Levee Vegetation Management in California: An Overview of Law, Policy and Science, and Recommendations for Addressing Vegetation Management Challenges

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This paper outlines the current regulatory framework governing vegetation on levees in California; describes challenges regarding state and federal levee vegetation laws, policies, and regulations; argues that the current regulatory framework is problematic for many reasons; and offers solutions to address levee vegetation challenges moving forward. The appendices provide further details and analyses on federal laws and policies, state laws and policies, case law, and science and research.

Applicable federal policies include the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP), the United States Army Corps of Engineers (USACE) National Levee Safety Program, USACE-issued policies on levee vegetation, the Water Resources Reform and Development Act of 2014 (WRRDA 2014), and the Endangered Species Act (ESA). USACE-issued levee vegetation regulations establish a "vegetation-free zone" on and around levees, although this has largely been met with criticism from the levee maintenance and natural resource communities. USACE-issued levee vegetation policies also include variance guidelines, which establish a procedure for an exemption from these vegetation policies.

At the statewide management level, the Central Valley Flood Protection Board (CVFPB) and California Department of Water Resources (DWR) operate

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and maintain California levees. The State has embraced a levee vegetation management strategy consistent with risk prioritization, and as such prioritizes possible threats posed by levee vegetation far below other possible risks to levee integrity such as seepage, erosion, and slope failure. The State has partially incorporated vegetation-free requirements in their lifecycle management (LCM) approach, which is part of their broader Levee Vegetation Management Strategy (LVMS). The LVMS is similar to USACE requirements in many respects, except that it allows already existing mature trees ("legacy vegetation") to remain on existing levee slopes and allows for additional recruitment of levee vegetation on the lower waterside portion of existing levee slopes. In contrast, USACE vegetation-free requirements require the entire levee slope to be removed of all vegetation, except for grass. In other words, while USACE requires levee maintainers to obtain a variance in order to retain existing vegetation, the State begins with a presumption that levee maintainers may retain existing levee vegetation without going through an additional exemption process. The State views the two policies as operationally compatible, although local maintainers still report significant differences between the policies and challenges in conforming to both.

Following the release of USACE vegetation management guidelines establishing vegetation-free zones on levees, two lawsuits were initiated against USACE. The first was brought by Friends of the River (FOR) and other environmental non-governmental organizations (NGOs) and the second by the California Department of Fish and Wildlife (CDFW). Both lawsuits alleged that USACE violated the ESA, the National Environmental Policy Act (NEPA) and the Administrative Procedure Act (APA) in promulgating their vegetation policies. The lawsuits also argued that the USACE variance policy is unworkable and similarly violates the ESA, NEPA, and the APA. Both lawsuits were voluntarily dismissed without prejudice (essentially suspended) by a California District Court following the passage of WRRDA 2014, which directed USACE to revisit and reissue their levee vegetation policies. As such, the Court declined to decide either case on the merits. The Court instead directed USACE to comply with the terms of WRRDA 2014 by December 2015. To date, USACE has failed to do so.

Considerable research on levee vegetation has been developed in recent years, largely in response to the contentious regulatory framework. Two Levee Vegetation Research Symposia were convened in recent years, one in 2007 and another in 2012. Each symposium brought experts and leaders in their respective fields together to discuss the state of the science and future research needs. USACE's Engineer Research and Development Center (ERDC), DWR, and the California Levee Vegetation Research Program (CLVRP) have also conducted substantial research. Most recently, CLVRP released a report that synthesized all of the most current research regarding levee vegetation. As will

be discussed in further detail below, there are certain areas where more research is needed, but research to date has generally not shown a causal link between levee vegetation and substantial increased risk to levee integrity.

The current regulatory framework is problematic for many reasons, and greater attention is needed to address critical issues faced by levee maintainers in California. There is dire need for levee repair, but local maintainers are often constrained by conflicting and confusing laws and policies, or requirements which are overly time-consuming and cost-prohibitive. For example, many USACE standards violate the ESA with respect to critical endangered fish habitat. Further, local levee maintainers are not always sure how to reconcile state and federal guidelines. Local levee maintainers also encounter problems with operations and maintenance requirements that conflict with other laws and regulations, and a time-consuming, cost-prohibitive variance policy. The confusing nature of levee vegetation guidelines can put these maintainers at risk of losing eligibility for federal rehabilitation assistance in the event of a flood.

This article concludes by offering solutions to move forward, including using the most current and best available science to inform better policy. The paper discusses engineering solutions and presents examples where levees have been designed to strict safety standards while maintaining vegetation. It considers new models, which can be used to better assess when a tree might pose a threat to levee integrity. Regionally-based, multi-benefit projects already underway could also provide experimental project designs, which, if successful, could inform new statewide and federal policies and guidance on levee vegetation management.

To best address these levee vegetation issues, collaboration between stakeholders is critical. An interagency working group, similar to the California Levees Roundtable, could help enormously in fostering relations and forming new policies. If all stakeholders are not able or willing to meet, other solutions could address levee vegetation issues. These include: development of one or multiple System-Wide Improvement Frameworks (SWIFs) for California's Central Valley, passage of new legislation encouraging new USACE vegetation management policies, litigation to encourage new USACE vegetation management policies, and using the ESA to maintain vegetation on levees despite USACE requirements. Alternatively, USACE could proactively update their levee vegetation policies to simply avoid the numerous problems identified here.

I. INTRODUCTION AND BACKGROUND

A. Introduction

In 2005, Hurricane Katrina devastated New Orleans and left a lasting imprint in the consciousness of all Americans. The realization that much of the tragedy may have been preventable had it not been for levee and floodwall failures, prompted swift changes to levee management policies. Regrettably, these well-intentioned policies have resulted in significant unintended consequences that continue to severely impact ecological and economic resources in flood-prone areas and may even impact public safety. This article will focus on policies implemented by the federal government soon after Hurricane Katrina, which were intended to upgrade levees nationwide and prevent any similar breach. Ultimately, they have resulted in more costly flood management systems with harmful environmental side effects, especially as applied to California's Central Valley. These policies include controversial provisions mandating that all vegetation (except for grass) be removed from levees.

Vegetation on levees serves many functions, including aesthetic value for homeowners and recreationalists and habitat value for endangered species.[1] Trees and other woody vegetation on levees can reduce river temperatures,[2]

[1] U.S. ARMY CORPS OF ENG'RS, ENGINEERING TECHNICAL LETTER 1110-2-583 1 (2014) [hereinafter ETL 1110-2-583].

[2] ASHLEY N. ADAMS, DETERMINING THE EFFECTS OF VEGETATION ON LEVEE STRUCTURAL INTEGRITY ON THE GREEN RIVER IN KING COUNTY, WASHINGTON 1 (2015), https://digital.lib.washington.edu/researchworks/bitstream/handle/1773/33177/Adams_washington_0

preventing the water from over-heating and killing or harming endangered fish.[3] Vegetation on riverward slopes of levees can also provide necessary habitat for rearing fish.[4] Many also argue that vegetation on levees strengthens slope stability and reduces erosion.[5] However, others believe that vegetation on levees reduces levee structural integrity.[6] Some levee maintainers, engineers, and flood fighters view vegetation as either a positive or negative factor in terms of levee stability, depending on the tree type and location.[7] These maintainers, engineers, and flood fighters cite observations of certain trees obstructing the ability to flood fight, attracting burrowing animals, preventing the growth of "good" vegetation, or causing the loss of embankment on both the waterside and landside.[8] The latter may worsen seepage, if seepage is present. Others view all vegetation as negative for levee stability, citing concerns of vegetation causing erosion and slope instability, aiding seepage, attracting burrowing animals, and hindering inspections and flood fighting activities.[9] This is exactly what prompted federal vegetation-free policies, which in turn spurred strong backlash from the environmental community and a surge in levee vegetation research. The debate over levee vegetation continues to this day, reflected in differing laws and policies.

This article summarizes the current regulatory framework in terms of federal law, California law and case law, relative to vegetation management on levees. It also presents the state of the science, describing the most recently released and best available science regarding levee vegetation. The paper argues that our

250O_14225.pdf.

[3] *Id.*

[4] *See* CAL. DEP'T OF WATER RES., DRAFT CENTRAL VALLEY FLOOD SYSTEM CONSERVATION STRATEGY (2015); NAT'L OCEANIC & ATMOSPHERIC ADMIN., RECOVERY PLAN: FOR THE EVOLUTIONARY SIGNIFICANT UNITS OF SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON AND CENTRAL VALLEY SPRING-RUN CHINOOK SALMON AND THE DISTINCT POPULATION SEGMENT OF CALIFORNIA CENTRAL VALLEY STEELHEAD 50-54 (2014), http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/california_central_valley/final_recovery_plan_07-11-2014.pdf.

[5] *See* LAURA KAPLAN, CALIFORNIA ROUNDTABLE FOR CENTRAL VALLEY FLOOD MANAGEMENT: ASSESSMENT REPORT (2011); Letter from Mark W. Cowin, Director, Cal. Dep't Water Res. & John McCamman, Director, Cal. Dep't Fish & Game to U.S. Army Corps of Eng'rs (Apr. 15, 2010), http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2010-0415_DWRLetter_and_attachment.pdf [hereinafter Letter from Cowin & McCamman]; MARK COWIN & GARY BARDINI, 2012 CENTRAL VALLEY FLOOD PROTECTION PLAN 3-25 (2012) [hereinafter CVFPP].

[6] *See* KAPLAN, *supra* note 5; ETL 1110-2-583, *supra* note 1.

