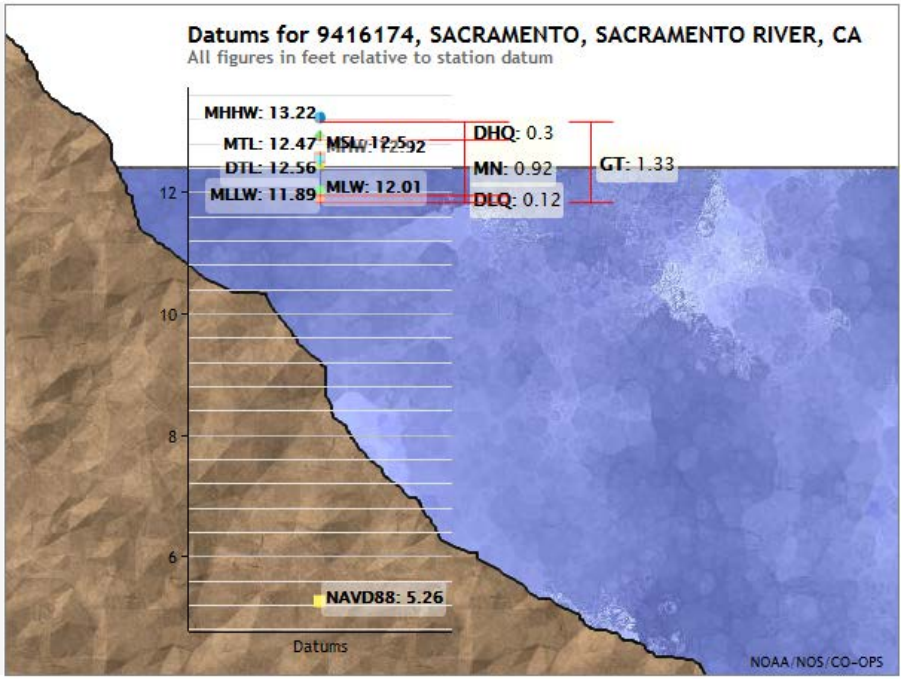
Tidal datums at SACRAMENTO, SACRAMENTO RIVER based on:

LENGTH OF SERIES:	24 MONTHS
TIME PERIOD:	July-Sep only for 1979-1987 except 9/80,8/82,7/83
TIDAL EPOCH:	1983-2001
CONTROL TIDE STATION:	9415144 PORT CHICAGO, SUISUN BAY

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

MEAN HIGHER HIGH WATER	MHHW	=	0.406
MEAN HIGH WATER	MHW	=	0.315
MEAN SEA LEVEL	MSL	=	0.186
MEAN TIDE LEVEL	MTL	=	0.176
MEAN LOW WATER	MLW	=	0.036
MEAN LOWER LOW WATER	MLLW	=	0.000
North American Vertical Datum	NAVD88	=	-2.020

North American Vertical Datum (NAVD88)



Benchmark Sheet

NAVD88 height at MLLW

Add 2.02m to 0.315m

MHW = 2.327m NAVD88

MHW = 7.634ft NAVD88

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NEW DATUMS ARE COMING IN 2022!

- Both a new geometric and a new geopotential (vertical) datum will be released in 2022.
- The realization of the new datums will be through GNSS receivers.
- NGS will provide the tools to easily transform between the new and old datums.

North American Terrestrial Reference Frame of 2022 (NATRF2022)
North American-Pacific Geopotential Datum of 2022 (NAPGD2022)
GEOID2022

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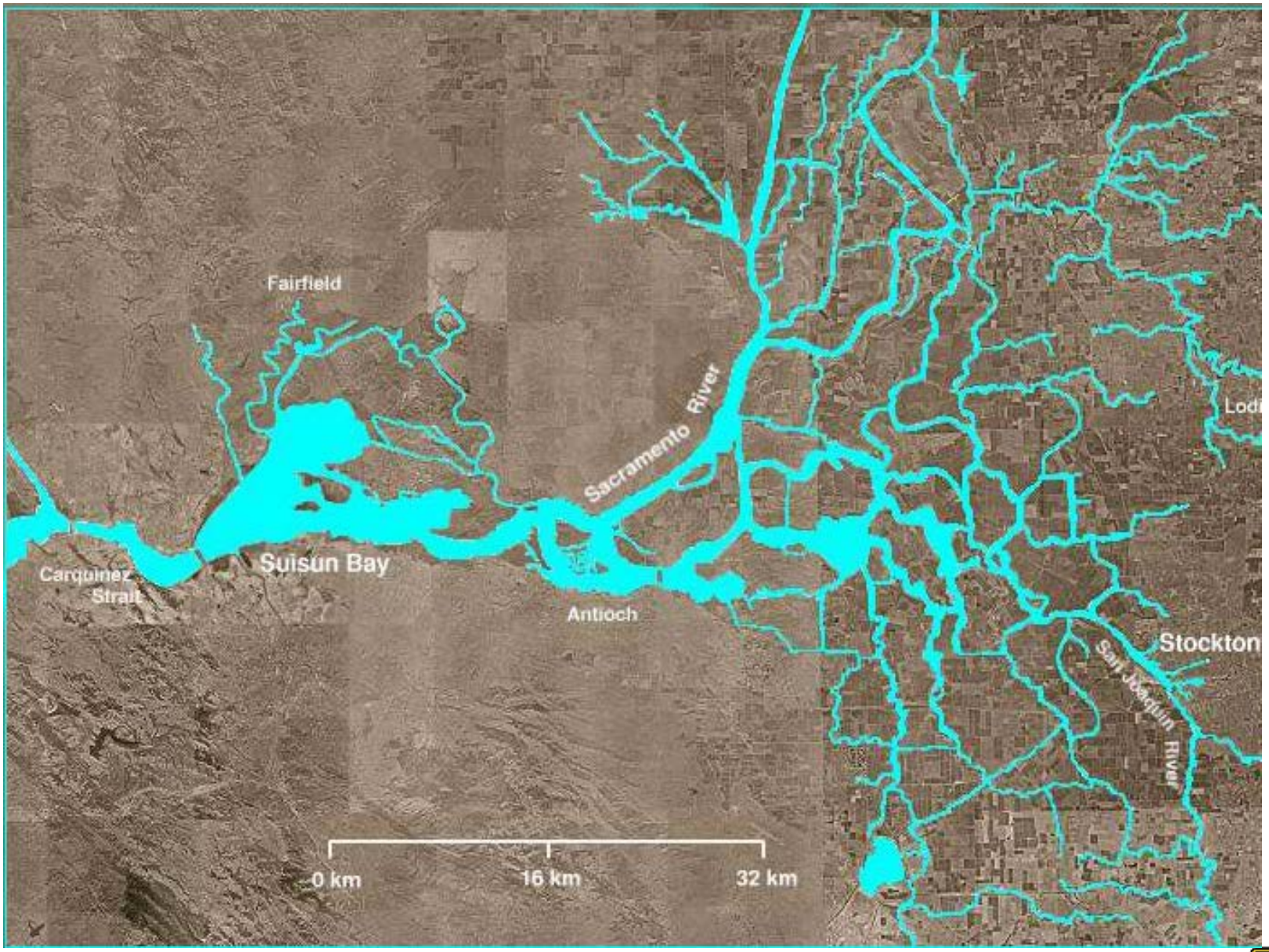

