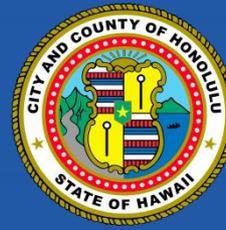


Hanalei Stream Bank Restoration Project and In-Water BMP Design





Introduction

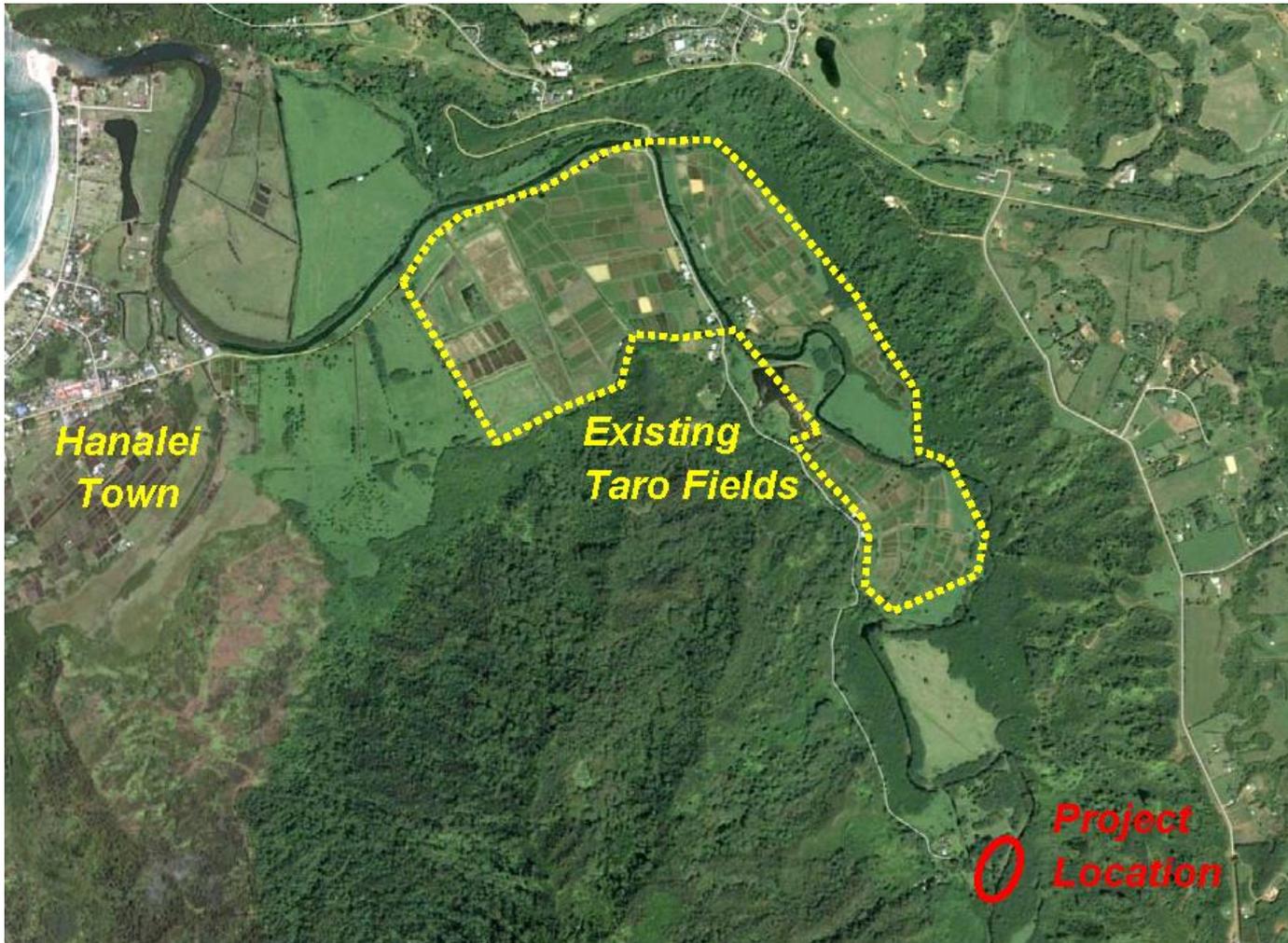
- **Noah Wong, PE**
Civil Engineer
AECOM
noah.wong@aecom.com