[7] *See* KAPLAN, *supra* note 5; *see* CAL. LEVEES ROUNDTABLE, CALIFORNIA'S CENTRAL VALLEY FLOOD SYSTEM IMPROVEMENT FRAMEWORK (2009), http://www.deltarevision.com/2007_docs/031209flood_improvement.pdf.

[8] *See* F. DOUGLAS SHIELDS, SYNTHESIS OF LEVEE VEGETATION RESEARCH RESULTS (2007-2014) 15-3 (2016), http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2016-0127-Levee-Veg-Synthesis-Report-FINAL.pdf.

[9] *Id*.

current regulatory system is unworkable for a variety of reasons, which will be expounded on in part II. It concludes by offering solutions for moving forward, and ways that the most critical issues articulated in part II might be addressed. Rather than advocating one preferred solution to the current problematic situation, the author recognizes that many solutions may be utilized in addressing this problem, including those not expressed here. Above all else, the goal of this paper is to provide background on levee vegetation issues, argue that our current system is in dire need of change, and highlight the importance of this issue to all regulators and policymakers involved in managing levee vegetation. The ultimate goal is that in reinforcing the problematic regulatory structure, leaders in their respective fields will be prompted to give this issue the attention it deserves and collaboratively move forward towards solutions.

Before analyzing the current state of policy in detail, this article provides a brief history of levee vegetation management in the United States and California. This aims to provide context and a better understanding of how we arrived at our current levee vegetation management policy patchwork.

B. History and Brief Overview of Levee Vegetation Management Policies

In California's Central Valley, individual landowners constructed low levees to protect their properties from inundation as early as the early-mid 1800s.[10] Settlers had flocked to California as part of the Gold Rush, and soon after began to farm the Central Valley.[11] These settlers soon found that trying to build a life with homes, ranches and farms in the vast wetlands of the Central Valley presented many dangers and difficulties. Author and historian Robert Kelly described the early conditions as follows:

> [D]uring the annual winter cycle of torrential storms that for millennia have swept in from the Pacific, or in the season of the spring snow melt in the northern Sierra Nevada, the Sacramento River and its tributaries rose like a vast taking in of a breath to flow out over their banks onto the wide Valley floor, there to produce terrifying floods. On that remarkably level expanse the spreading waters then stilled and ponded to form an immense, quiet inland sea a hundred miles long, with its dense flocks of birds rising abruptly to wheel in the sky and its still masses of tule rushes stretching from the delta to the Sutter Buttes and beyond. Not until the late spring and

[10] U.S. ARMY CORPS OF ENG'RS, STANDARD OPERATION AND MAINTENANCE MANUAL FOR THE LOWER SAN JOAQUIN RIVER LEVEES: LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT, CALIFORNIA 2 (1959) [hereinafter U.S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT]; U.S. ARMY CORPS OF ENG'RS, STANDARD OPERATION AND MAINTENANCE MANUAL FOR THE SACRAMENTO RIVER FLOOD CONTROL PROJECT 2 (1955) [hereinafter U.S. ARMY CORPS OF ENG'RS, SACRAMENTO RIVER FLOOD CONTROL PROJECT].

[11] ROBERT KELLEY, BATTLING THE INLAND SEA: FLOODS, PUBLIC POLICY, AND THE SACRAMENTO VALLEY xv (1989).

summer months would it drain away downstream.[12]

Faced with these conditions, landowners created individual makeshift levees to protect their property from flood events and ensure relatively stable year-round conditions on their land. Kelly describes the marked change as, "[n]o more the long tarrying of floodwaters on the Valley floor for months on end, forming the inland sea; it is a brisk and disciplined passage now to Suisun Bay."[13]

Well into the late 1800s, landowners continued to extend levees, "encroaching on streams and confining waters."[14] Eventually, these landowners formed reclamation districts, and in turn constructed higher "and more substantial" levees around these districts for protection.[15] Rather than constructing levees on a state-wide scale, these levees were largely created by small communities to protect their immediate property, "so that levees mount[ed] higher and higher, and all without overall plan or guidance in an absolute wilderness of classic American laissez-faire and localism."[16]

Hydraulic mining was invented in 1853 and soon gained prevalence in California's Central Valley, becoming commonplace by the 1870s.[17] This practice demanded large amounts of water and had devastating effects on the rivers, constantly blasting mining debris into the waterways and downstream.[18] As early as the mid-1850s, newspaper articles reported fears that the Sacramento River would no longer be navigable due to the constant influx of mud and debris.[19]

An engineer report submitted to the California State Legislature from 1880 described the Feather and Sacramento River being "greatly reduced in flood carrying capacity by the lodgment of sand in their channels which has come down the rivers from the mining regions during the past 25 years or more."[20] Because individual landowners initially constructed levees on a local scale, early

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[12] *Id.*

[13] *Id.* at xvi.

[14] U.S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER TRIBUTARIES PROJECT, *supra* note 10, at 2.

[15] TURRENTINE W. JACKSON & DONALD J. PISANI, THE EVOLUTION OF CALIFORNIA STATE WATER PLANNING 1850–1928 57 (1983), https://cloudfront.escholarship.org/dist/prd/content/qt0s84j2ww/qt0s84j2ww.pdf.

[16] KELLEY, *supra* note 11, at xvii.

[17] *Id.* at 16–20 (describing how Edward E. Mattson first developed hydraulic mining in March 1853 in Nevada City and quoting an 1897 article from the San Francisco Bulletin describing the widespread practice in California).

[18] *See id.* at 19–20.

[19] *Id*. at 26 (citing two Nevada County and California Farmer newspaper articles from 1856).

[20] William Hall, *Report of the State Engineer to the Legislature of the State of California—Session of 1880: Part II, in* 5 APPENDIX TO THE JOURNALS OF THE SENATE AND ASSEMBLY OF THE TWENTY-THIRD SESSION OF THE LEGISLATURE OF THE STATE OF CALIFORNIA 1, 11 (1880).

flood protection in the Central Valley was "developed in a piecemeal fashion."[21] The 1880 engineer report described the dangers from "unequal treatment" of levees throughout the system, and recommended that the State, "take charge of drainage ways and all drainage works, and exercise such control over them as will regulate their use, promote their improvement, and systematize construction and management of all works designed to promote rapid drainage and prevent inundations."[22]

Similar engineer reports in following years reiterated the problem of mining deposits severely reducing the natural channel capacity of the Sacramento River, San Joaquin River, and their tributaries.[23] In 1893, the California Debris Commission (CDC) was formed with the goal of regulating hydraulic mining to protect agricultural development from flooding, and to maintain navigability of the rivers.[24] In 1910, the CDC submitted a plan to Congress, commonly referred to as the "Jackson Report." The Jackson Report proposed a comprehensive plan for the Central Valley, including constructing and enlarging levees along the riverbanks, and confining river water to narrow channels with weirs to discharge floodwaters.[25] The Jackson Report marked the first comprehensive flood plan for the Central Valley, and its recommendations have ultimately led to the Central Valley's current flood protection system.[26]

Federal participation in regulating levee development and maintenance began in the early 1900s.[27] In 1917, the CDC Jackson Report was approved for construction as the Sacramento River Flood Control Project, authorized by the Flood Control Act of 1917.[28] The plan for the Sacramento River Flood Control Project was modified and extended by the Flood Control Act of 1928, the Flood Control Act of 1936, and the Flood Control Act of 1941. This legislation authorized the Federal government to pay for levee construction, with local cost-sharing arrangements that developed with each new piece of legislation.[29]

The United States Army Corps of Engineers is responsible for designing and constructing levees after plans have been submitted and authorized by the

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[21] U.S. ARMY CORPS OF ENG'RS, POST-FLOOD ASSESSMENT FOR 1983, 1986, 1995, AND 1997 2-1 (1999), http://deltarevision.com/maps/islands_floods_levees/usace_flood_history2002.pdf.

[22] Hall, *supra* note 20, at 75.

[23] *See id.* at 29 (citing T.G. DABNEY ET AL., REPORT OF THE COMMISSION OF ENGINEERS TO THE COMMISSIONER OF PUBLIC WORKS, CALIF. (1904)) ("From the mouth of the Yuba to its junction with Sacramento River the Feather is so encumbered by sedimentary deposits that have entered it . . . that its channel capacity has been reduced to one-half of its former dimensions. . . . * * * [M]ining debris . . . covers the original surface of the ground outside of the channel to a depth near Feather River of about 13 feet.").

[24] U.S. ARMY CORPS OF ENG'RS, *supra* note 21, at 2-1.

[25] *Id.* at 2-4.

[26] *Id.* at 2-12.

[27] KELLEY, *supra* note 11, at xviii.

[28] U.S. ARMY CORPS OF ENG'RS, *supra* note 21, at 2-12.