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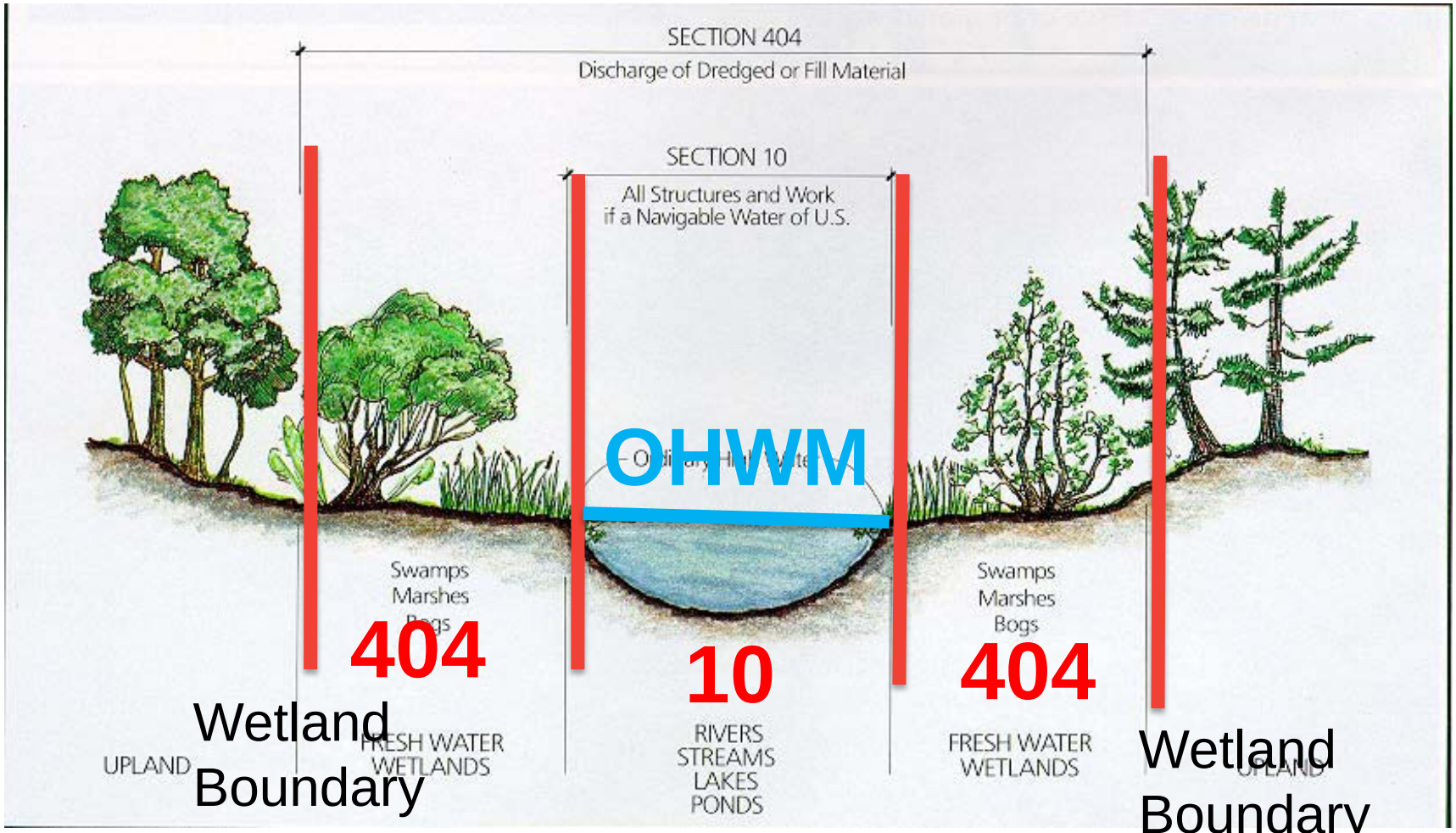

