Attachment C:
Landward Levee Alignment
East of Artesian Slough Memo

South San Francisco Bay
Shoreline Project

City of San Jose
Santa Clara County

December 2017

TO: South Bay Shoreline Protection Project Team (internal)

FROM: Christina Toms
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PLANNING DIVISION

DATE: June 8, 2017

SUBJECT: South Bay Shoreline Protection Project: Justification for landward levee alignment

The South Bay Shoreline Protection Project (Project) is a joint Flood Risk Management (FRM)/Ecosystem Restoration (ER) effort between the US Army Corps of Engineers (Corps), California Coastal Conservancy (Conservancy), and Santa Clara Valley Water District (District). The purpose of this memo is to briefly memorialize the Water Board's reasons for preferring a landward levee alignment (Figure 1) east of Artesian Slough to the Locally Preferred Plan (Figure 2) proposed in the US Army Corps of Engineers' 2015 Final Interim Feasibility Study/EIS/EIR.

1. Smaller Earthwork Volumes

The LPP proposes to build the FRM levee east of Artesian Slough along the centerline of the present Pond A18 levee. The precise bathymetry of Pond A18 is not known, but bottom elevations appear to range between +2 and +3 ft NAVD. The Pond A18 is levee is un-engineered, has crest elevations largely below +12 ft NAVD (Figures 3 and 4), and is located in an area with Bay Mud depths of up to 18 ft (see geotechnical appendix to the USACE report). To compensate for the likely settlement that would occur along much of the FRM levee in this area, the Corps proposes to build Reach 4 to an as-built elevation of +19.7 ft NAVD (Reach 5 would be built to +15.2 ft NAVD – the design levee crest – due to negligible local depths of Bay Mud). Figure 5 displays a cross-section of the FRM levee design on top of a cross-section of the existing Pond A18 berm. The Corps report describes a fill volume of approximately **1.55M cy** to construct Reaches 4 and 5; of this volume, approximately 1.2M cy would have to be imported from off-site (Table 1). The levee fill volume calculation assumes a base elevation of 0 ft NAVD, meaning below-grade foundation soils would have to be excavated and treated/compacted to be compatible with FRM levee specs.

The landward levee alignment moves the FRM levee centerline inland where it can capture existing high ground around the Zanker Landfill, the un-engineered berms that separate the San Jose-Santa Clara WWTP's inactive biosolids ponds, and the engineered levee along the active sludge ponds' western boundary (Figures 3 and 4). Of the levee alignment's four segments east of Artesian Slough (Zanker Landfill, Inactive Sludge Ponds, Active Biosolid Ponds Segment 1, and Active Biosolid Ponds Segment 3), only the Inactive Biosolid Ponds segment would require a full core FRM levee (3H:1V side slopes, 16 ft crest width). The Zanker and Active Biosolid Pond segments would likely only require "veneer" treatments to augment existing side slopes, which would ultimately be buried under the 30H:1V ecotone (for example, Figure 6 shows just

such a treatment for the Zanker Landfill). In addition, the negligible depth of Bay Mud deposits beneath most of the landward alignment means that only the portion near the Zanker Landfill would likely have to overbuild, and then only to approximately +16.7 ft NAVD. As a result, the landward levee alignment would likely require less fill volume to construct. Using the Corps' assumption of a levee/ecotone base at 0 ft NAVD, we estimate the landward levee would require roughly **1.45M cy** of material, only 110K cy less than the LPP (Table A-1). However, the alignment's location farther inland likely means that such deep excavation is likely not necessary. Applying conservative assumptions about local topography (City mitigation marsh at +2 ft NAVD, inactive biosolid ponds graded down to +5 ft NAVD, and the interior of Pond A18 at +3 ft NAVD) to the levee fill volume calculation results in an estimate of **895K cy** for the entire levee/ecotone. The ultimate volume necessary for levee construction will likely fall somewhere between these two estimates, and be considerably less than the LPP volume. The landward levee alignment's smaller volumes will likely result in a project that is cheaper and easier to build.

2. Volume, Availability, and Proximity of Inactive Sludge Pond Material

As mentioned previously, construction of the LPP levee and ecotone would require the import of over a million cy of material from off-site locations. This material would have to be trucked to the site, likely stockpiled, and managed until it could be used for construction. The volumes and timing of available material are uncertain due to the variety of projects in the SF Bay Area that require clean fill, particularly other upcoming FRM/ER projects such as Phase 2 of the South Bay Salt Ponds and the SAFER Bay project.

The footprint of inactive biosolid ponds that would be underneath and bayward of the landward levee alignment is approximately 95 acres. This area has an average elevation of +7.7 ft NAVD, slightly above local MHHW of +7.6 ft NAVD; low cordgrass marsh in the area begins to establish at roughly +4.3 ft NAVD (ESA PWA 2012). There is therefore considerable "elevation capitol" within the 95-acre pond footprint to provide material for construction of the ecotone, while still being able to rapidly develop tidal wetland habitats post-restoration. Table A-1 displays the volume of soil available in the inactive biosolid ponds and biosolid piles above a range of elevations.[1] For example, if the ponds and piles were excavated down to an elevation of +5 ft NAVD, they would provide over half a million cy of material for ecotone construction. A likely similar amount of material would be available landward of the levee, in the inactive sludge ponds between Zanker Landfill and the active sludge ponds. Since the inactive ponds are immediately adjacent to the levee/ecotone footprint, material from them would not require extensive trucking or handling to get into place, lowering potential GHG emissions from construction.

Use of inactive sludge pond material provides a "win-win" for the project: it provides a nearby source of construction material (likely making construction quicker and cheaper), and gives the City of San Jose (City) a mechanism to efficiently close its legacy biosolid ponds. The Water Board's practice for other similar properties is to require remedial actions to permanently close sites with contaminants, such as the inactive biosolid ponds, in a manner that will be protective

[1] Table A-1 separates the volumes of the sludge piles from the pond beds/berms because the pile material has slightly elevated levels of cadmium, and should be buried beneath the surface of the ecotone. Preliminary review of inactive sludge pond geotechnical data by Groundwater Protection Division chief Terry Seward indicates that the bed/berm material is largely suitable for ecotone construction. Note that the physical and chemical properties of the legacy biosolids are considerably different from fresher biosolids due to extensive exposure to time and sunlight; this proposal is not meant to address the feasibility of utilizing younger biosolids as a wetland construction medium.

of human health and the environment. This would potentially make it easier for the City to utilize this land consistent with its proposed Master Plan.