[29] *Id.*

United States Congress.[30] Rather than being a centrally funded agency, USACE is only funded on a project-by-project basis, once Congress has authorized the project and appropriated project funds. Following design and construction, USACE relinquishes control of the levee to the non-federal sponsor, who is responsible for operations and maintenance of the levee.[31]

In 1936, the Federal Flood Control Act declared a national interest in flood damage prevention and established requirements for local cooperation.[32] Essentially, a state or local agency could receive federal funds for constructing flood control improvement projects. To do so, they would first be required to give assurances, satisfactory to USACE, that they would (a) provide without cost to the United States all lands, easements, and rights-of-way necessary for construction; (b) hold the United States free from damages due to the constructed works; and (c) maintain and operate all works after completion in accordance with regulations prescribed by the USACE.[33] In 1944, USACE issued regulations on operations and maintenance procedures for local flood control project maintainers.[34]

Following the promulgation of operation and maintenance regulations, USACE developed two manuals specific to the two major flood control projects in California's Central Valley involving extensive levee systems: the Sacramento River Flood Control Project and San Joaquin River and Tributaries Project. The two operations and maintenance (O&M) manuals provide requirements for all maintaining agencies that operate flood control units. The manuals, which date back to 1955 and 1959, allow "brush and small trees" on the waterside slope of levees "where desirable for the prevention of erosion and wave wash."[35] It seems that USACE saw value, or at least did not recognize the danger of woody vegetation on levees, because when the State of California accepted responsibility from USACE for the Sacramento River Flood Control System in 1958 there was a substantial amount of mature trees and other vegetation present on the levee system.[36]

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[30] 33 U.S.C. § 15

[31] 33 U.S.C. § 701c

[32] Flood Control Act of 1936, Pub. L. No. 74-738, § 1.

[33] Flood Control Act of 1936, Pub. L. No. 74-738, § 3.

[34] U. S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT, *supra* note 10, at 12; U.S. ARMY CORPS OF ENG'RS, SACRAMENTO RIVER FLOOD CONTROL PROJECT, *supra* note 10, at 12.

[35] U.S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT, *supra* note 10, at 12; U.S. ARMY CORPS OF ENG'RS, SACRAMENTO RIVER FLOOD CONTROL PROJECT, *supra* note 10, at 12.

[36] CAL. DEP'T OF WATER RES., FLOODSAFE: THE CORPS' VEGETATION REMOVAL POLICY: JEOPARDIZING NATIONAL PUBLIC SAFETY (2012), https://cwc.ca.gov/Documents/2012/03_March/March2012_Agenda_Item_13_Attachment_4_Vegetation%20White%20Paper.pdf.

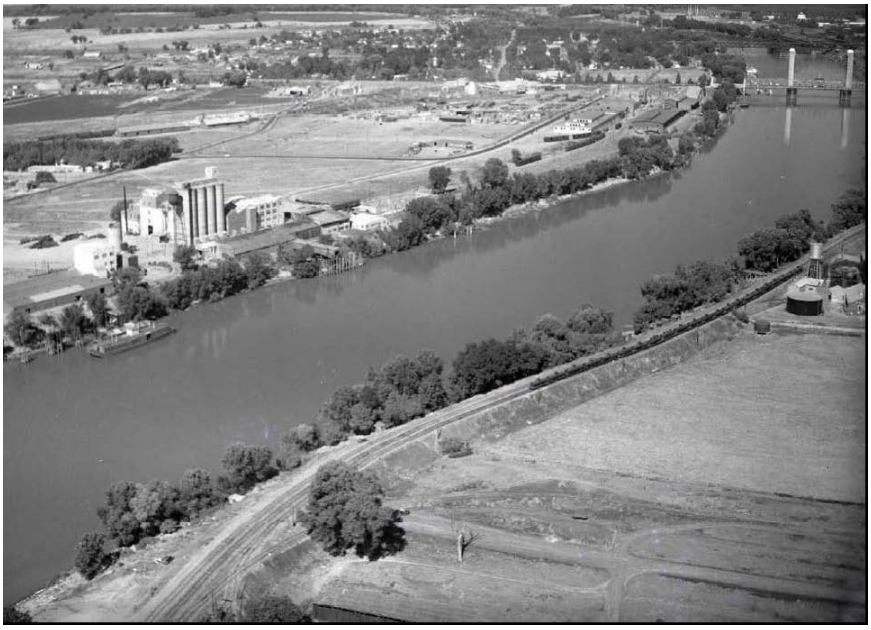

Figure 1: 1955 Sacramento Levee[37]

These provisions remained in effect for decades, during which time woody vegetation was present, and at times encouraged, by USACE and State and local maintainers.[38] In 1996, Section 202(g) of the Water Resources Development Act directed the USACE to review their vegetation management guidelines.[39] The law specifically mandated that USACE, ". . . examine current policies in view of the varied interests in providing flood control, preserving, protecting, and enhancing natural resources, protecting the rights of Native Americans pursuant

[37] Photo of Sacramento River levees in 1955, prior to acceptance of the Sacramento River Flood Control System by the State of California in 1958. For a digital version of this image, see *id*.

[38] See RICHARD E. WARNER & KATHLEEN M. HENDRIX, CALIFORNIA RIPARIAN SYSTEMS: ECOLOGY, CONSERVATION, AND PRODUCTIVE MANAGEMENT 539 (1984) ("Aesthetics are of special concern from the standpoint of protecting the environment and blending levees with the surrounding environment. Vegetation on levees could serve purposes such as harmonizing a levee project with the surrounding environment, controlling dust and erosion, separating activities, providing privacy or screening of undesirable features, or providing habitat for wildlife. . . With regard to vegetation, the regulations require that measures be taken to promote the growth of sod, exterminate burrowing animals, and provide for routine mowing of the grass and weeds and removal of wild growth and drift deposits. The regulations also encourage planting willows and other suitable growth on the river side of levees to retard bank erosion; they discourage activities which retard or destroy the growth of sod, such as burning grass and weeds.").

[39] Water Resources Development Act of 1996, Pub. L. No. 104-303, § 202(g), 110 Stat. 3658.

to treaty and statute, and such other factors as the Secretary considers appropriate."[40] In other words, USACE was ordered to consider multiple interests while updating their vegetation policies, such as environmental protection, rather than focusing solely on flood control. Additionally, USACE was directed to include regional considerations while updating their policies to better serve individual management and resource needs of the region.[41]

In 1967, then California governor Ronald Reagan and the Department of Water Resources published *Bulletin No. 167: Pilot Levee Maintenance Study, Sacramento-San Joaquin Delta*.[42] This bulletin summarized the results of a pilot study to test methods of levee maintenance with vegetation. It concluded that, "with proper vegetative management programs, certain Delta levees can be adapted and maintained to serve the needs of esthetics, recreation, and wildlife, as well as the primary purpose of flood control."[43] The bulletin also cautioned that, "uncontrolled vegetation prevents effective inspection and impedes flood fighting [sic],"[44] thus recognizing a distinction between positive and negative effects vegetation can have on levee stability, depending on type and maintenance. The bulletin further recognized the high value of levee vegetation in terms of recreational use for fishermen, picnickers, and campers; scenic or aesthetic value for recreationists, boaters and motorists, and as wildlife habitat, stating,

> levee vegetation, particularly trees, provides an important habitat for significant populations of over 100 wildlife species. Continued removal of this vegetation could mean the eventual elimination of these species from the Delta. Thick, bushy evergreen trees and shrubs, affording frequent small sanctuaries along levees and berms, are necessary for the protection and perpetuation of wildlife.[45]

The bulletin further recognized that, thus far, conformance with USACE operations and maintenance procedures "have been interpreted many ways, depending upon the objectives of the user at the time."[46] It clarified the meaning of the regulations, stating, "it is not logical, however, to accept an interpretation of the regulations that would forever prevent all trees and shrubs on levee slopes under all circumstances."[47] In other words, USACE operations and maintenance procedures were interpreted as allowing vegetation on levees in some

[40] Water Resources Development Act of 1996 § 202(g)(1).

[41] Water Resources Development Act of 1996 § 202(g)(3).

[42] CAL. DEP'T OF WATER RES., BULLETIN NO. 167: PILOT LEVEE MAINTENANCE STUDY, SACRAMENTO-SAN JOAQUIN DELTA (1967).

[43] *Id.* at viii.

[44] *Id.* at 1.

[45] *Id.* at 1-2.

[46] *Id.* at 3.

[47] *Id.*

circumstances. Overall, the bulletin summarized years of experiments conducted to study levee vegetation and concluded that "alternative levee maintenance practices can be used to allow vegetation on levees. This vegetation can be maintained for the multiple use of levees without jeopardizing the primary function of flood control."[48]

In 2001, USACE issued Engineering Regulation 500-1-1 (ER 500-1-1), which allowed vegetation on levees when such vegetation would preserve, protect, and/or enhance natural resources, and/or protect the rights of Native Americans, while maintaining levee safety.[49] This vegetation was allowed where (1) the safety, structural integrity, and functionality of the levee was retained; (2) accessibility for inspection and flood fighting purposes was retained; (3) in the case of NFIP certified levees, the level of flood protection did not fall below that required for certification; and (4) the level of protection did not fall below the minimum permissible for PL 84-99 eligibility.[50]

In sum, prior to 2005, the USACE and California State policy for vegetation on levees was generally supportive and allowed for regional considerations, so long as the structural integrity and functionality of the levee system were retained.

In 2006, following Hurricane Katrina and the New Orleans levee failures, the California governor declared a state of emergency for the California levee system. In May 2006, the governor signed into law AB 140, which granted $4 billion in levee repair and flood control, and AB 142, which appropriated $500 million from the general fund to California DWR for levee evaluation and repair.[51] In November of 2006 Propositions 84 and 1E passed. The propositions aimed to rebuild and repair California's most vulnerable flood control structures, protect homes and prevent loss of life from flood-related disasters, protect California's drinking water supply system by rebuilding delta levees vulnerable to earthquakes and storms, and generally fund flood control, natural resources, and park and conservation projects.[52] These funds have enabled FloodSAFE California (launched by California DWR to implement projects to improve public safety through integrated flood management).