TIDAL/NO-TIDAL INFLUENCE

Inland rivers and lakes

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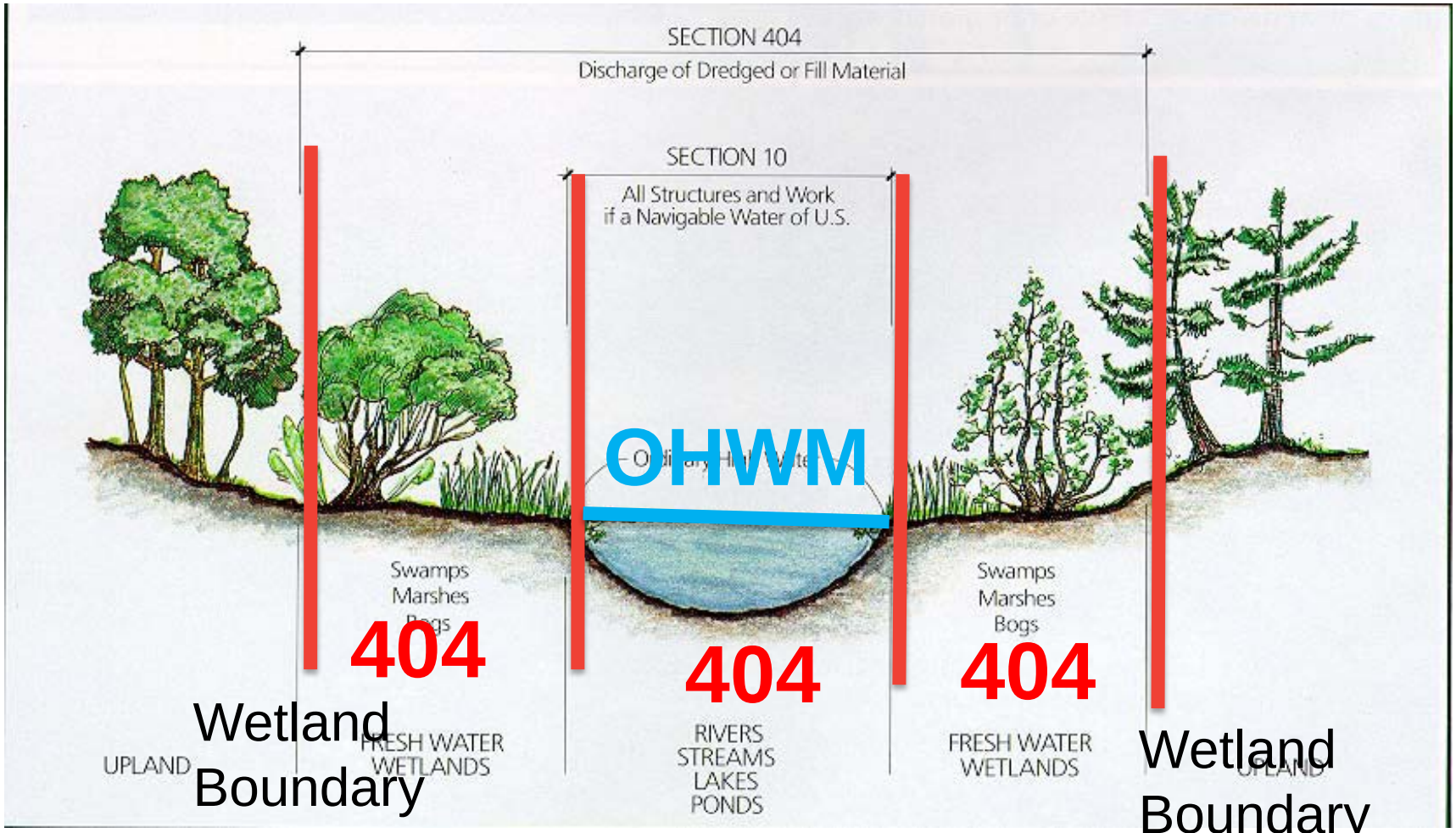

NO-TIDAL INFLUENCE

Inland rivers and lakes

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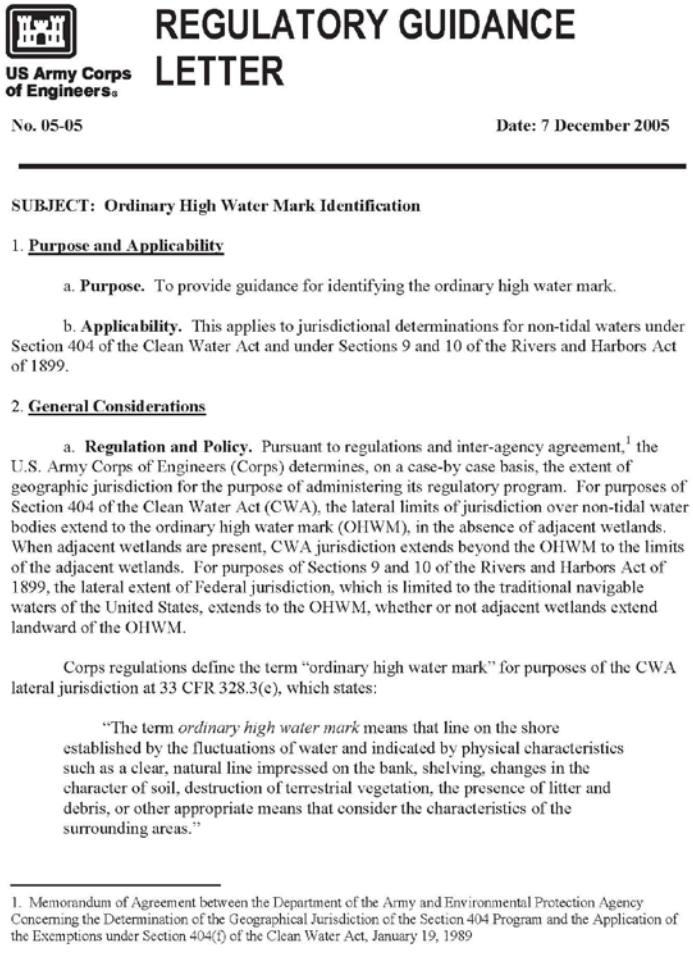
OHWM CRITERIA

The concept of “ordinary high water” encompasses water levels that are ***above average, but not extreme, and that occur with some regularity***

The OHWM should generally be represented by a **physical mark on the landscape**

OHWM indicators should be **fairly stable/consistent over time**

OHWM IDENTIFICATION



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REGULATORY GUIDANCE LETTER

No. 05-05 Date: 7 December 2005

SUBJECT: Ordinary High Water Mark Identification

1. Purpose and Applicability

a. **Purpose.** To provide guidance for identifying the ordinary high water mark.

b. **Applicability.** This applies to jurisdictional determinations for non-tidal waters under Section 404 of the Clean Water Act and under Sections 9 and 10 of the Rivers and Harbors Act of 1899.

2. General Considerations

a. **Regulation and Policy.** Pursuant to regulations and inter-agency agreement,[1] the U.S. Army Corps of Engineers (Corps) determines, on a case-by case basis, the extent of geographic jurisdiction for the purpose of administering its regulatory program. For purposes of Section 404 of the Clean Water Act (CWA), the lateral limits of jurisdiction over non-tidal water bodies extend to the ordinary high water mark (OHWM), in the absence of adjacent wetlands. When adjacent wetlands are present, CWA jurisdiction extends beyond the OHWM to the limits of the adjacent wetlands. For purposes of Sections 9 and 10 of the Rivers and Harbors Act of 1899, the lateral extent of Federal jurisdiction, which is limited to the traditional navigable waters of the United States, extends to the OHWM, whether or not adjacent wetlands extend landward of the OHWM.