3. Elimination of "No Net Loss" as an Obstacle to Permitting

A June 2015 submittal from the Corps to the Water Board indicated that construction of the Project overall (not just Reaches 4 and 5) would require filling of 137.6 acres of wetlands and waters of the State, and would restore 54.7 acres of wetlands along the ecotones of Ponds A12 and A18 as well as the lowered levees around Pond A18. This results in a net loss of 82.9 acres of wetlands and waters. In 2016, the Corps updated this assessment, and calculated a net loss of 101.4 ac from construction of the overall Project. With high rates of sea level rise (estuarine transgression over the ecotone), the Corps estimated that this net loss would shrink to 74.1 acres. In the long term, of course, the Project also facilitates the tidal restoration of 2,900 acres of salt ponds (A9-A15, A18).

Most of the wetlands and waters that would be filled are isolated, non-tidal wetlands, while the restored wetlands would be tidal wetlands within a recovering regional tidal wetland complex. The Corps has argued that the restored wetlands would have comparatively greater habitat values than most of the existing wetlands that would be filled, and they are correct. Nonetheless, the Water Board's historic interpretation and application of the "no net loss" policy makes it difficult to reconcile the certain short-term loss of wetlands and waters with the uncertain long-term recovery of tidal wetland habitats. This is particularly challenging given (1) short-term (Phase 1, A12 and A18) wetland restoration would largely be limited to narrow strips along ecotones and lowered levees, not broad expanses of dendritic tidal marsh plains (Figure 2)[2], and (2) the long-term development of tidal wetland habitats within salt ponds subsided below tidal vegetation elevation thresholds is largely dependent on local sediment supply, sediment accretion rates, and SLR rates, all of which are temporally/spatially variable and challenging to predict (see ESA PWA 2012).

The landward levee alignment effectively eliminates this obstacle by facilitating the short-term restoration of over 70 acres of vegetated marsh within the footprint of the bayward former inactive sludge ponds. These areas could be graded to an appropriate elevation such that as soon as Pond A18 was breached, they would have sufficient "elevation capitol" to rapidly establish and develop vegetated marsh habitats much sooner than lower, subsided areas within the Pond A18 interior. The landward levee alignment also facilitates the enhancement of approximately 66 acres of existing mitigation marshes (managed wetlands) north and west of the Zanker landfill. These mitigation wetlands were developed in the 1980s, when the field of tidal wetland restoration was in its infancy, and are not providing the types of fully functional tidal habitats they were meant to provide. The LPP isolates these wetlands between the FRM levee and the Zanker landfill, further degrading their habitat values; in the long term SLR would gradually reduce opportunities for the mitigation marshes (which sit low in the tidal frame at about +2 to +4 ft NAVD) to drain at low tide. The landward alignment would instead allow these marshes to be directly breached to Pond A18 so that they may develop as fully functional tidal wetlands.[3]

[2] Broad, dendritic marsh plains are much more effective than narrow fringing wetlands at supporting the beneficial uses targeted by tidal wetland restoration, particularly the provision of habitat for rare and endangered species.

[3] This transitional period would likely result in a temporary shift from pickleweed-dominated to cordgrass-dominated habitats; the transition could be executed gradually to minimize impacts to listed species.

The ecological functions and values of the newly restored (in the inactive sludge ponds) and enhanced (in the mitigation marshes) wetlands would be further improved by lowering the Pond A18 "stairstep" levee to marsh elevations between MHHW and EHW (Figure 1). This way, the levee can provide critical high tide refugia that is ***internal*** to the Pond A18/former inactive sludge pond complex, as opposed to the high ride refugia along the outer fringes of the marsh on the ecotone. Internal high tide refugia is critical for listed species such as Ridgway rail and salt marsh harvest mouse that have small home ranges that may be far from terrestrial ecotones. The lowering of this levee (and the rest of the Pond A18 levee) would provide additional upland-to-wetland acreage for the Project's accounting.

Finally, construction of the landward FRM levee and ecotone would require the placement of fill in jurisdictional wetlands within inactive biosolid ponds and the mitigation marshes. The footprint of impact from these fill activities has not yet been calculated, but it would likely be offset by the restoration and enhancement activities described above. Table 1 below presents the approximate differences in post-project habitat types between the landward levee alignment and the LPP. Note how the landward levee alignment restores significantly more vegetated wetland areas (highlighted in green) than the LPP.

Table 1. Estimated Post-Project Habitats for the Landward Levee Alignment and the LPP.

Habitat Type	**Acreages – Landward**	**Acreages – LPP**
Upland	84	85
High Marsh – Pickleweed	24	4
High Marsh – Cordgrass	77	13
Low Marsh – Cordgrass	83	17
High Intertidal Mudflat	386	355
Mid-High Intertidal Mudflat	337	321
Mid-Low Intertidal Mudflat	30	31
Low Intertidal Mudflat	25	16
Shallow Subtidal B	27	19
Shallow Subtidal A	>1	>1
Managed Wetlands	N/A	90

4. Police Bomb Disposal Range

One of the legacy sludge ponds south of the proposed landward levee alignment is used on a non-continual basis (a few times a month) by local police departments for bomb disposal, target practice, and other related uses. The Project proposes constructing a new portion of the Bay Trail on top of the levee. In the case of the landward alignment, a short (~300 ft) portion of the new trail would therefore be located adjacent to this pond. To avoid conflicts with police activities, the trail in this area could be subject to temporary closures (requiring gates, and someone to open/close them), or routed instead farther out (bayward) along the ecotone levee, possibly with a boardwalk. The proximity of the disposal range to the levee needs to be evaluated further but should not preclude the use of this alignment.

5. Conclusion

The landward levee alignment eliminates a major obstacle to South Bay Shoreline Protection Project permitting, would likely require less dirt to build and be cheaper and easier to construct, and provides an alternative mechanism for the City of San Jose to address their legacy biosolid ponds.