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[48] *Id.* at 14.

[49] U.S. ARMY CORPS OF ENG'RS, ENGINEERING REGULATION NO. 500-1-1, § 5-22 (2001), https://www.publications.usace.army.mil/portals/76/publications/engineerregulations/er_500-1-1.pdf.

[50] *Id.*

[51] Cal. State Leg., Assemb. B. 140, 2005-2006 Sess. (Cal. 2006) (amending sections 5096.800 through 5096.968 of the Public Resources Code); Cal. State Leg., Assemb. B. 142, 2005-2006 Sess. (Cal. 2006).

[52] The Disaster Preparedness and Flood Prevention Bond Act of 2006 ("Proposition 1E") provided $265 million to the Delta Levees Program, beginning in fiscal year 2007-08 through fiscal year 2012-13. The Safe Drinking Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 ("Proposition 84") authorized over $320 million to Delta levees.

Following Hurricane Katrina, the realization that levee failure contributed to the national disaster increased national scrutiny for levee maintenance, and USACE developed stringent nationwide policies. In February of 2007, USACE conducted a nationwide levee inspection which identified maintenance deficiencies from woody vegetation. In April of 2007, the USACE released a White Paper, "Treatment of Vegetation with Local Flood-Damage-Reduction Systems," in essence stating that USACE intended to require substantial vegetation removal on levees.[53]

Prompted by the release of the USACE White Paper, levee vegetation experts from the Central Valley became alarmed at the proposal to remove substantial amounts of woody vegetation from California levees, due to potential safety and environmental consequences.[54] These experts worried that vast woody vegetation removal would decrease levee safety and decimate critical habitat for threatened and endangered species.[55] In order to attempt to gather the best available existing science on the subject, in August 2007 they convened a research Symposium in Sacramento. This Symposium brought experts on woody vegetation from around the world to discuss benefits and dangers of woody vegetation on levees, dangers of removing a substantial amount of existing woody vegetation on levees, and associated environmental effects. Details on research presented during the 2007 Symposium are expounded *infra* in Appendix 4: Science and Research. A point of consensus that emerged from the discussion was the need for additional research to better assess the issues presented.

In August 2007, the California Levees Roundtable launched to analyze issues and interests associated with woody vegetation on levees.[56] This was a collaborative group process formed by leadership of key federal, state, and local agencies with responsibility for federal flood control levees in the state of California. The roundtable included officials from USACE, DWR, the CVFPB, National Marine Fisheries Service (NMFS), U.S. Fish & Wildlife Service (USFWS), CDFW, FEMA, Reclamation District No. 2068, and the Sacramento Area Flood Control Agency (SAFCA). This roundtable attempted to work through competing opinions on potential dangers and benefits of woody vegetation on levees. One significant product of the Roundtable was California's Central Valley Flood System Improvement Framework of 2009 ("Roundtable Framework"), signed by all California levee roundtable

[53] CHIEF OF ENG'G & CONSTR. DIV., DRAFT FINAL WHITE PAPER: TREATMENT OF VEGETATION WITHIN LOCAL FLOOD-DAMAGE-REDUCTION SYSTEMS (2007).

[54] *See* Letter from Cowin & McCammon, *supra* note 5.

[55] *Id.* at 2-3.

[56] *See* CAL. LEVEES ROUNDTABLE, *supra* note 7 ("This document has been collaboratively developed by the California Levees Roundtable, a partnership of federal, State, and local agencies that was formed in August 2007 to address vegetation issues affecting the State-federal levee system in the Central Valley.")

participants.[57] Although initially involved, USACE withdrew their participation following multiple lawsuits related to the release of their vegetation removal policies.[58] Following their withdrawal, the remaining Roundtable participants voted to disband the group because USACE was such an integral component to discussions.[59] The Roundtable Framework document persisted despite the group's disbandment, representing a tentative, temporary written cooperation between the participants before the group disbanded.

The Roundtable Framework provided short-term levee vegetation management guidelines for local levee sponsors and the State. If the state and local levee maintainers abided by these guidelines, they would be temporarily excused from the compliance with the soon-to-be-released USACE vegetation removal requirements, while maintaining eligibility in important federal rehabilitation funding programs. This gave state and local levee sponsors a brief grace period to come into compliance with USACE vegetation removal requirements, so long as they met interim vegetation management objectives.[60] The management objectives were based on DWR's Interim Levee Vegetation Inspection Criteria for Vegetation.[61] These requirements represented an approach to levee vegetation management which avoided vast, widespread vegetation removal, but allowed for partial vegetation trimming and management for easier inspection access. Pursuant to this approach, vegetation would be trimmed and thinned on the landside slope and top twenty feet of the waterside slope but allowed to grow on the lower waterside slope.[62] This approach eventually formed the foundation for the State's Levee Vegetation Management Strategy.

In 2008, California passed the Central Valley Flood Protection Act (CVFPA) of 2008 (commonly referred to as "SB 5"), which required DWR to prepare the 2012 Central Valley Flood Protection Plan (CVFPP).[63] This prompted the state of California to assess and articulate its own stance on woody vegetation on levees. As such, the State invested in substantial research projects, such as providing funds and support for the CLVRP, discussed in greater detail below (See *infra* Appendix 4: Science and Research). The CVFPA of 2008 also established Urban Levee Design Criteria (ULDC), which requires urban levels of flood protection with a 0.5% chance of flood occurring in any given year ("1 in 200" or "200 year level"), using criteria consistent with or developed by

[57] CAL. LEVEES ROUNDTABLE, *supra* note 7.

[58] Interview with H. Brown (December 1, 2017).

[59] *Id*.

[60] *Id.* at 4-5.

[61] *Id.* at 5.

[62] CAL. DEP'T OF WATER RES., INTERIM LEVEE VEGETATION INSPECTION CRITERIA (2007).

[63] Cal. Water Code § 9603.

DWR.[64]

In April 2009, the USACE vegetation-free policy, first announced in the aforementioned 2007 USACE White Paper[65], was formally adopted. USACE issued the Engineering Technical Letter (ETL) 1110-2-571, establishing a uniform nationwide vegetation policy.[66] This policy established vegetation-free and root-free zones for levees throughout the entire country. The vegetation-free zone applied to all vegetation except for grass. The vegetation-free zone included all areas on the levee profile, plus an additional fifteen feet on both the landside and waterside of the levee toe.[67]

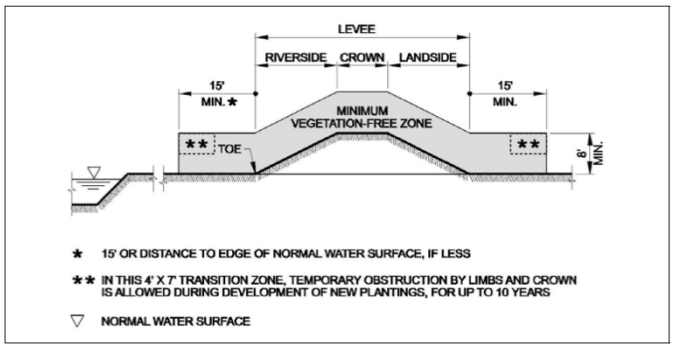

Figure 2: ETL Vegetation Free Zone

The ETL applied to all levee systems under direct USACE control. Further, any levees maintained by the State or LMAs would be required to conform to the vegetation policy laid out in ETL 1110-2-571 in order to maintain eligibility under Public Law (PL) 84-99.[68] PL 84-99 provides federal funding for emergency management activities, and authorizes USACE to undertake emergency disaster preparedness, emergency operations during and after flood events, rehabilitation of flood control works threatened or destroyed by floods, emergency water provisions, and other federal emergency assistance during and after flood events.[69] Thus, if the State and LMAs wished to maintain eligibility for emergency rehabilitation relief following the promulgation of ETL 1110-2-571, they were required to comply with its vegetation-free zone requirements. The ETL may also apply in situations where other federal permits and approvals are sought through USACE, although to what extent is unclear. This will be

[64] CAL. DEP'T OF WATER RES., URBAN LEVEE DESIGN CRITERIA (2012), https://www.water.ca.gov/LegacyFiles/floodsafe/leveedesign/ULDC_May2012.pdf.

[65] *See* CHIEF OF ENG'G & CONSTR. DIV., *supra* note 53.

[66] U.S. ARMY CORPS OF ENG'RS, ENGINEERING TECHNICAL LETTER 1110-2-571 (2009) [hereinafter ETL 1110-2-571].

[67] *See generally id.* (Chapter six illustrates the vegetation-free zone as applied to numerous levee profiles).

[68] U.S. ARMY CORPS OF ENG'RS, *supra* note 49, at 1.

[69] Flood Control and Coastal Emergency Act, 33 U.S.C. § 701(n) (2016).

explored in greater detail below.

In February of 2010, USACE issued a draft Policy Guidance Letter (PGL), describing a variance process from USACE vegetation management guidelines.[70] The PGL established basic requirements to obtain a variance or exemption from the ETL's vegetation removal requirements. If any nonfederal levee sponsor wished to maintain PL 84-99 eligibility and avoid removing all woody vegetation on levees under their control, they would need to comply with the PGL requirements. These requirements are situation-specific and are discussed in greater detail below (See *infra* Appendix 1: Federal Laws and Policies). In practice, levee maintainers seeking to apply for a variance through the PGL process have found it confusing, lengthy, expensive, and impractical. As such, very few successful variances have been granted by USACE for levee maintainers in California.