Corps regulations define the term "ordinary high water mark" for purposes of the CWA lateral jurisdiction at 33 CFR 328.3(e), which states:

> "The term *ordinary high water mark* means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."

1. Memorandum of Agreement between the Department of the Army and Environmental Protection Agency Concerning the Determination of the Geographical Jurisdiction of the Section 404 Program and the Application of the Exemptions under Section 404(f) of the Clean Water Act, January 19, 1989

- "Corps districts generally rely on physical evidence to ascertain the lateral limits of jurisdiction…"
- "In addition, districts use…stream gage data, flood predictions, historic records of water flow, and statistical evidence."
- "…districts should generally try to identify two or more characteristics, unless there is particularly strong evidence of one."
- "…districts should be careful to look at characteristics associated with OHW events, which occur on a regular or frequent basis."

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AQUATIC RESOURCE DELINEATION

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"A statement that the delineation has been conducted in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual and appropriate regional supplement(s). The regional supplement(s) used must be identified. **For ordinary high water mark (OHWM) delineations, a statement identifying the use of the OHWM field guide must be included."**

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ARID WEST OHWM FIELD GUIDE

ERDC/CRREL TR-08-12 A **Field Guide** to the Identification of the Ordinary High Water Mark (OHWM) in the **Arid West R**egion of the Western United States by Lichvar, Robert; McColley, Shawn, M, August 2008

Supporting Research and Technical Reports

ERDC/CRREL TR-13-3 Channel Classification across Arid West Landscapes in Support of OHW Delineation (Lefebvre et al. 2013)

ERDC/CRREL TR-13-2 Survey of OHWM Indicator Distribution Patterns across Arid West Landscapes (Lefebvre et al. 2013)

ERDC/CRREL TR-11-12 Ordinary High Flows and the Stage-Discharge Relationship in the Arid West Region (Curtis et al. 2011)

ERDC/CRREL TR-09-5 Vegetation and Channel Morphology Responses to Ordinary High Water Mark Discharge Events in Arid West Stream Channels (Lichvar et al. 2009)

ERDC/CRREL TR-07-16 Review and Synopsis of Natural and Human Controls on Fluvial Channel Processes in the Arid West (Field and Lichvar 2007)

ERDC/CRREL TR-06-05 Distribution of Ordinary High Water Mark (OHWM) Indicators and Their Reliability in Identifying the Limits of "Waters of the United States" in Arid Southwestern Channels (Lichvar et al. 2006)

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WMVC OHWM FIELD GUIDE

ERDC/CRREL TR-14-13 A **Guide** to Ordinary High Water Mark (OHWM) Delineation for Non-Perennial Streams in the **Western Mountains, Valleys, and Coast Region of the United States** by Mersel, Matthew King; Lichvar, Robert August 2014

Supporting Research and Technical Reports

ERDC/CRREL TR-14-11 Occurrence and Distribution of Ordinary High Water Mark (OHWM) Indicators in Non-perennial Streams in the Western Mountains, Valleys, and Coast Region of the United States (Mersel et al. 2014)

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OHWM DATA SHEET

ARID WEST

Appendix B in Arid West Field Guide
ERDC/CRREL TR-08-12

ERDC/CREEL TN-01-1 Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States

WMVC

Google search: OHWM Delineation Datasheet

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CONCEPTS OF THE OHWM

We have a general notion of the hydrology associated with the OHWM
(average < OHWM < extreme)

BUT, the OHWM is ultimately defined by physical characteristics and should be represented by an actual mark on the landscape

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CONCEPTS OF THE OHWM

Indicators of ordinary high water should be ordinary themselves (i.e., relatively stable; consistently present and identifiable over time and by different investigators)

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Photo 28. Ephemeral tributary, Converse County, WY. White lines mark approximate location of OHWM.

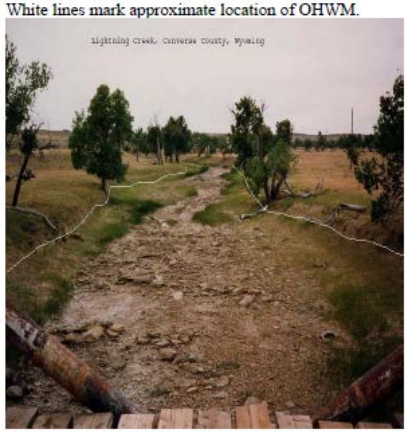

Photo 20. Unnamed ephemeral tributary, TX. Water flows typically during and after storm events. Yellow lines mark approximate location of OHWM.

Photo 21. Soft-bottom intermittent tributary with a flood control levee, Ventura County, CA.

Photo 29. Ephemeral tributary, a concrete flood control channel, Santa Barbara, CA.

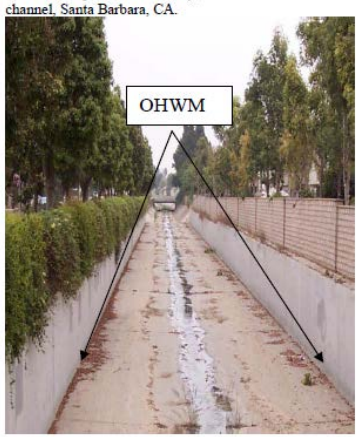

Photo 22. Desert ephemeral tributary, Los Angeles County, CA.

Photo 37. Wetland is adjacent to a non-RPW, AR. Red lines mark approximate location of OHWM.