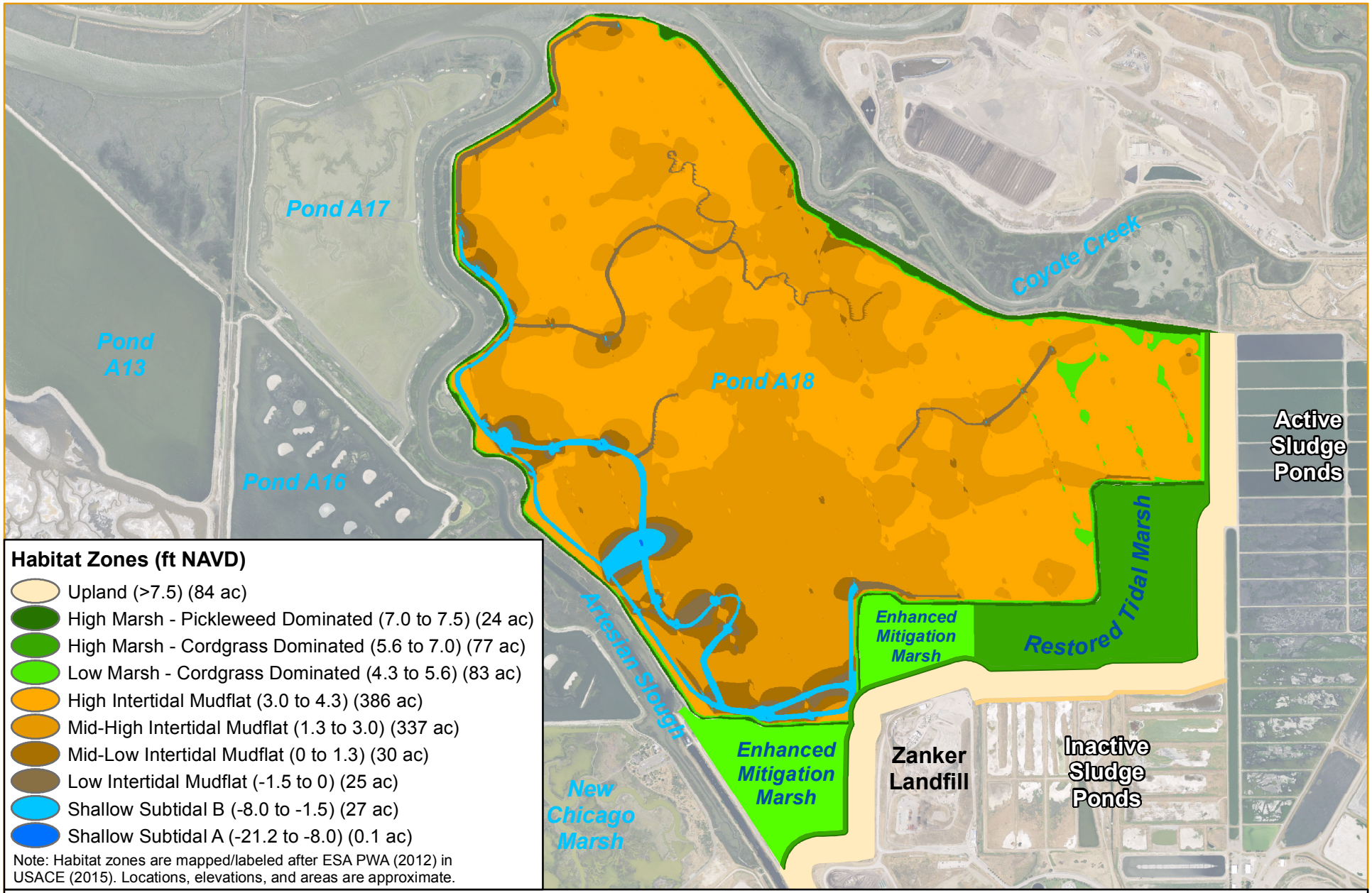

Figure 1
South Bay Shoreline Protection Project
Landward Levee Alignment:
Projected Post-Restoration Habitats