Background

- ❑ Stream bank breach first occurred during a November 1995 flood event
- ❑ Continuous soil erosion occurred at the breach and along the breach channel
- ❑ Reduction of water at the existing USFWS irrigation intake system
- ❑ Less water available to taro farmers and wildlife refuge
- ❑ Emergency Proclamation 2012 and 2018
- ❑ Restoration construction completed November 2015
- ❑ Multiple flooding events
- ❑ Existing stream bank overtops naturally



Project Location



**Existing Taro Fields
(Hanalei Wildlife Refuge)**

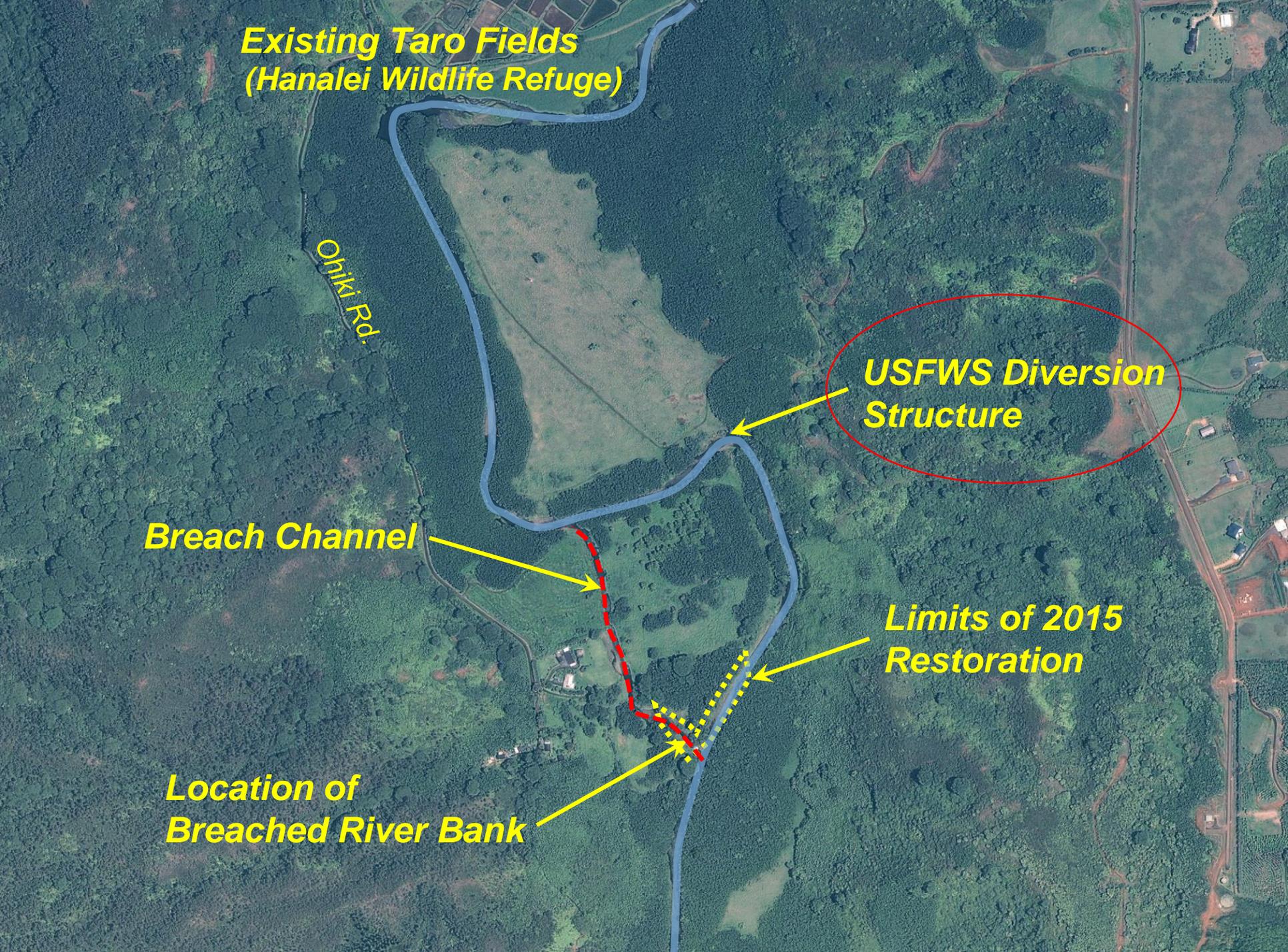
Ohiki Rd.