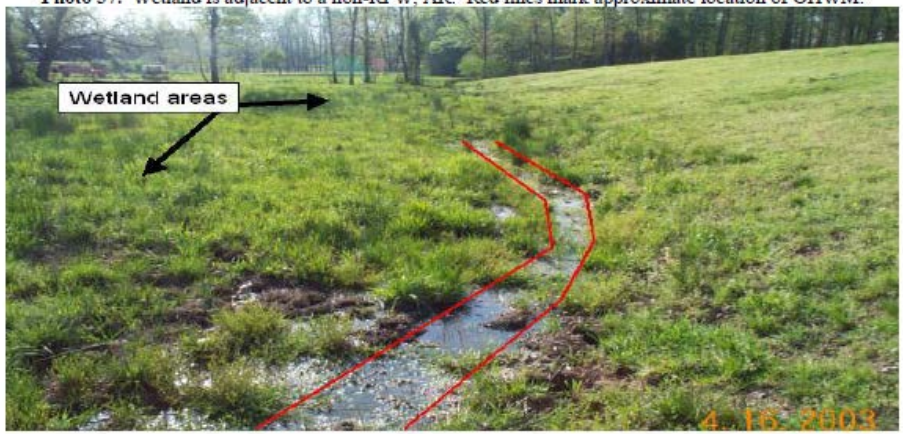

Photo 27. Red Stone Creek (ephemeral tributary), Larimer County, CO. White line marks approximate location of OHWM.

Photo 42. Impoundment on an RPW, South Atlantic Division. Water flows into a TNW; water is jurisdictional under the CWA. Red lines mark the approximate location of the OHWM.

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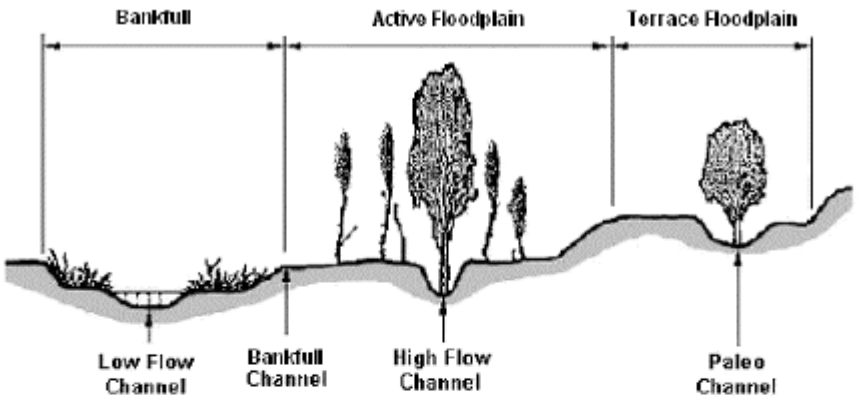
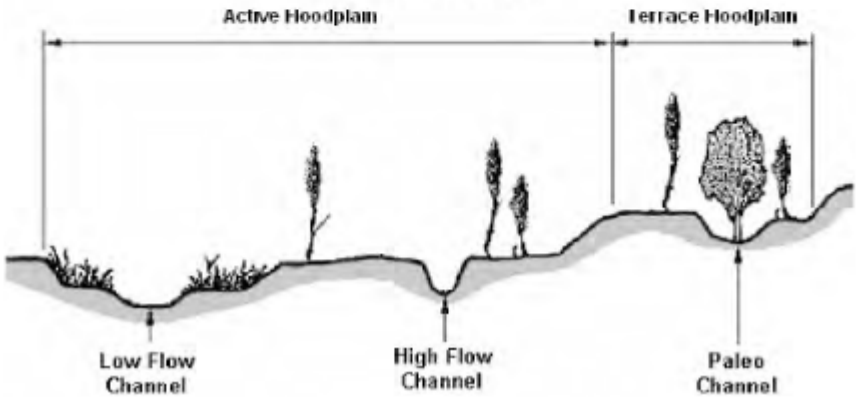
BANKFULL + ACTIVE FLOODPLAIN = ACTIVE CHANNEL



a. Perennial channel forms.



Change from 2008 Field Guide

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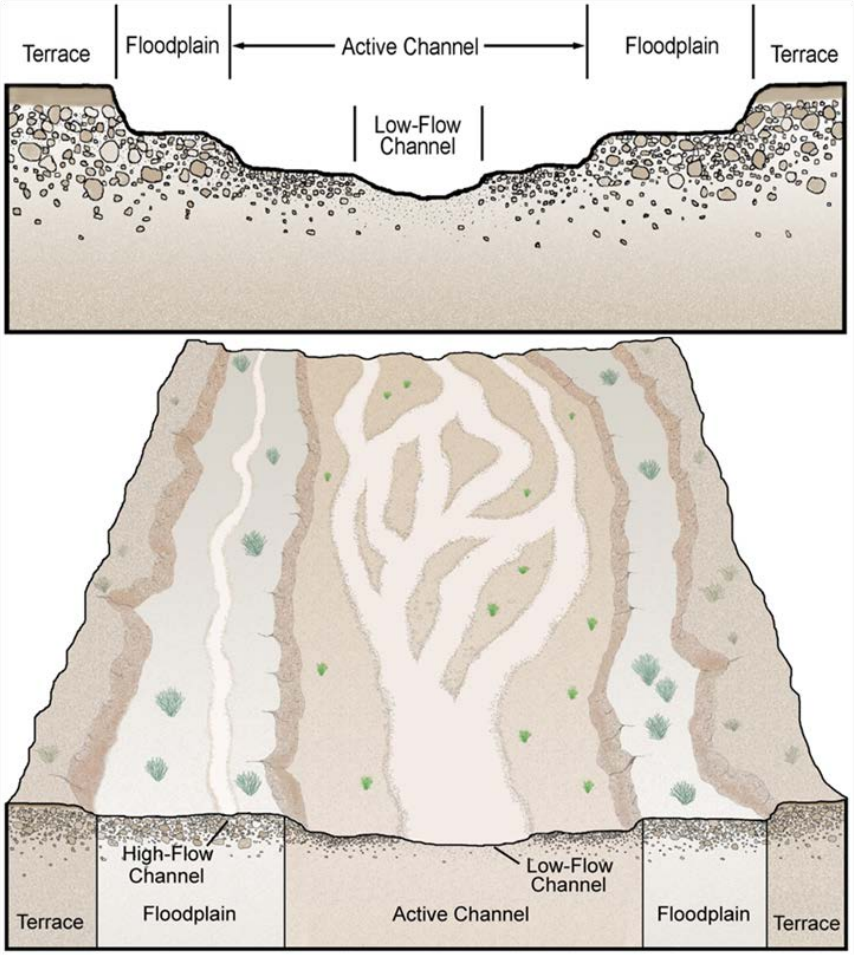
THE ACTIVE CHANNEL