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

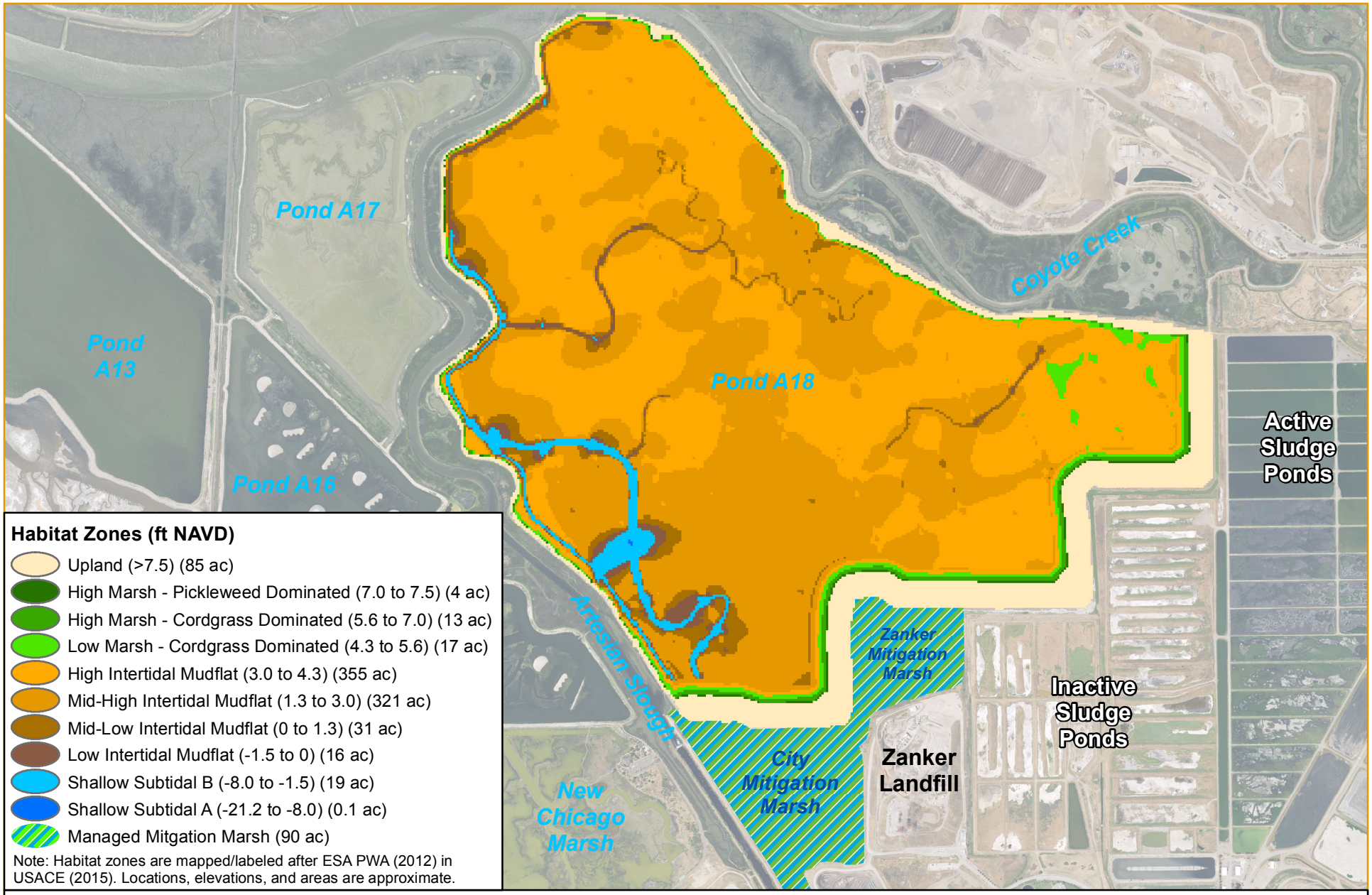

Figure 2
South Bay Shoreline Protection Project
LPP Levee Alignment:
Projected Post-Restoration Habitats

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

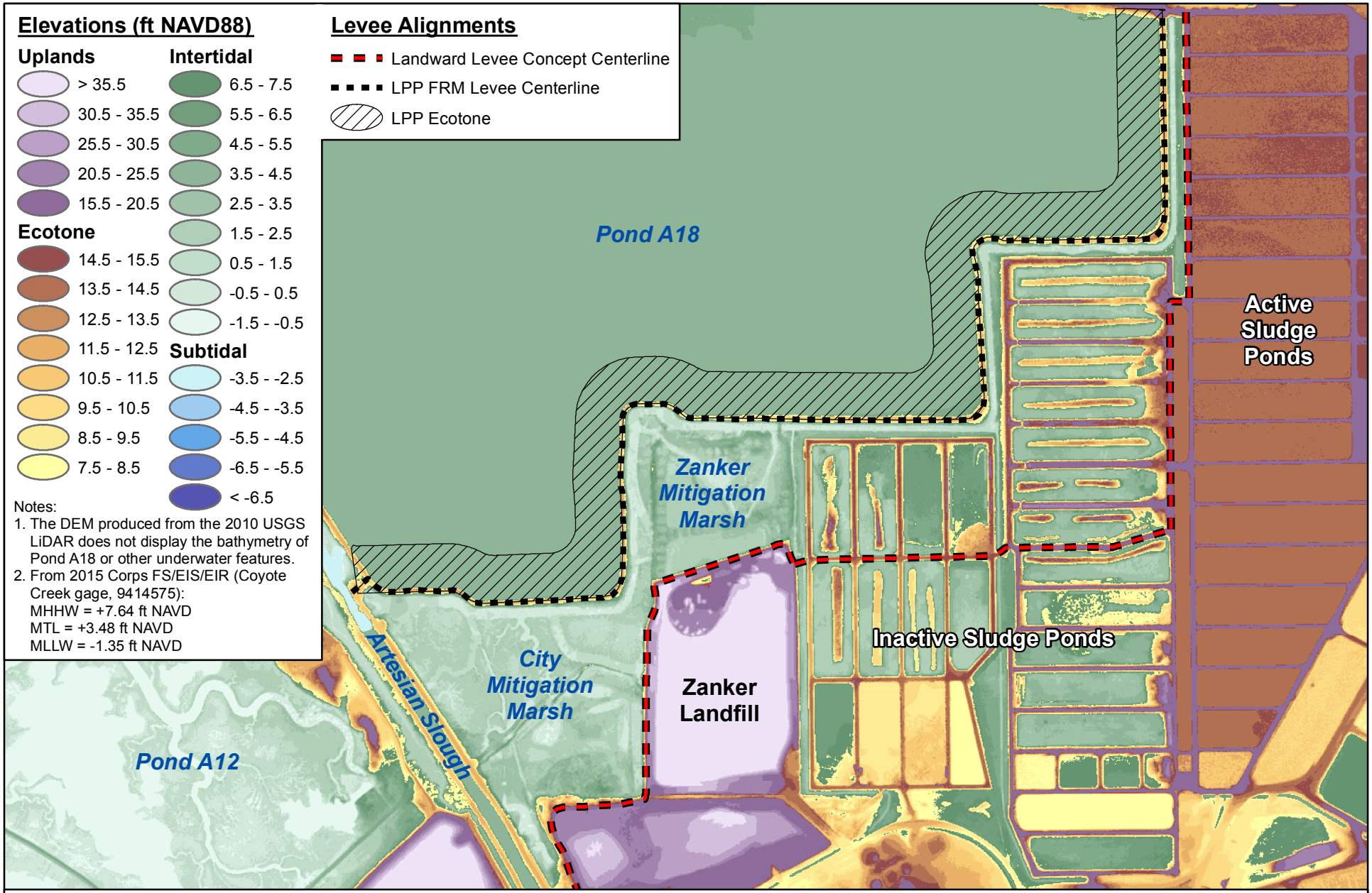

Figure 3
South Bay Shoreline Protection Project
Local Topography + Levee Alignments:
East of Artesian Slough

California Water Boards
State Water Resources Control Board
Regional Water Quality Control Boards