On April 15, 2010, DWR and CDFW submitted extensive comments on the ETL and PGL. The DFW and DWR comments mainly argued that the new USACE policies would reduce public safety in California, result in extensive and unnecessary environmental damage, and eliminate USACE responsibility to assist the State and LMAs in ensuring the integrity of the California levee system. The comments also posited that there would be unintended consequences of the ETL and PGL, stemming from an attempt to address complex technical, financial, legal and institutional problems with a highly prescriptive, one-size-fits-all approach to vegetation management.[71]

In 2010, USACE issued a Literature Review, ERDC branch of USACE reviewed existing literature on topics related to vegetation on levees.[72] This review provided information on potential impacts from woody vegetation on levees and pointed to areas where more research was still needed.[73] Based on their review, ERDC recommended that levee vegetation policies be supported by strong science and engineering principles, and that specific guidance for levee systems be provided and managed for based on site-specific ecosystem considerations.[74]

In 2011, USACE proposed a System-Wide Improvement Framework Policy (SWIF).[75] The intent of the SWIF was for levee sponsors to collaboratively work

[70] Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls, 75 Fed. Reg. 6,364 (Feb. 9, 2010) [hereinafter 2010 PGL].

[71] Letter from Cowin & McCamman, *supra* note 5.

[72] *Id.*

[73] MAUREEN K. CORCORAN ET AL., LITERATURE REVIEW—VEGETATION ON LEVEES 1 (2010), http://wri.usace.army.mil/documents/Literature_Review-Vegetation.pdf.

[74] *Id.*

[75] U.S. ARMY CORPS OF ENG'RS, MEMORANDUM FOR COMMANDERS, MAJOR SUBORDINATE COMMANDS AND DISTRICTS: POLICY FOR DEVELOPMENT AND IMPLEMENTATION OF SYSTEM-WIDE IMPROVEMENT FRAMEWORKS (SWIFS) (Nov. 29, 2011), https://www.iwr.usace.army.mil/Portals/70/docs/frmp/SWIF_2011-11-29.pdf.

with natural resource agencies and USACE to transition existing levees to USACE engineering standards, while maintaining PL 84-99 eligibility and adhering to the ESA.[76] Under this policy, if the State or LMA successfully develops a SWIF, and the USACE accepts it, then the State/LMA may focus its resources on pressing issues and immediate dangers to levees. Issues like vegetation management may be deferred until more immediate problems have been resolved.[77] This is commonly referred to as the "worst first" approach. Only levee sponsors who are, or have been eligible for the PL 84-99 program in the past may use the SWIF process to regain or maintain eligibility.[78] The SWIF does not create an exemption from vegetation-free requirements, but rather gives the levee sponsors time to come into compliance and a means to divert limited resources to more pressing threats to levee integrity.[79] However, a SWIF may be used in conjunction with a vegetation variance obtained via PGL requirements if the levee sponsor already has a vegetation variance in place.[80] The SWIF process can also help LMAs come into compliance with ESA mandates by providing a "federal nexus" for Section 7 purposes. A federal nexus can be crucial in situations where local levee maintainers may impact endangered species during their operations and maintenance activities. If they have no ability to undergo Section 7 consultation, then they could be left vulnerable if they accidentally cause harm to the species or habitat. This policy, its implementation and Section 7 implications is discussed in greater detail below (See *infra* Appendix 1: Federal Laws and Policies).

In March of 2011, DWR distributed an internal technical memorandum, *Influence of Vegetation on Levee Past Performance—a Review of Historic Data Based on Levee Evaluation Program Database*.[81] The memorandum summarized the results of a study, which reviewed over 10,000 records to identify levee breaches and causes of levee failure.[82] Of the 348 records demonstrating levee breach from floodwater flowing to the landside of the levee, none identified vegetation as the cause of the breach.[83]

Shortly after the release of the DWR memorandum, USACE released the 2011 report, *Initial Research into the Effects of Woody Vegetation on Levees*.[84] The ERDC-developed report summarized a two-year effort by ERDC to gain a

[76] *Id*. at 2.

[77] *Id.* at 2–4.

[78] *Id.* at 6(a).

[79] *Id.* at 8.

[80] *Id.*

[81] Memorandum from Nadira Kabir & Fran Bean, URS Corp., to Mike Inamine, Cal. Dep't of Water Res. (Mar. 23, 2011), http://www.safca.org/protection/NR_Documents/CLVRP_Influence_of_Vegetation_on_Levee_Past_Performance.pdf.

[82] *Id.*

[83] *Id.*

[84] CORCORAN ET AL., *supra* note 73, at 1.

better understanding of potential impacts of woody vegetation on levee performance.[85] The report concluded that woody vegetation on levees may increase or decrease levee stability, depending on site specific factors. It also identified areas for future research.[86] Following the release of the report, USACE made the policy decision to retain their vegetation-free requirements.[87] This reflects the USACE strategy of adopting a uniform, conservative approach to levee maintenance in the face of situation-specific results and general uncertainty over whether woody vegetation is beneficial or detrimental to levee integrity.

In 2012, DWR released the 2012 CVFPP. This comprehensive statewide planning document was adopted by the Central Valley Flood Protection Board (CVFPB) and is intended to guide California's management of flood risk along the Sacramento River and San Joaquin River systems.[88] The 2012 CVFPP includes the State's vegetation management guidelines on levees, most commonly referred to as the Levee Vegetation Management Strategy (LVMS). Under this strategy, newly constructed levees must meet the guidelines of the ETL (vegetation-free zones) on the entirety of the levee.[89] Newly constructed levees are rare, however, and most management considerations relate to woody vegetation on existing levees. For existing levees, woody vegetation on the lower waterside slope is generally retained and additional woody vegetation is allowed to grow.[90] For this portion of the levee, woody vegetation is only removed when it poses an unacceptable threat to levee integrity.[91] This is in part because vegetation on the lower waterside slope of levees provides the most critical habitat to listed threatened and endangered species, and the greatest benefits to levee stability.[92] Existing vegetation on the remainder of the levee prism is managed pursuant to "lifecycle management" ("LCM.")[93] Under LCM, existing vegetation (also referred to as "legacy" vegetation) on the landside and upper waterside slope of levees is to be trimmed for visibility and access, but not removed unless it poses a threat to the levee.[94] Additional vegetation is not allowed to grow on this portion of the levee, and so routine inspections and maintenance to remove new growth are essential for LCM.[95] The CVFPP and LVMS are also discussed in greater detail below (See *infra* Appendix 2:

85 *Id.*
86 *Id*. at 16.
87 *Id.*
88 CVFPP, *supra* note 5.
89 *Id*. at 4-13.
90 *Id.* at 4-14.
91 *Id.*
92 *Id*. at 4-13–4-14.
93 *Id.* at 4-14.
94 *Id.* at 4-15.
95 *See id.* at 4-14.

California State Laws and Policies).

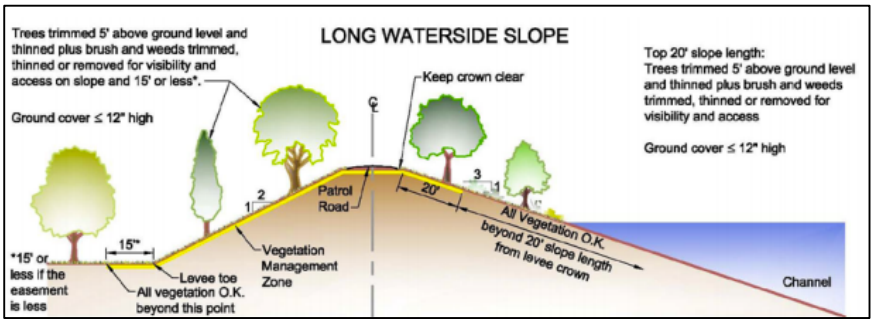

Figure 3: State Levee Vegetation Management Strategy (LVMS)[96]

In February of 2012, USACE released another *Draft Policy Guidance Letter: Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls* (Revised PGL).[97] This updated the procedure for obtaining a variance from the ETL requirements, with the same applicability as the 2010 PGL. The Revised PGL differs from the first in that it requires any scientific information regarding levee vegetation to be peer-reviewed and submitted to ERDC for evaluation.[98]

In August 2012, a second Levee Vegetation Research Symposium was convened in Sacramento, California. This symposium was a follow-up to the 2007 Symposium and included many of the same researchers and policy-makers. The 2012 Symposium revisited questions left unanswered and targeted areas for further research identified in the 2007 Symposium. As such, the 2012 Symposium presented some of the latest research and models on levee vegetation from top scientists around the world.[99] Most of the research and models presented in the 2012 Symposium were later included in the CLVRP Synthesis Report, described in greater detail below.

On April 30, 2014, USACE issued another ETL, *ETL 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*.[100] ETL 1110-2-583 maintained similar requirements as ETL 1110-2-571, requiring vegetation-free zones on

[96] CAL. DEP'T OF WATER RES., CVFPP CONSERVATION STRATEGY: APPENDIX D. VEGETATION MANAGEMENT STRATEGY D-7 (2015).

[97] Process for Requesting A Variance from Vegetation Standards for Levees and Floodwalls; Additional Filings, 77 Fed. Reg. 9,637 (Feb. 17, 2012) [hereinafter 2012 PGL].

[98] *Id.* § 12(a).

[99] *See Levee Vegetation Research Symposium 2012: 2012 Symposium Overview*, SACRAMENTO AREA FLOOD CONTROL AGENCY, http://www.safca.org/symposium2012.htm (last visited June 15, 2018).