- The area of a stream system within which the local hydrologic regime and geomorphic processes are effective in maintaining a **linear topographic depression** on the landscape, typically characterized by the presence of a bed and banks

- **Note changes in terminology since the 2008 manual:**
  - bankfull channel now referred to as the low-flow channel
  - active floodplain now referred to as the active channel
  - low terrace now referred to as the floodplain

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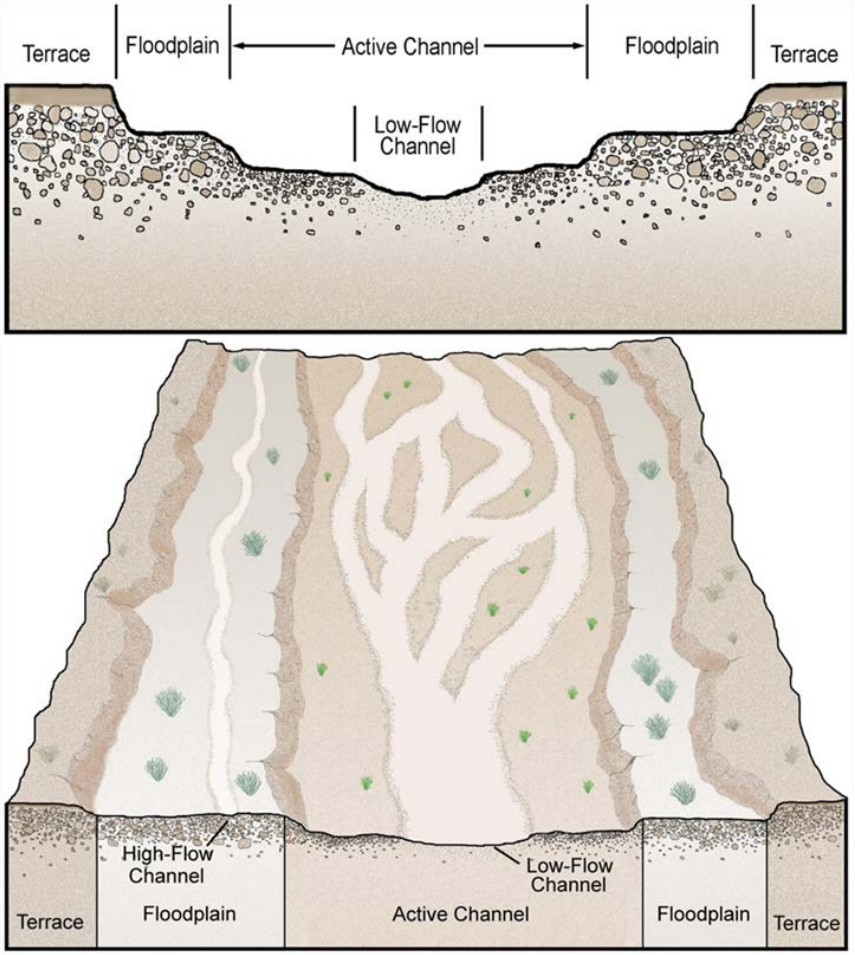
THE ACTIVE CHANNEL



- The only hydrogeomorphic unit that is **common** to essentially every river or stream
- Fully **contains streamflow** the vast majority of time
- Where the **majority of sediment transport** processes occur
- Established and maintained by flows that typically **recur on the order of several times per year or decade**

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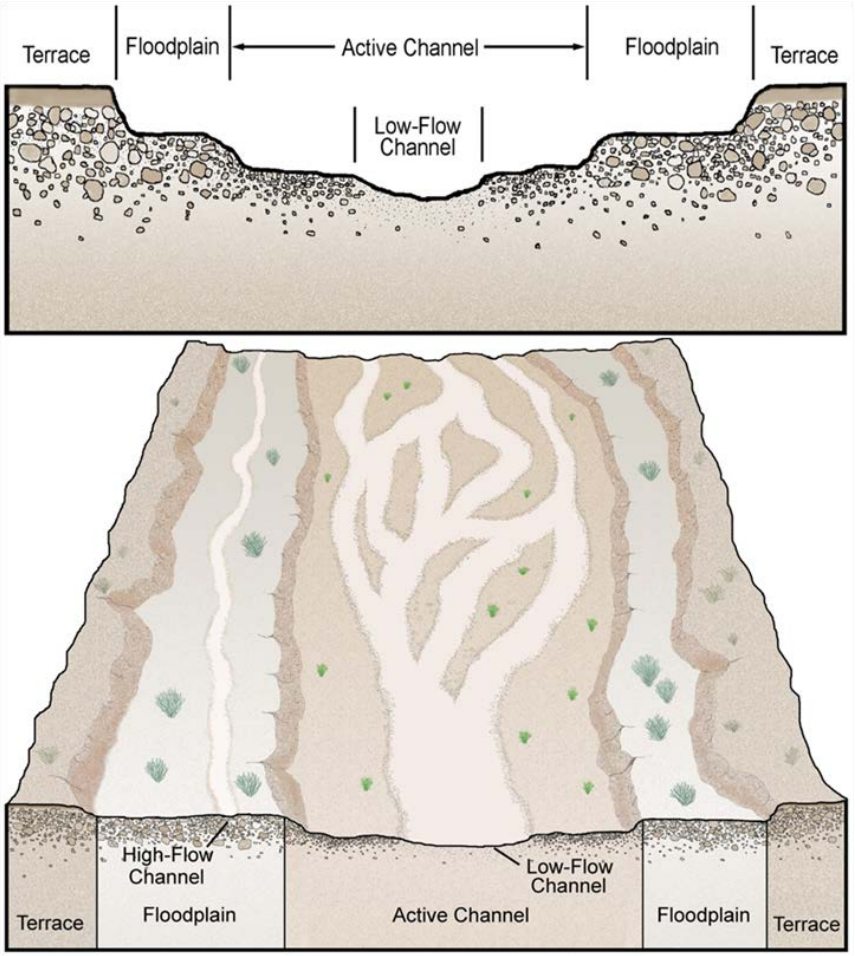
OHWM = ACTIVE CHANNEL BOUNDARY