Figure 4: Levee Alignments: Profile Elevations

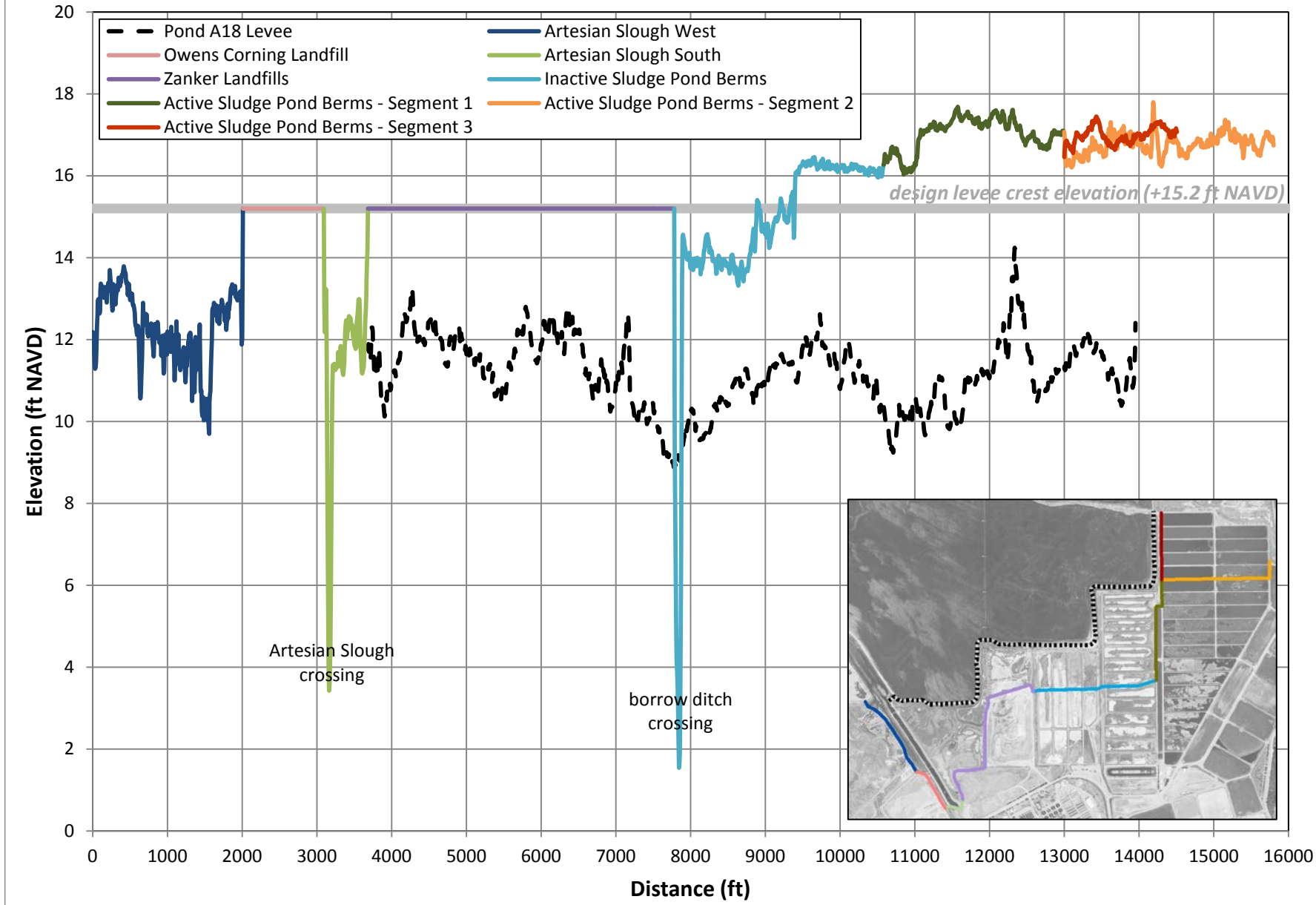

Figure 5: Representative Cross-Section + LPP: Pond A18 Levee

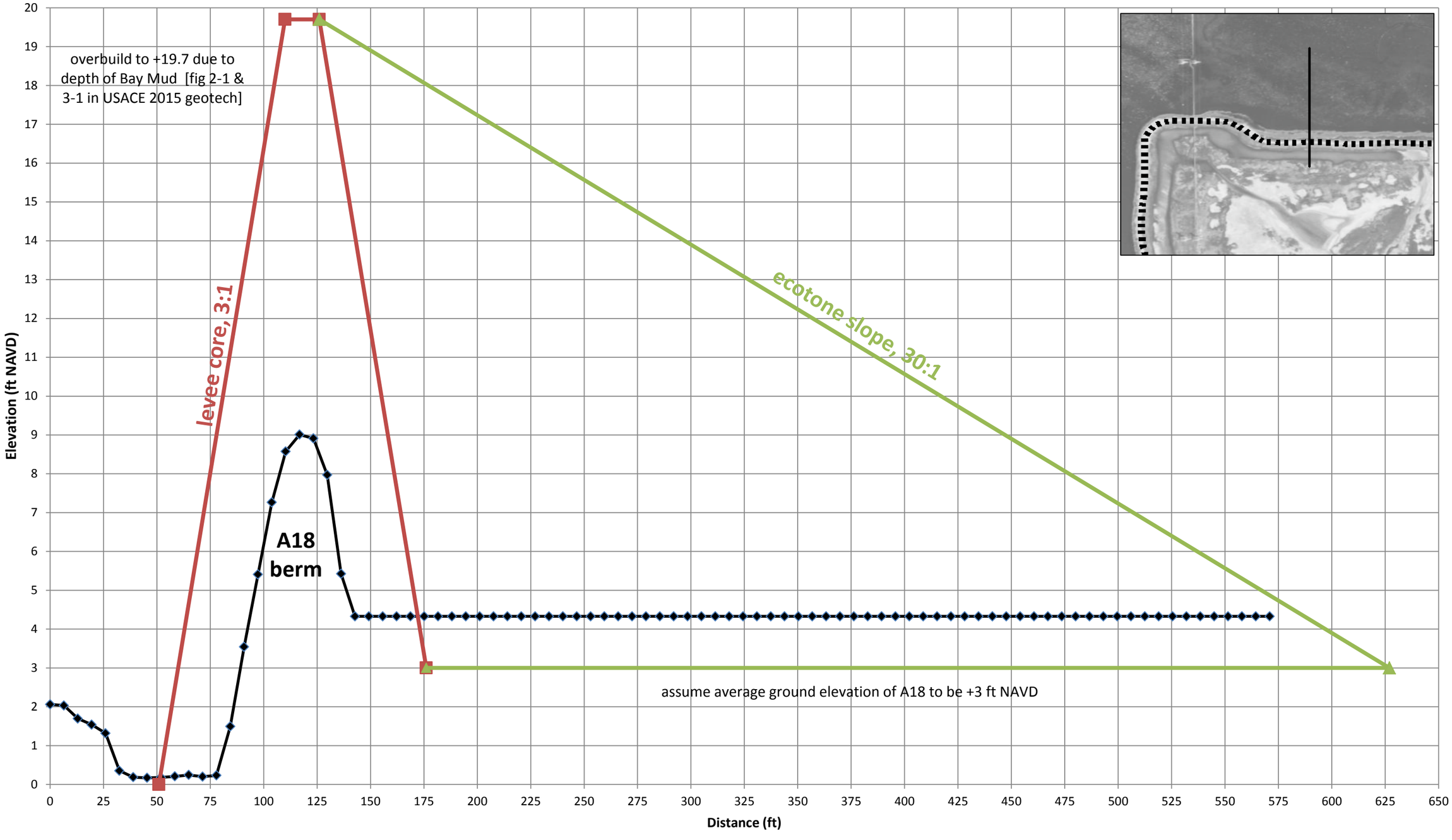

Figure 6: Representative Cross-Section +LPP: Zanker 2

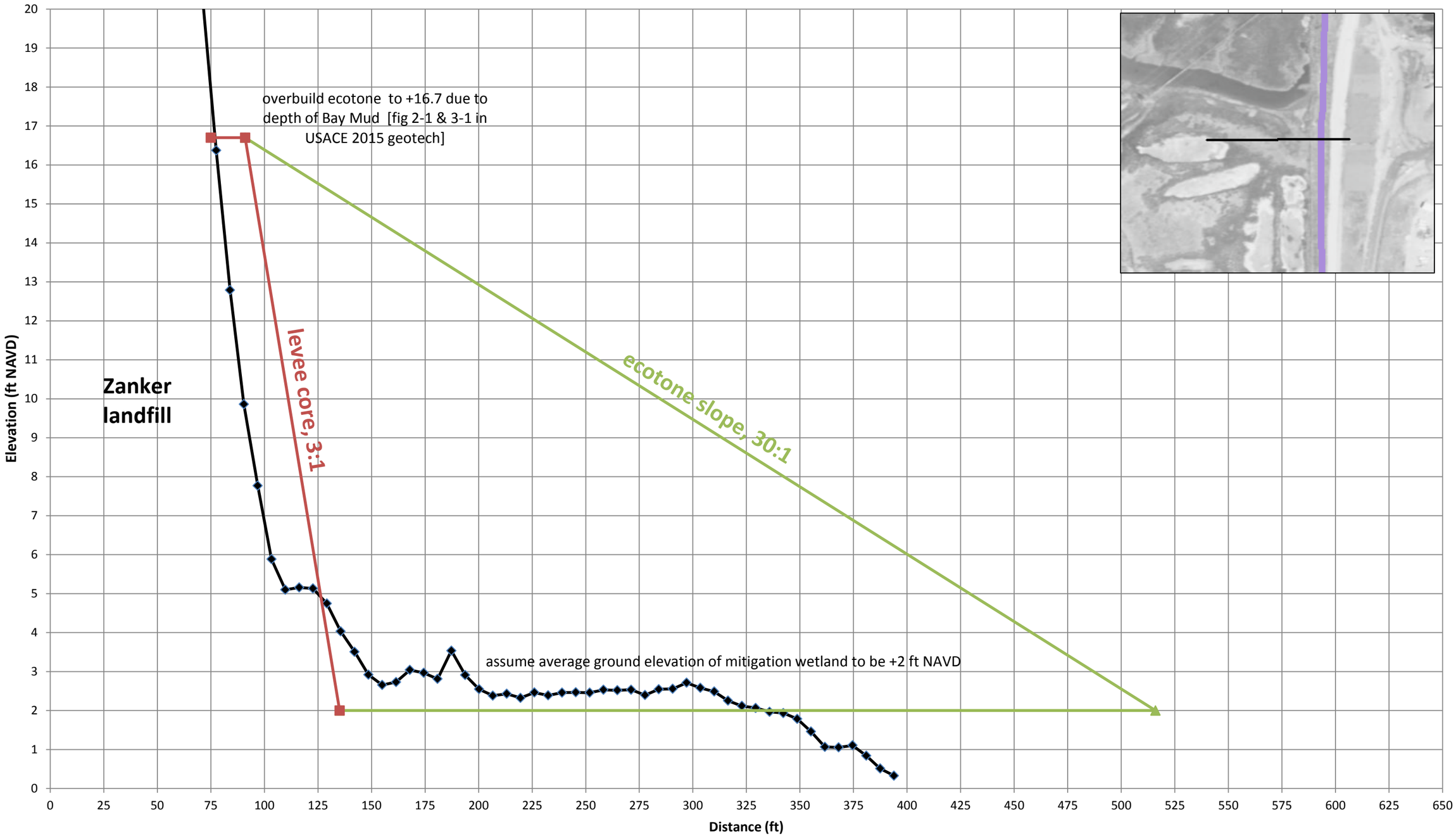

Figure 7: Representative Cross-Section + LPP: Inactive Sludge Ponds

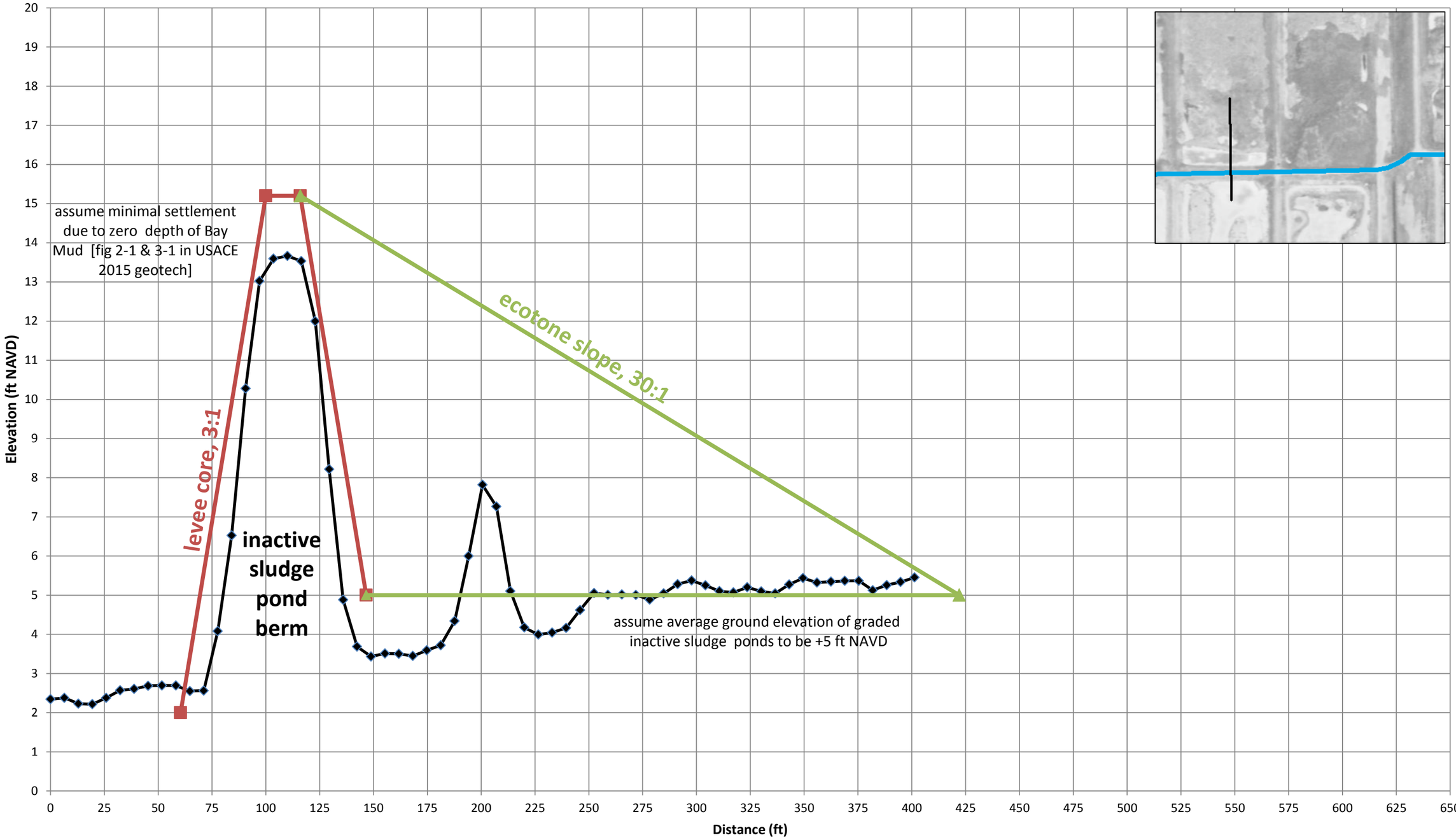

Figure 8: Representative Cross-Section+ LPP: Active Sludge Ponds - Segment 1

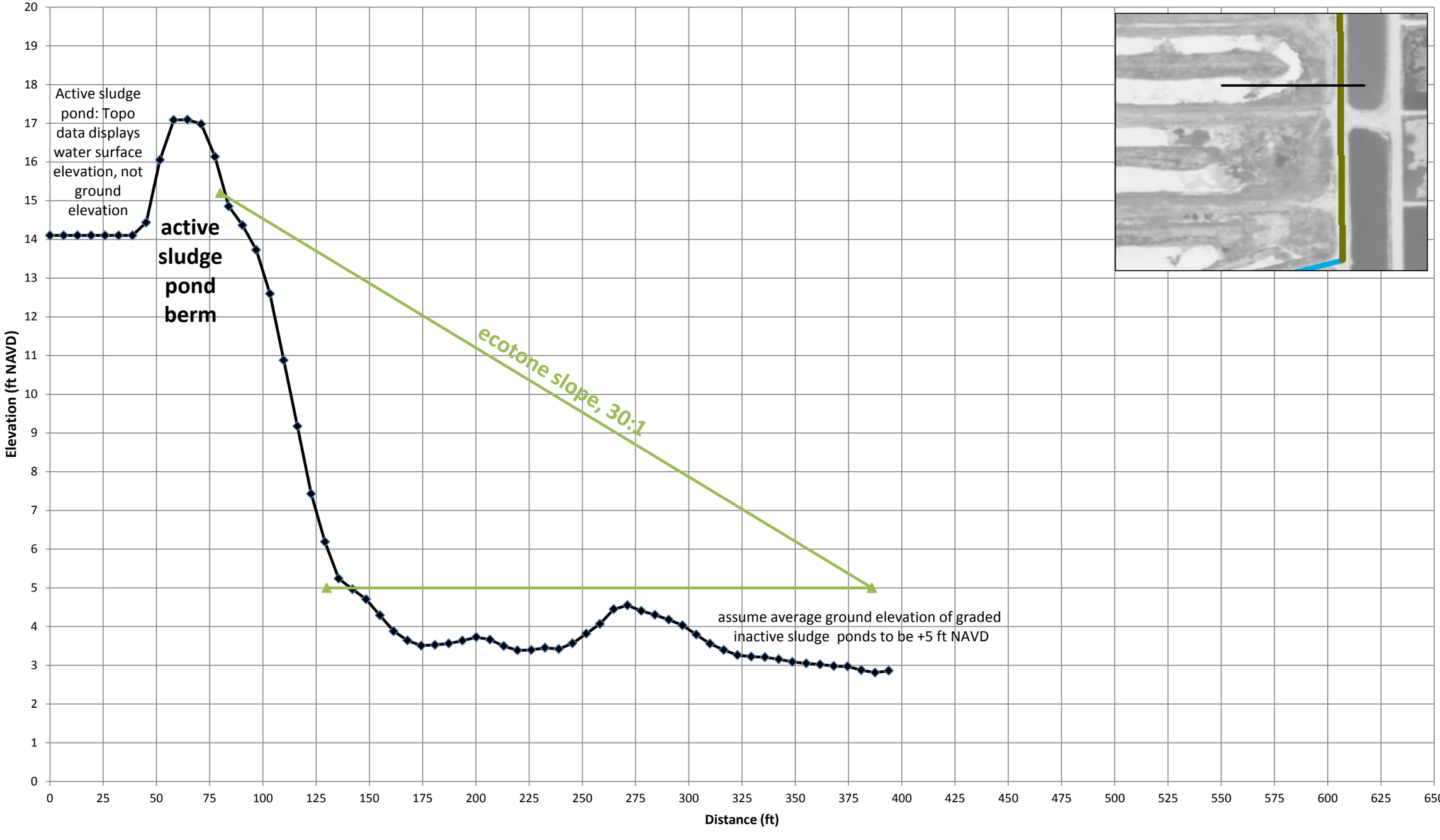

Figure 9: Representative Cross-Section + LPP: Active Sludge Ponds - Segment 3

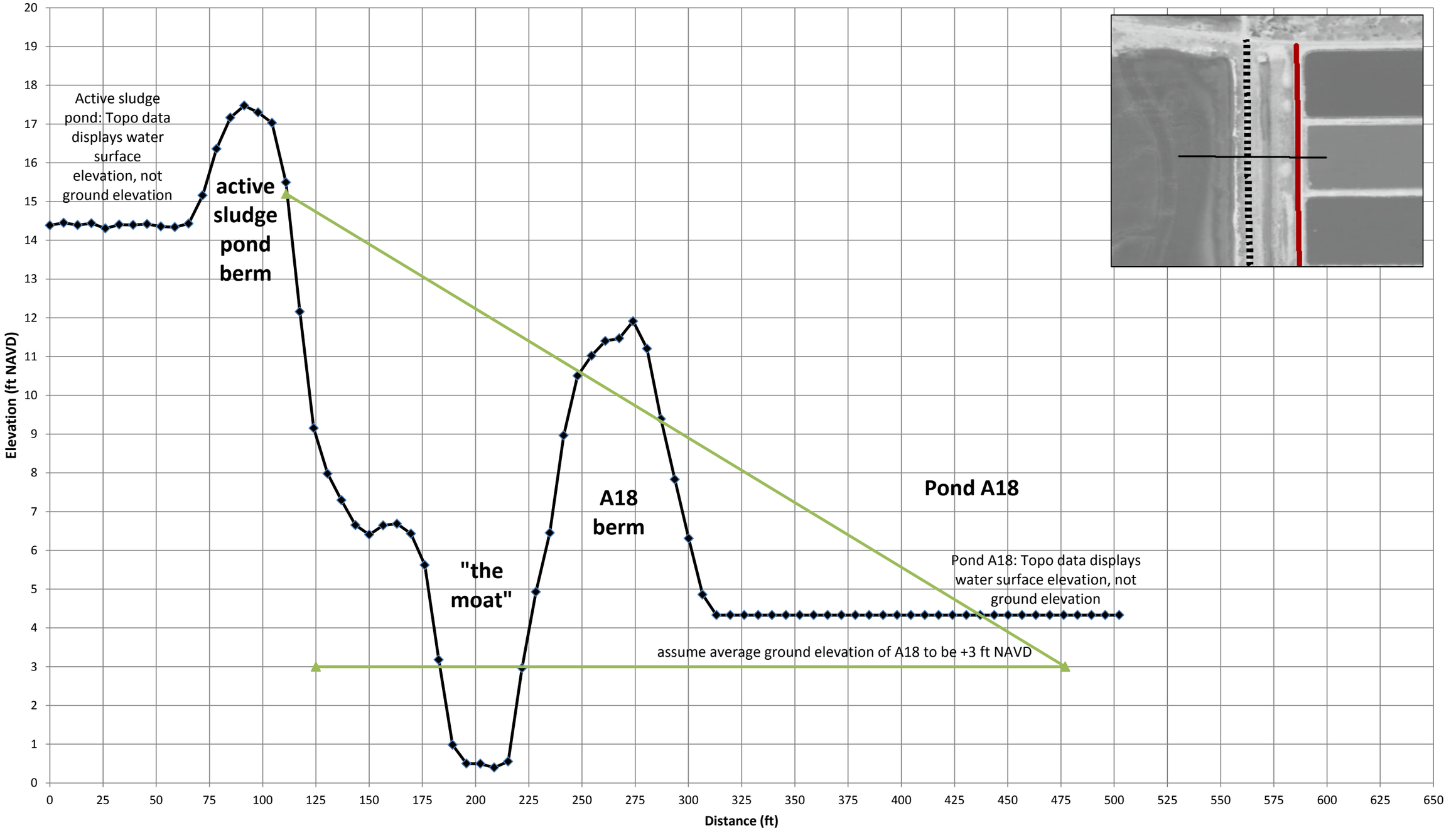

Table A-1: Levee Cut and Fill Volumes

Levee Fill Volumes (LPP, USACE 2015)