[100] ETL 1110-2-583, *supra* note 1.

levees and extending fifteen feet on either side of the levee toe.[101] There is little difference between ETL 1110-2-583 and ETL 1110-2-571 in applicability. However, ETL 1110-2-583 updated vegetation removal requirements with respect to PL 84-99 eligibility. The new ETL still requires vegetation-free zones and vegetation removal on the entirety of the levee and uses vegetation compliance as a factor for PL 84-99 eligibility analysis.[102] However, if the State or LMA is only deficient in terms of levee vegetation removal requirements, they will not lose eligibility in the PL 84-99 program, as they would have under the terms of the previous ETL.

In 2014, Congress enacted the Water Resources Reform and Development Act (WRRDA) of 2014, which, among other things, addressed the USACE's levee vegetation policy. Section 3013 of WRRDA 2014 required that the USACE carry out a comprehensive review of their vegetation policy, including the ETL and PGL, within eighteen months.[103] At the time of this article, USACE has not complied with the terms of WRRDA 2014, and no review of the ETL and PGL has been completed. In July 2016, the United States Government Accountability Office (GAO) released a report summarizing USACE and FEMA's failure to carry out the requirements of WRRDA 2014.[104] The GAO found that USACE and FEMA have not made significant progress implementing the Water Resources Reform and Development Act of 2014's required national levee-safety-related activities. USACE cited funding constraints for not being able to carry out the requirements of WRRDA 2014, but GAO noted that the federal agencies lacked any structured plan for achieving WRRDA 2014 requirements, and without a plan requesting projected levels of funding, little progress would ever be made.[105] Consequently, GAO recommended that USACE and FEMA, "develop a plan that includes milestones for implementing the required national levee-safety-related activities using existing resources or requesting additional resources as needed."[106]

Section 3013 specifically directs USACE to consider regional variation while undergoing their policy review.[107] Additionally, USACE must consider potential benefits vegetation may offer to levee safety and the environment, as well as dangers of removing mass amounts of woody vegetation on levees.[108] Section

[101] *Id.*

[102] *Id.*

[103] Water Resources Reform and Development Act of 2014, Pub. L. No. 113-121, § 3013, 128 Stat. 1193, 1284–87.

[104] U. S. GOV'T ACCOUNTABILITY OFF., GAO-16-709, REPORT TO CONGRESSIONAL COMMITTEES, LEVEE SAFETY: ARMY CORPS AND FEMA HAVE MADE LITTLE PROGRESS IN CARRYING OUT REQUIRED ACTIVITIES (2016).

[105] *Id.*

[106] *Id.*

[107] Water Resources Reform and Development Act § 3013(c)(2)(A)(i).

[108] *Id.* § 3013(c)(2)(A)(iv), (vii); (c)(1)(B).

3013 further directs USACE to revisit their variance policy, set forth in the PGL, so as to make obtaining a variance more attainable based on site-specific environmental conditions.[109] In undergoing this review, Section 3013 directs USACE to consult with representatives from state and federal agencies, local and tribal governments, nongovernmental organizations, and the public, as well as with independent engineering and environmental experts.[110] Section 3013 further provides interim requirements to be applied while USACE undergoes the review process.[111] These interim requirements preclude USACE from enforcing the ETL's vegetation-free policy, or from requiring ETL compliance from any state or local levee sponsor in order to obtain or maintain PL 84-99 eligibility.[112] Rather, USACE may only require woody vegetation removal when it poses an unacceptable threat to levee integrity.[113]

In March 2014, USACE released: *Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for Rehabilitation Program Pursuant to Public Law 84-99*. This Memorandum described interim eligibility criteria to determine PL 84-99 eligibility while USACE undergoes its larger vegetation policy review.[114] Pursuant to this interim policy, USACE still requires a root-free zone on the levee profile but does not use vegetation presence as the determining factor for whether the levee in question is eligible for the PL 84-99 program.[115] For more information on this policy see *infra* Appendix 1: Federal Laws and Policies. Given the above interim requirements, the Section 3013 interim requirements and USACE's failure to comply with the deadline set forth in Section 3013 of WRRDA 2014, state and local levee sponsors have expressed confusion and differing opinions as to the extent that USACE currently requires vegetation removal for PL 84-99 eligibility.[116]

In July of 2014, USACE issued *Engineering Circular (EC) 1165-2-216*, clarifying the use and applicability of Rivers and Harbors Appropriation Act Permits[117] ("Section 408").[118] Under the terms of Section 408, USACE can grant

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[109] *Id.* § 3013(f)(2).

[110] *Id.* § 3013(d).

[111] *Id.* § 3013(g).

[112] *Id.* § 3013(g)(1).

[113] *Id.*

[114] U.S. ARMY CORP OF ENG'RS, MEMORANDUM FOR COMMANDERS, MAJOR SUBORDINATE COMMANDS AND DISTRICTS: INTERIM POLICY FOR DETERMINING ELIGIBILITY STATUS OF FLOOD RISK MANAGEMENT PROJECTS FOR THE REHABILITATION PROGRAM PURSUANT TO PUBLIC LAW (P.L.) 84-99 (2014), https://www.iwr.usace.army.mil/Portals/70/docs/frmp/Interim_Policy_for_Rehabilitation_Program_21March2014_FINAL.PDF.

[115] *Id*. at 2.

[116] *See, e.g.*, Letter from Cowin & McCamman, *supra* note 5.

[117] 33 U.S.C. § 408 (1899).

[118] U.S. ARMY CORPS OF ENG'RS, POLICY AND PROCEDURAL GUIDANCE FOR PROCESS TO ALTER U.S. ARMY CORPS OF ENGINEERS CIVIL WORKS PURSUANT TO 33 U.S.C. § 408 (2015),

the authority of an applicant to alter a levee (or similar public works project) only if the applicant demonstrates that the alteration is in the public interest and does not impair the usefulness of the levee.[119] USACE authority under Section 408 dates back to 1899, but USACE did not act on issuing or enforcing Section 408 until the issuance of the EC, which essentially breathed life back into the Section 408 program. Pursuant to the EC and Section 408 permission program, an applicant proposing to modify or alter a levee must meet current USACE design and construction standards for the area proposed for alteration,[120] which arguably include the ETL's vegetation-free requirements. This could exacerbate vegetation-removal issues. State and local levee maintainers have voiced concerns over selective applicability of Section 408, arguing that the program is enforced for environmental conservation projects but not for agricultural projects.[121] Although there is no tangible evidence pointing to inequitable enforcement, one theory for this perception could be that agricultural projects were generally included in the levee project's inception. Thus, common maintenance activities associated with levees would already be covered by the O&M manual, where restoration activities would not be. Levee maintainers have also voiced concerns that the Section 408 consultation process is lengthy and time consuming, especially because 408 review requires NEPA compliance.[122] (For more on Section 408, see *infra* Appendix 1: Federal Laws and Policies.)

In March of 2016, the CLVRP issued the report, *Synthesis of Levee Vegetation Research Results*.[123] This Synthesis Report compiled the most recent scientific research on levee vegetation issues from top experts around the world, with much of the report stemming from models and research presented at the 2012 Levee Vegetation Research Symposium. Results from the report are discussed in greater detail below (See *infra* Appendix 4: Science and Research). Overall, the report reviewed research demonstrating that woody vegetation likely poses low risks to levee integrity for levees in California, due in part to California wind conditions and soil types.[124] Further, current research indicates that woody vegetation presence can help slope stability in almost all conditions.[125] However, more research is needed regarding potential effects that woody vegetation can have in terms of impairing visual inspections and flood fighting activities.[126]

http://www.publications.usace.army.mil/Portals/76/Publications/EngineerCirculars/EC_1165-2-216.pdf?ver=2016-06-28-100552-103 [hereinafter EC 1165-2-216].

119 33 U.S.C. § 408 (1899).

120 U.S. ARMY CORPS OF ENG'RS, *supra* note 118, at B-2.

121 Confidential Personal Communication, 2016.

122 Confidential Personal Communication, 2016.

123 SHIELDS, *supra* note 8.

124 *Id.*

125 *Id*. at 15-1.

126 *Id.*

National tragedy led to greater attention and funding for California levee development and maintenance. However, with this greater attention also came an overly-conservative approach to levee maintenance from the federal government, especially regarding vegetation maintenance on levees. The result in California has been a federal policy that arguably oversimplifies levee vegetation management and potentially conflicts with State policy.[127]

II. ISSUES ASSOCIATED WITH VEGETATION REMOVAL REQUIREMENTS

Strict conformance with USACE vegetation removal requirements would have negative consequences for the natural environment. Total removal of woody vegetation from California levees would eliminate the last remaining critical habitat for endangered fish species,[128] and in so doing, violates the ESA. Furthermore, conformance with vegetation removal requirements could have real safety consequences for those in flood risk communities. Spending time and money removing vegetation from levees could unnecessarily divert limited funds from other, more pressing levee safety projects. Further, complete compliance with USACE vegetation-free guidelines and total vegetation removal could directly contribute to erosion and slope instability, making levees less safe overall and increasing risk to life and property.[129]

USACE vegetation removal requirements could also differ from California's Levee Vegetation Management Strategy, although State policymakers generally view the two as operationally compatible within the context of risk prioritization. The dichotomy between federal and state policies is nuanced and can be very confusing and difficult for local levee maintainers to understand. Unfortunately the uncertainty and confusion does not end there. Although presently vegetation removal will not by itself preclude levee maintainers from PL 84-99 eligibility, the full extent of vegetation removal requirements and consequences of not doing so are poorly understood. Significant confusion surrounds the issues of whether and to what extent vegetation removal is

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[127] For an overview of major levee vegetation milestones in California, see *infra* Attachment 1: Timeline of Federal and State Policies Regarding Levee Vegetation Management in California. For greater details on federal policies, state policies, science and research, and case law, see Appendixes 1 through 4, respectively

[128] NAT'L OCEANIC & ATMOSPHERIC ADMIN., CENTRAL VALLEY CHINOOK SALMON & STEELHEAD RECOVERY PLAN 2 (2014), http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/california_central_valley/cv_chin_stlhd_r_plan_fs_071614.pdf ("In addition, 98 percent of riparian and floodplain habitat in the lower river and Delta is no longer available to support healthy fish runs.").