**USFWS Diversion
Structure**

Breach Channel

**Limits of 2015
Restoration**

**Location of
Breached River Bank**



Problems

- ❑ Soil erosion
- ❑ Environmental pollution
- ❑ Stream and reef degradation
- ❑ Reduction of water at irrigation intake system
- ❑ Loss of water for taro
- ❑ Loss of water for wildlife refuge
- ❑ Loss of property
- ❑ Formation of breach channel



Soil Erosion

- ❑ Erosion along breach channel has deposited an estimated 28,000 tons of sediment into Hanalei Bay.



Breach Channel

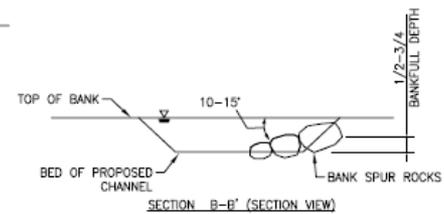
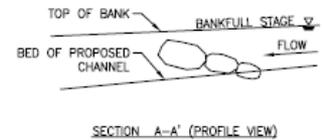
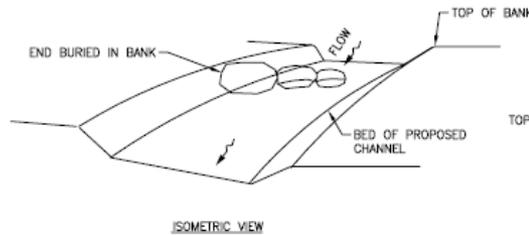
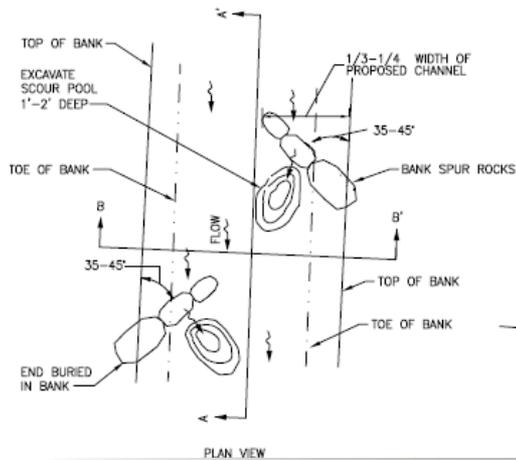
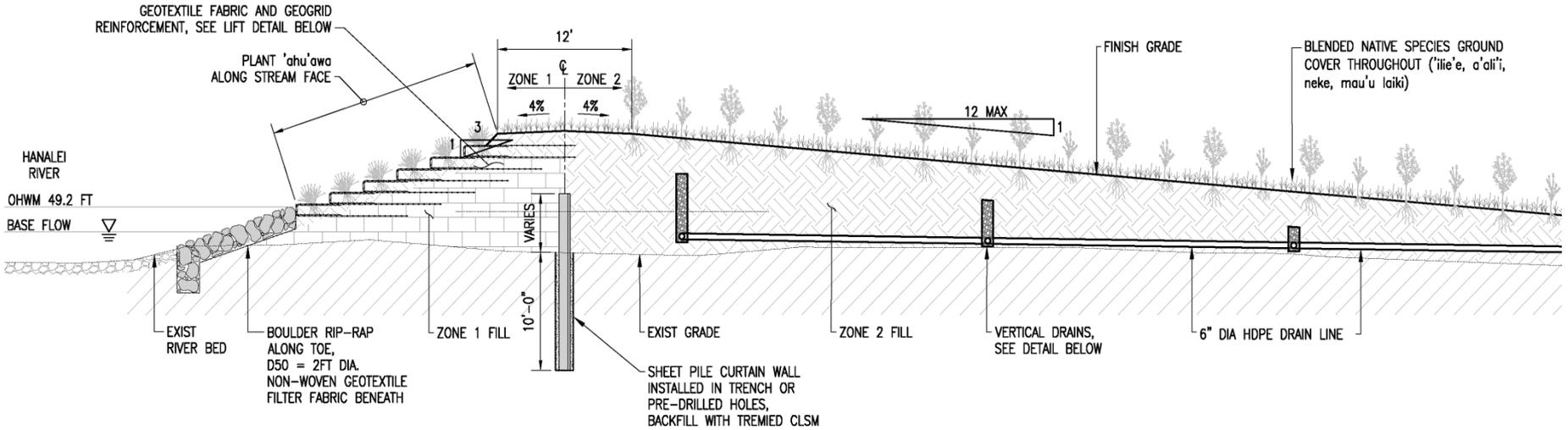