	Project Station			Fill (cy)			
LPP Levee Reach	Begin	End	Distance (ft)	Levee Core	50-ft Bench	Ecotone	Subtotal Fill (cy)
4	94+75	150+00	5,525	312,566	92,083	477,102	881,751
5	150+00	197+75	4,775	174,079	79,583	412,337	665,999
							1,547,750 TOTAL

Levee Fill Volumes (Landward Alignment, Water Board 2017)

Assumptions re: existing topography (mitigation marsh edge at +2 ft NAVD, inactive sludge ponds at +5 ft NAVD, Pond A18 at +3 ft NAVD)

		Design Elevations (ft NAVD)		Fill (cy/lf)		Subtotal Fill (cy)		
Levee Reach	Distance (ft)	Levee Crest	Bayward Ground Surface	Levee Core	Ecotone	Levee Core	Ecotone	
Zanker	4,099	16.7	2	9	108	35,707	442,876	
Inactive Sludge	2,802	15.2	5	18	52	49,328	145,760	
Active Sludge - 1	2,419	15.2	5	0	48	0	116,515	
Active Sludge - 3	1,509	15.2	3	0	69	0	103,981	
						85,034	809,133	894,167 TOTAL

Assumptions consistent w/ USACE approach (base elevation of 0 ft NAVD)

		Design Elevations (ft NAVD)		Fill (cy/lf)		Subtotal Fill (cy)		
Levee Reach	Distance (ft)	Levee Crest	Bayward Ground Surface	Levee Core	Ecotone	Levee Core	Ecotone	
Zanker	4,099	16.7	0	10	139	40,565	571,585	
Inactive Sludge	2,802	15.2	0	35	116	97,169	323,687	
Active Sludge - 1	2,419	15.2	0	0	107	0	258,743	
Active Sludge - 3	1,509	15.2	0	0	107	0	161,407	
						137,734	1,315,423	1,453,157 TOTAL

Available Cut Volumes from Pond A18 Levee (LPP, USACE 2015)

	Project Station			Cut (cy)		
LPP Levee Reach	Begin	End	Distance (ft)	Degrade	Inspection Trench	Subtotal Cut (cy)
4	94+75	150+00	5,525	154,817	9,822	164,639
5	150+00	197+75	4,775	164,712	8,489	173,201
						337,840 TOTAL

Available Cut Volumes from Inactive Sludge Ponds (Landward Alignment, Water Board 2017)

	Volume (cy) Above Elevation (ft NAVD)							
Location	0	1	2	3	4	5	6	7
Inactive Sludge Ponds	942,511	818,961	696,174	582,069	489,277	410,450	340,530	283,819
Old Sludge Piles	209,011	185,596	162,182	138,830	115,876	94,366	75,040	58,134
TOTALS	**1,151,521**	**1,004,557**	**858,355**	**720,899**	**605,153**	**504,816**	**415,570**	**341,953**

Note: This is only for the ponds underneath and bayward of the proposed levee/ecotone. Additional material could be made available from inactive ponds landward of the levee.