[129] SHIELDS, *supra* note 8, at 5-2. ("[T]he death of a single tree on a densely vegetated slope has effects quite different from those of clear-cutting, because zones occupied by dead roots are quickly occupied by a new generation of roots from surrounding trees. Thus, slope stability is not adversely affected by the root death of a single tree in a stand, because in a dense stand or grove the live roots will intermingle and intersperse with dead roots.").

required for PL 84-99 eligibility. Further, despite WRRDA 2014 mandates that USACE not require total vegetation removal for PL 84-99 eligibility, WRRDA 2014 interim requirements have created unintended consequences of incentivizing total vegetation removal, or else placing the burden on levee maintainers to demonstrate that any particular tree does not pose a risk to levee integrity.

Finally, complying with vegetation removal requirements is cost-prohibitive for most local levee maintainers.[130] If local maintainers wish to pursue a variance from vegetation removal requirements, they are similarly met with confusing, time-consuming and expensive variance requirements, making obtaining a variance impractical in most areas.

A. Vegetation Removal Effects on the Natural Environment

Levee vegetation provides numerous benefits to California's natural environment, including critical habitat for ESA listed species. These benefits would be lost from strict adherence to the USACE vegetation-free policy. Further, strict adherence to this policy would violate the ESA.

California is unique in that the levee system contains almost all of the last three to five percent of riparian forest that was once present along Central Valley river corridors.[131] Due to the location and close alignment of Central Valley levees, they essentially form the riverbank and provide hundreds of miles of habitat for anadromous fish species.[132] Thus, California's Central Valley levees serve two purposes: public safety, and designated critical habitat for listed threatened and endangered species.[133] If vegetation were removed from Central Valley levees, this designated critical habitat would be entirely lost.[134] Such widespread loss of designated critical habitat would strongly threaten the survival of already imperiled species.[135]

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[130] CAL. DEP'T OF WATER RES., FISCAL IMPACT OF U.S. ARMY CORPS OF ENGINEERS POLICY ON VARIANCE FROM VEGETATION STANDARDS FOR LEVEES AND FLOODWALLS (2010).

[131] *See* CAL. DEP'T OF WATER RES., *supra* note 4; NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4.

[132] NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4.

[133] *See* CAL. DEP'T OF FISH & GAME, LEVEE VEGETATION—HABITAT VS. STABILITY (2010) ("In California's Central Valley, most remaining riparian habitat is found on levees, and the [DFG] habitat experts believe vegetation removal under USACE's new policy would have a significant impact on California's riparian and adjacent riverine ecosystem. The levees that confine California's river systems hold the last remnants of a once great riparian forest ecosystem that dominated the Central Valley. Some federal- and state-listed wildlife species, such as winter- and spring-run Chinook salmon, depend on habitats now only occurring on vegetated levees along Central Valley rivers and in the Sacramento San-Joaquin Delta. In addition, the Central Valley and Delta habitats provide the critical rearing area for one of the last remaining commercial salmon stocks in California, the Central Valley fall-run Chinook."

[134] *See id.*

[135] *See* CAL. DEP'T. OF WATER RES., CENTRAL VALLEY FLOOD PROTECTION PLAN

Levees in California are unique for a variety of reasons. Most notably, they were constructed very close to flood channels to facilitate scour of hydraulic mining debris during the Gold Rush.[136] Building levees to narrowly confine the river system also took advantage of California topography and maximized the land available for agriculture.[137] This has ultimately disrupted natural functioning floodplains, separated rivers from their natural processes, and removed fish species from their natural riparian habitat. Salmonids historically used floodplain habitat for rearing; for cover in the summer months and side-channel and pond habitats in the winter months; for spawning; as shallow habitat with cover to escape from predators; as providing high abundance of food sources; as a slow-water refuge for juvenile salmon to avoid high river flows, allowing them to conserve energy for their ocean migration; as a filtration source for excess nutrients; as storage for excess sediment; and as an exchange of nutrients and organic material between land and water, increasing habitat complexity with food sources and large woody debris.[138] Because floodplains are so important to salmonid survival, the NMFS Recovery Plan points to the loss of floodplains and construction of "armored" banks[139] as a major contributor to the decline of endangered salmonids.

Riparian habitat in the Central Valley has also been adversely affected by other stressors, including: human settlement, historical and current land use, nonnative species invasions, water diversions, flood management, dam construction, hydropower management, and other major modifications to natural watershed conditions.[140] This has resulted in impaired ecosystem processes; eliminated, fragmented, and degraded habitats; and declining native species populations.[141]

The elimination of natural floodplains and flood basin ecosystems and removal of extensive areas of wetland and riparian habitat has had drastic consequences. Overall there is less diversity, abundance, and distribution of

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CONSERVATION STRATEGY 2-1 (2016), https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Flood-Management/Flood-Planning-and-Studies/CVFPP-Conservation-Strategy/Files/2016-CVFPP-Conservation-Strategy.pdf

136 *Id.*

137 *Id*.

138 NAT'L OCEANIC & ATMOSPHERIC ADMIN., THE IMPORTANCE OF HEALTHY FLOODPLAINS TO PACIFIC SALMON & STEELHEAD (2014), http://www.westcoast.fisheries.noaa.gov/publications/habitat/fact_sheets/floodplains_fact_sheet_031114.pdf.

139 *Armor (hydrology)*, ACADEMIC DICTIONARIES AND ENCYCLOPEDIAS (2017), http://enacademic.com/dic.nsf/enwiki/6456361 ("Armor, in hydrology and geography is the association of surface pebbles, rocks or boulders with stream beds or beaches. . . Man-made form is usually called riprap, when shorelines or stream banks are fortified for erosion protection with large boulders or sizable manufactured concrete objects.").

140 CAL. DEP'T OF WATER RES., *supra* note 4; NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4.

141 CAL. DEP'T OF WATER RES., *supra* note 4; NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4.

natural plant and animal species in the Central Valley, the remaining habitat is degraded, and this has all contributed to the extinction or extirpation of several species, and endangerment of others.[142] Approximately 95 percent of historical wetlands and riparian habitats no longer exist in the Sacramento and San Joaquin Valleys.[143] Figure 4 shows the current extent of riparian forest and scrub (dark purple), freshwater perennial and seasonal wetland (pink) and the historical extent of riparian/wetland vegetation (green).

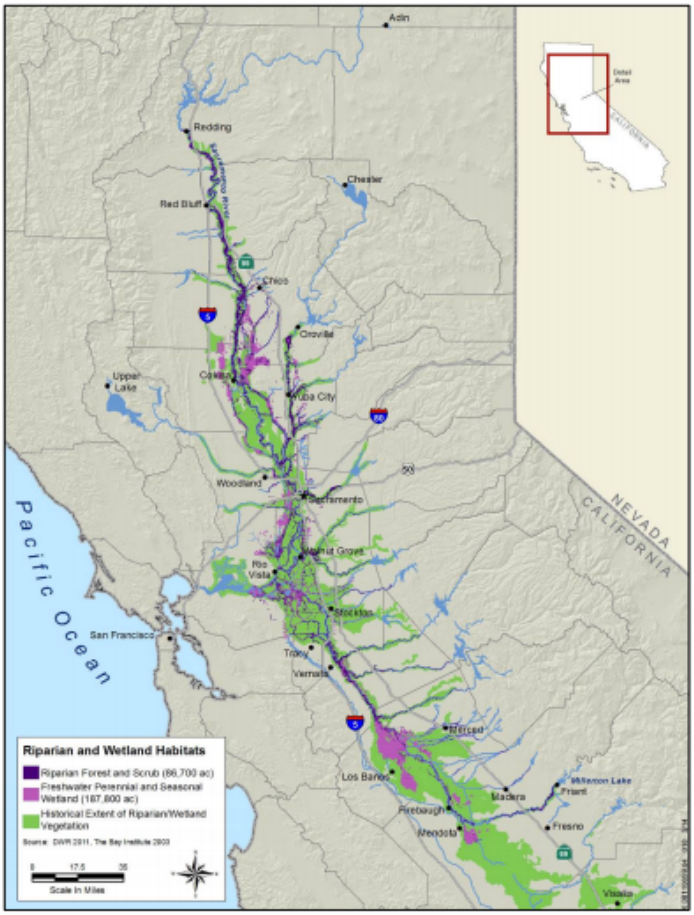

Figure 4: Historical and Existing Distribution of Riparian and Wetland Vegetation[144]

142 CAL. DEP'T OF WATER RES., *supra* note 4.

143 *Id.*

144 CAL. DEP'T OF WATER RES., *supra* note 135, at 2-5.

Much of the remaining wetlands in the Central Valley are managed habitat, located in federal and State wildlife areas, or on private duck clubs, and most of these are not directly connected to rivers. In addition, much of the remaining riparian habitat in the Central Valley (56,000 acres) is highly fragmented or occurs as narrow strips along the waterway.[145]

Figure 5: Representative Photograph of Remnant Riparian Habitat along the Sacramento River[146]

This fragmentation and reduction in wetlands and riparian forest has caused a reduction in the abundance and number of fish and wildlife species. More than 16 animal species associated with floodplain and flood basin habitats of the Sacramento and San Joaquin Valleys are now listed under California Endangered Species Act (CESA) or ESA, and 22 other animal species dependent on floodplain habitats are considered sensitive species.[147]

Anadromous and other native fish species have especially suffered, as their habitat connectivity, quantity and quality has been greatly reduced or degraded.[148] At one point, millions of wild salmon returned from the sea every

[145] *Id.*

[146] *Id.* at 2-6.