Solution

- ❑ Repair the streambank at the breach and restore the main river channel
- ❑ Vegetated reinforced earth construction
- ❑ Match the estimated pre-breach bank elevation
- ❑ Utilize native and other vegetation suitable for the area
- ❑ Rock rip-rap protection along water line
- ❑ Bank spurs within main river



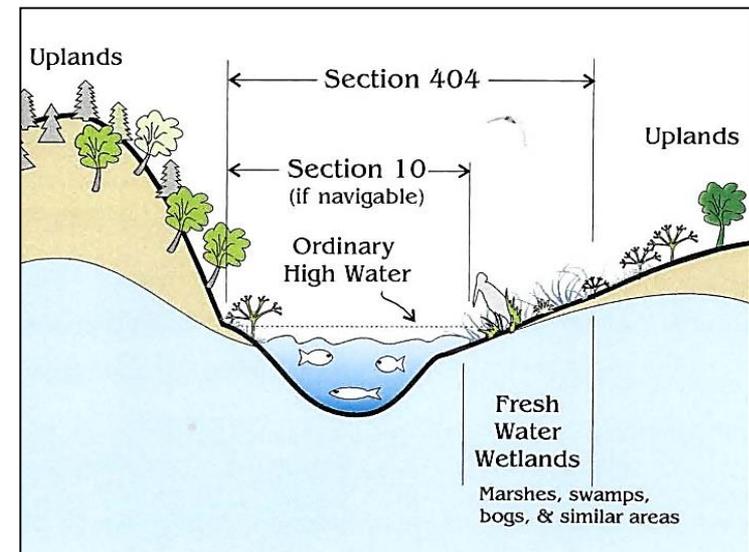
Solution





Permits

- ❑ Army Corp of Engineers CWA Section 404 Permit
- ❑ Section 401 Water Quality Certification
- ❑ Coastal Zone Management Federal Consistency Review
- ❑ National Pollutant Discharge Elimination Permit (NPDES)
- ❑ Conservation District Use Permit
- ❑ Stream Channel Alteration Permit
- ❑ State Historic Preservation Division Consultation



CWA § 404 Permit Conditions

□ Permit Project Description

- Purpose, volume, and area of each specific type of fill
 - Earthen berm = 1,288 CY of fill (684 CY rock and 604 CY soil) within 0.625 acres of the river
 - Rock vane and bank spurs = 36 CY of fill within 0.04 acres of the river
 - Temporary cofferdam of large boulders collected on-site and reused for construction of permanent improvements