- Hydrogeomorphic significance to active channel boundary; consistent with OHWM
- **Topography** (break in slope)
  - Channel topography formed by sediment transport in moderate events
- **Sediment**
  - Function of how vigorous the flow is
  - Coarse sediment in main channel, finer on floodplains
- **Vegetation**
  - Balance between supply of water and vigorous flow that uproots vegetation

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ACTIVE CHANNEL “SIGNATURE”

- The active channel commonly leaves a physical and/or biological “signature” on the landscape

- Primary indicators of the active channel signature are:
  - **Topographic breaks in slope**
  - **Changes in sediment characteristics**
  - **Changes in vegetation characteristics**

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ACTIVE CHANNEL "SIGNATURE"

Policy

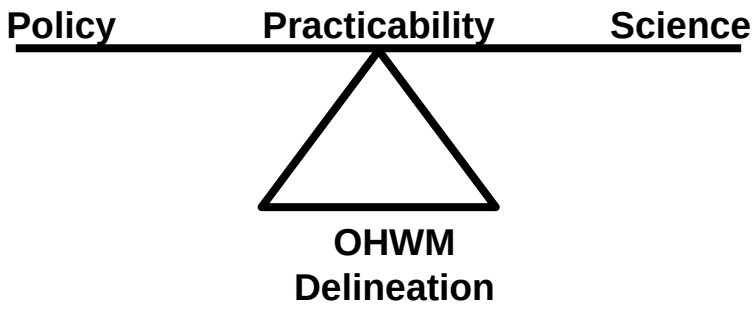
- Leaves a mark on the landscape
- A proxy for the extent of recurring high flows

Science

- Hydrogeomorphic significance

Practicability

- Consistent feature across different landscapes/stream types
- Relatively stable over time



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ACTIVE CHANNEL

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BED & BANK

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SLOPE

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CHANGE IN VEGETATION COVER

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CHANGE IN TEXTURE

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DRIFT

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CHANGE IN VEGETATION SPECIES

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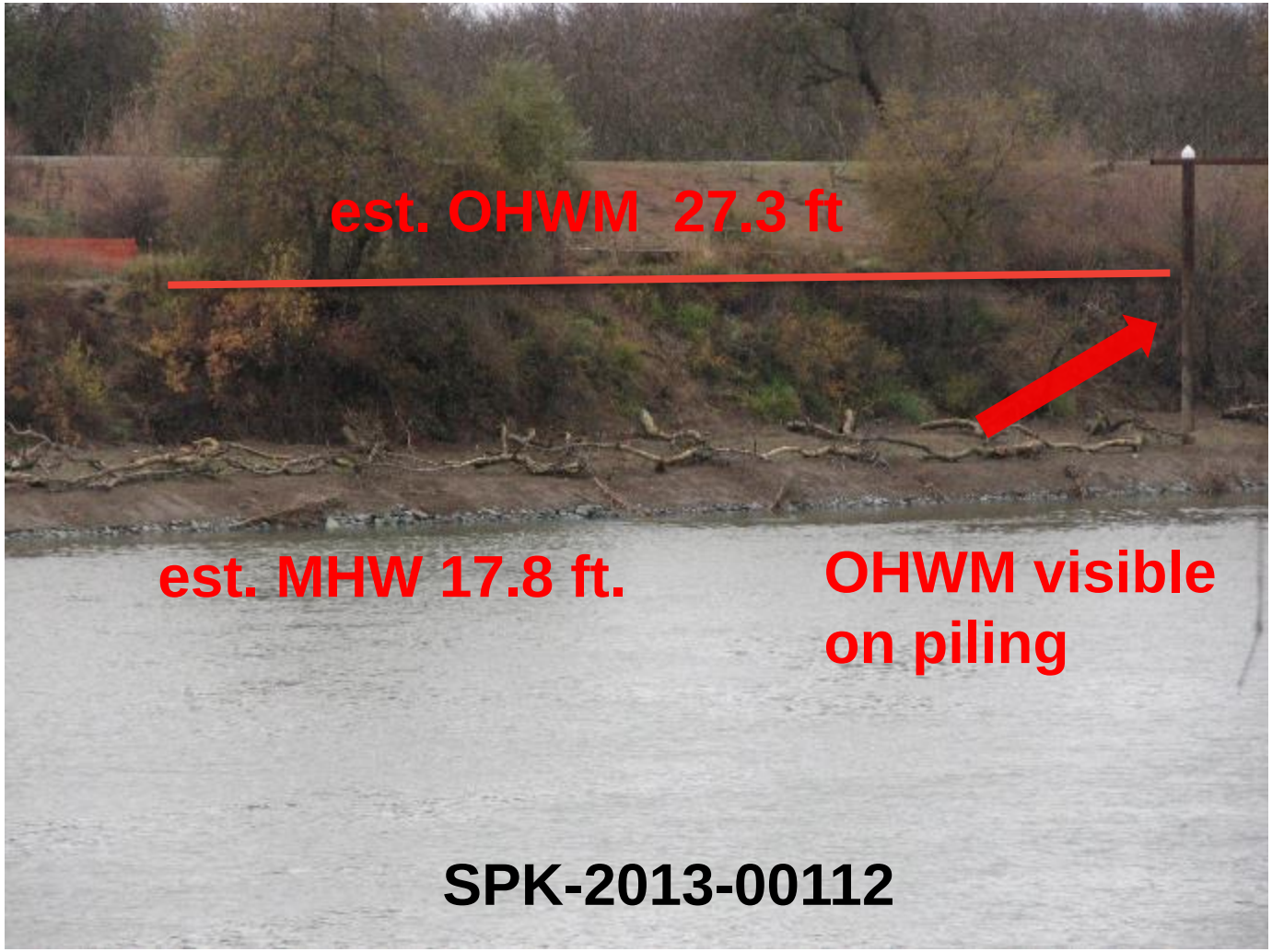
RM 72.7 SACRAMENTO RIVER