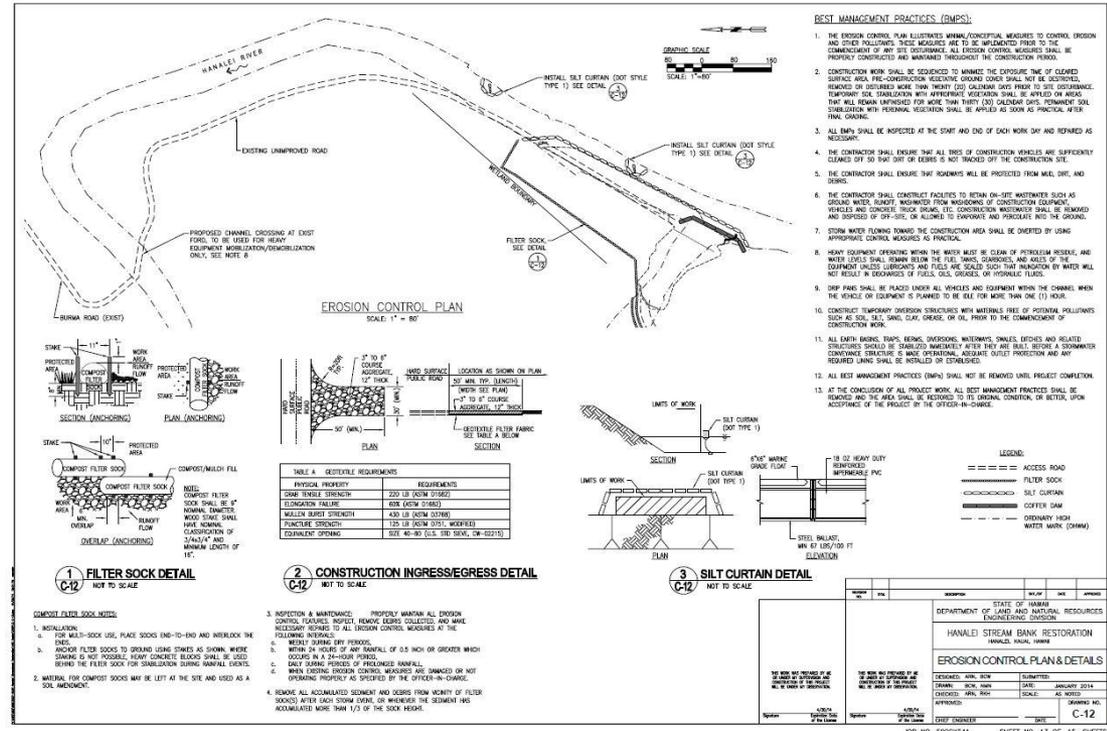
Construction Challenges

- Dynamic river conditions with large flows
- Limited work area
- Remote project location
- Heavy rainfall
- Permitting
- Delays
- Revisions to BMPs



BMPs

- ❑ Selected based on agency expectations and previous success
- ❑ Manage sediment by removing flow from the work area
- ❑ Understand project site conditions
- ❑ Minimize discharge
- ❑ Minimize exposure