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RM 72.7 SACRAMENTO RIVER

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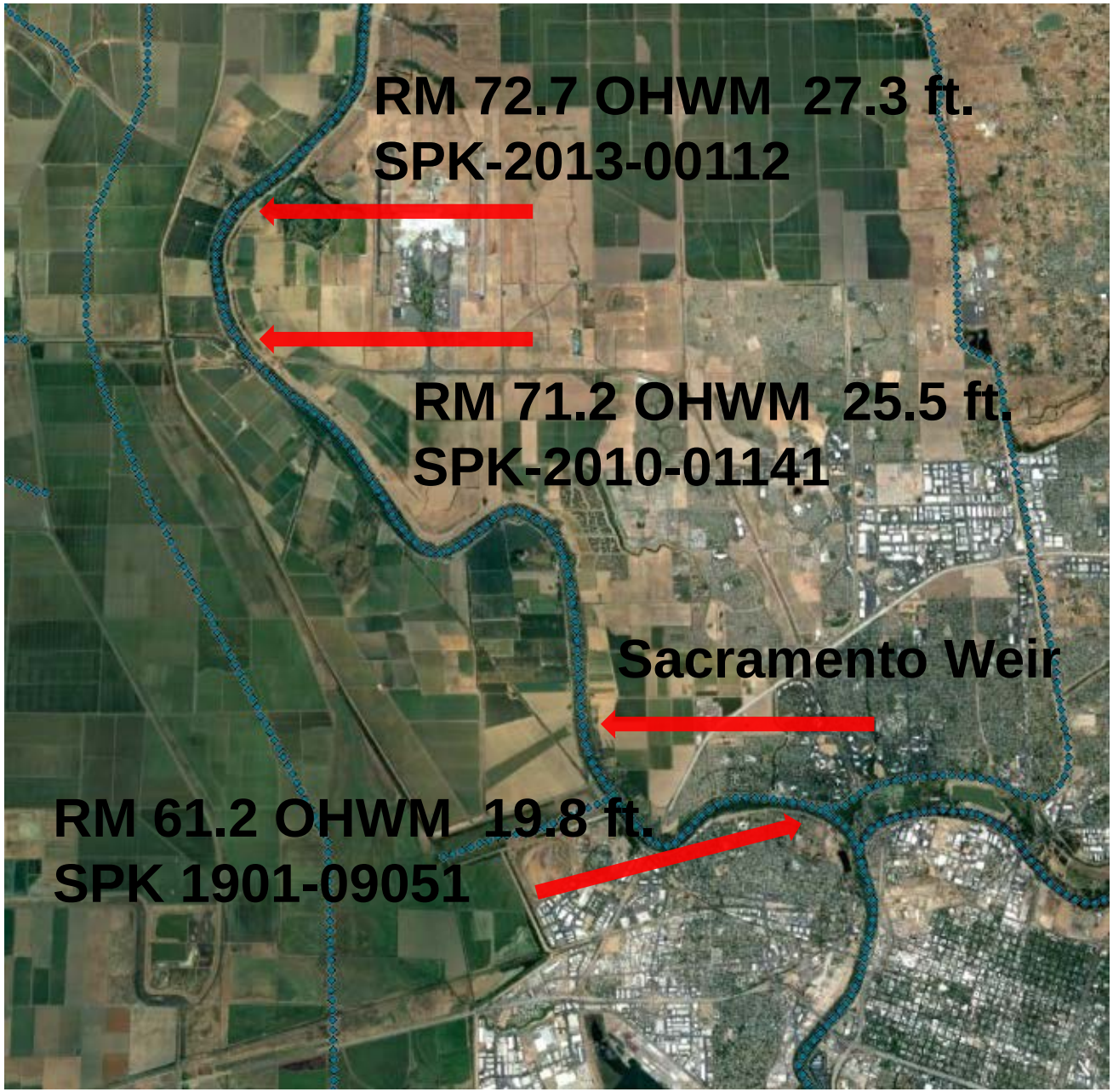

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OHWM KEY POINTS

The active channel boundary commonly leaves a physical/biological signature on the landscape expressed in terms of multiple primary indicators:

- **A topographic break in slope**
- **Changes in sediment characteristics (texture, soil development)**
- **Changes in vegetation characteristics (density, maturity, species composition)**

The OHWM should generally correspond with features evidenced to be:

- Representative of **long-term hydrologic conditions** rather than individual flow events
- Representative of **high-flow conditions** rather than low or average flow conditions
- **Relatively stable** (i.e., consistently present and identifiable over time)

The OHWM should be identified based on the **site conditions at the time of assessment in conjunction with auxiliary supporting data**. Speculation as to past or future stream conditions should be minimized without ample supporting evidence.

Supporting Research and Technical Reports

Synthesizing the Scientific Foundation for Ordinary High Water Mark Delineation in Fluvial Systems (Wohl et al. 2016)

The Benefits and Limitations of Hydraulic Modeling for Ordinary High Water Mark Delineation (Gartner et al. 2016)

Hydrologic Modeling and Flood Frequency Analysis for Ordinary High Water Mark Delineation (Gartner et al. 2016)

Integrating Hydrologic Modeling, Hydraulic Modeling, and Field Data for Ordinary High Water Mark Delineation (Gartner et al. 2016)

Occurrence and Distribution of Ordinary High Water Mark (OHWM) Indicators in Non-perennial Streams in the Western Mountains, Valleys, and Coast Region of the United States (Mersel et al. 2014)

A Review of Land and Stream Classifications in Support of Developing a National Ordinary High Water Mark Classification (Mersel et al. 2014)

Channel Classification across Arid West Landscapes in Support of OHW Delineation (Lefebvre et al. 2013)

Survey of OHWM Indicator Distribution Patterns across Arid West Landscapes (Lefebvre et al. 2013)

Supporting Research and Technical Reports

Ordinary High Flows and the Stage-Discharge Relationship in the Arid West Region (Curtis et al. 2011)

Vegetation and Channel Morphology Responses to Ordinary High Water Mark Discharge Events in Arid West Stream Channels (Lichvar et al. 2009)

Review and Synopsis of Natural and Human Controls on Fluvial Channel Processes in the Arid West (Field and Lichvar 2007)

Distribution of Ordinary High Water Mark (OHWM) Indicators and Their Reliability in Identifying the Limits of "Waters of the United States" in Arid Southwestern Channels (Lichvar et al. 2006)

Regulatory Guidance Letter: Ordinary High Water Mark Identification (USACE 2005)

Review of Ordinary High Water Mark Indicators for Delineating Arid Streams in the Southwestern United States (Lichvar and Wakeley 2004)

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