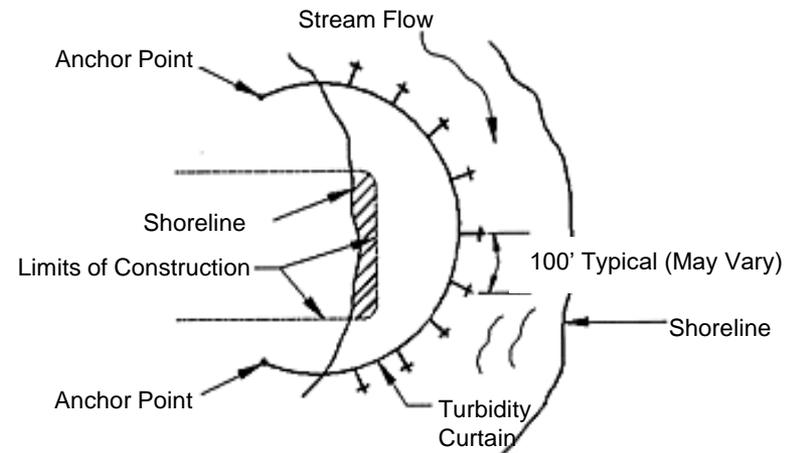
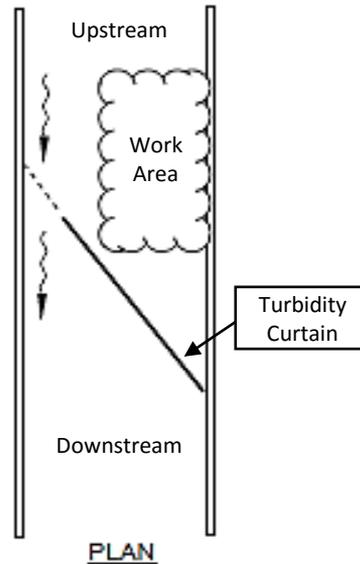
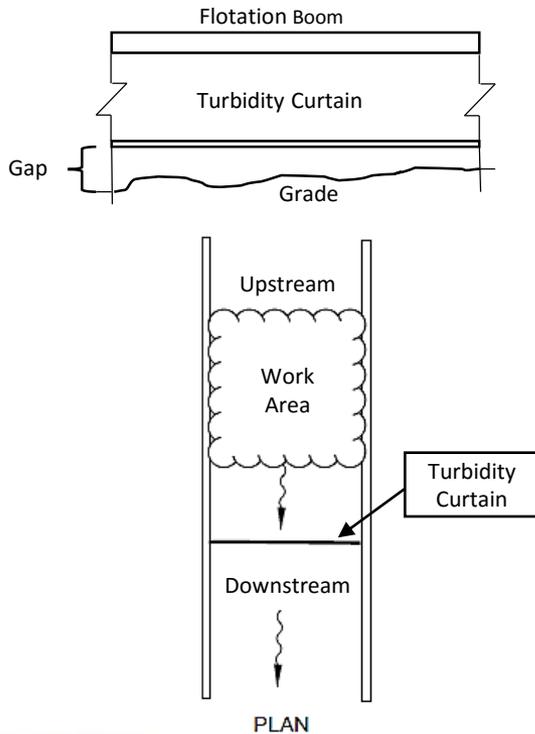
BMPs

- ❑ Work during low stream flows
- ❑ Clean equipment and vehicles
- ❑ Earthen cofferdam
- ❑ Type III Turbidity barriers
- ❑ Compost filter socks
- ❑ Stockpile protection
- ❑ Other alternatives
 - Pump around systems
 - Divert only a portion of the channel
 - Work in wet
 - Rapid construction



In-water BMPs: Turbidity Barriers

- ❑ Never allowed to fully block stream flow
- ❑ Backup Curtains
- ❑ Best in slow, calm water
- ❑ Source of turbidity if improperly used



In-water BMPs: Cofferddam and Turbidity Curtains

- ❑ Type I – calm water
- ❑ Type II – 1.5 ft/s
- ❑ Type III – 2.5 ft/s
- ❑ Challenging to install in moving water
- ❑ Difficult to anchor into stream bed



In-water BMPs: Cofferdam and Turbidity Curtains

- ☐ Cofferdam construction



June 2015 storm event



Construction 2015

- ❑ Steel sheet piles



Construction 2015



Construction 2015



Construction 2015



Construction 2015



Construction 2015

- ☐ Performed in-stream work during low flows



- ☐ Constructing bank spur



- ☐ Restoring river channel

Construction 2015

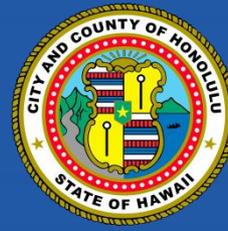


Construction 2015



Construction 2015





Thank You!

Questions?

Noah Wong
noah.wong@aecom.com