[147] CAL. DEP'T OF WATER RES., *supra* note 4; CAL. DEP'T OF FISH & WILDLIFE, APPENDIX G. IDENTIFICATION OF TARGET SPECIES AND FOCUSED CONSERVATION PLANS (2011).

[148] CAL. DEP'T OF WATER RES., *supra* note 4.

year to spawn in the foothills and mountains of California's Central Valley.[149] Natural streams provided habitat for a diversity and abundance of Chinook salmon and steelhead.[150] By the 1990s, three of the Central Valley's native anadromous fish populations were close to extinction and thus listed under the federal ESA: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead.[151] Today, only a few historic populations of these iconic fish remain.[152]

Dams block Chinook salmon and steelhead from over 90 percent of their historical spawning habitat in the Central Valley.[153] Additionally, 98 percent of historical riparian and floodplain habitat is no longer available to support healthy fish runs.[154] The little remaining habitat overlaps almost entirely with rivers surrounded by levees.

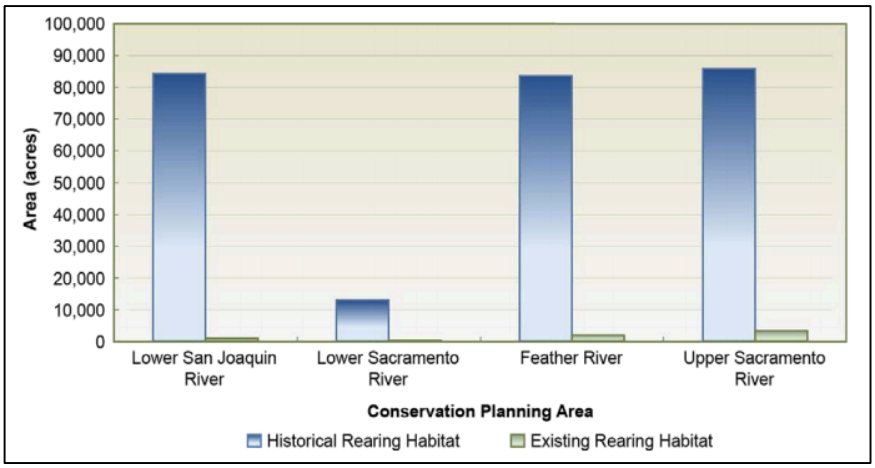

Figure 6: Historical and Existing Chinook Salmon Rearing Habitat[155]

Salmonids require instream large woody material (LWM) in river channels and shaded riverine aquatic (SRA) cover along channels.[156] However, LWM and SRA have dramatically diminished in the past century, mainly due to the loss of

149 NAT'L OCEANIC & ATMOSPHERIC ADMIN, *supra* note 128.

150 *Id.*

151 Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs, 70 Fed. Reg. 37,160 (June 28, 2005); Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead, 71 Fed. Reg. 834 (Jan. 5, 2006).

152 NAT'L OCEANIC & ATMOSPHERIC ADMIN, *supra* note 4.

153 *Id.*

154 *Id.*

155 CAL. DEP'T OF WATER RES., *supra* note 135, at 2-3.

156 *Id.*

natural riverbanks and riparian vegetation along riverbanks of the Sacramento and San Joaquin Rivers and their tributaries.[157] LWM generally refers to logs or other woody material over four inches in diameter and more than six feet long, lying in the river or stream channel.[158] LWM provides valuable cover and resting habitat for fish, but as riparian forests have declined around river corridors, so has LWM. SRA is found at the interface between river corridors and adjacent woody riparian areas where, "natural banks support overhanging vegetation and provide inputs of woody debris, falling insects, and other foods for aquatic species, and create variable velocities, depths, and flows."[159] Revetment projects, including levees, have eliminated much of the high-value SRA cover along the banks of the Sacramento and San Joaquin River systems. Current data show that the amount of high-quality SRA cover along Central Valley riverbanks represents only a small fraction of what was present historically.[160]

Spawning salmon are also affected by the flood system in terms of spawning habitat and pebble size.[161] Spawning salmon need gravel with small to moderate pebble sizes.[162] In a natural flood system river flows regularly replenish sources of sediment, but in the current system, gravel beds quickly degrade. This is due to altered water flows as well as dams, which hold back gravel from flowing downstream and replacing gravel that has been lost over time.[163] Large pebbles remain while small ones wash away, and new gravel does not recruit in the streambed. The current flood control system has ultimately resulted in serious degradation of salmon spawning habitat in Central Valley rivers.[164]

Overall, endangered fish habitat in the Central Valley is now reduced to its very last remnants, and these few remaining remnants are a poor substitute for natural riparian forests and floodplains. Almost all of the historical natural SRA cover on the Sacramento River and its tributaries has been lost due to levee and bank revetment construction.[165] The little residual riparian habitat falls almost completely within our flood management system.[166] Thus, levees do not merely

157 *Id.*

158 *Id.*

159 *Id.* at 2-4.

160 *Id.*

161 G. Mathias Kondolf & M. Gordon Wolman, *The Sizes of Salmonid Spawning Gravels*, 29 WATER RESOURCES RES. 7 2275, 2275 (1993), http://yubashed.org/sites/default/files/null/fish_kondolf_1993_sizespawninggravels_prj.pdf.

162 CAL. DEP'T OF WATER RES., *supra* note 135, at 2-4.

163 *Id.*

164 *Id.*

165 *See*. U.S. FISH & WILDLIFE SERV., SHADED RIVERINE AQUATIC COVER OF THE SACRAMENTO RIVER SYSTEM: CLASSIFICATION AS RESOURCE CATEGORY 1 UNDER THE FWS MITIGATION POLICY 2-3 (1992), http://www.deltarevision.com/Issues/fish/dpm/riverine-aquatic-cover.pdf.

166 Discussions with NMFS Fisheries Biologists (July 2016); *see also* CAL. DEP'T OF WATER

act to protect people and property from flood events, but they contain the little remaining habitat necessary for the survival of ESA-listed species. If Central Valley levees conformed to USACE guidelines and contained no vegetation on the entirety of the levee plus fifteen feet on each side, we would degrade designated critical fish habitat and remove important ecosystem functions vegetation provides for ESA-listed species.

B. Vegetation Removal and the Endangered Species Act

The USACE policy requiring vegetation-free zones on levees could potentially violate the federal ESA. Per Section 7 of the ESA, all federal agencies are required to undergo consultation with FWS and/or NMFS prior to taking an action that may affect an ESA listed species.[167] So long as the "Action Agency" (the federal agency undertaking the action)[168] successfully undergoes this consultation process, the permit applicant will be legally protected from any incidental take that may arise as part of the project.[169] However, the permitted action cannot jeopardize the continued existence of the listed species or destroy or adversely modify designated critical habitat.[170]

As discussed in the above section, complete compliance with the USACE policy by all levee maintainers would cause the extensive destruction of designated critical habitat and would jeopardize the continued existence of several ESA-listed fish species. In the case of such projects, the permit applicant and action agency typically come up with "reasonable and prudent alternatives" (RPAs). RPAs are economically and technologically feasible for the action agency, but which do not jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.[171] However, for endangered Chinook salmon and steelhead, there is little to offer in terms of RPAs because there is no way to simply move the project to an area where listed species and their habitat will not be affected. This is because of the extremely limited remaining critical habitat available to support healthy fish runs (see discussion above). ESA Section 7 applicants currently try to resolve this conflict between the ESA and USACE policy on a case-by-case, literal "tree-by-tree basis" but a higher-level solution is desperately needed to avoid further fragmentation of remaining critical fish habitat.[172]

Absent an action by a federal agency (generally referred to as a "federal nexus," triggering ESA Section 7) there is an even higher likelihood of a local

RES., *supra* note 135, at 2-2–2-6.

167 16 U.S.C. § 1536 (1973).

168 *Id.*

169 *Id.*

170 *Id.*

171 50 C.F.R. § 402.02 (1986).

172 Interview with H. Brown (June 30, 2016).

levee sponsor violating the terms of the ESA. Section 9 of the ESA prohibits all actors, including private citizens, from engaging in "take" of a listed species.[173] "Take" can mean many things per the ESA definition, including harming or killing the species, or destroying critical habitat.[174] If a State or local maintainer attempts to remove vegetation from levees to comply with USACE vegetation-free policies, they would essentially be removing critical endangered fish habitat and in direct violation of the ESA. Absent a federal nexus, local agencies are barred from engaging in consultation under ESA Section 7 and developing RPAs. This leaves local maintainers vulnerable to ESA Section 9 violations with no opportunities to exempt their actions. This is extremely problematic for local maintainers. More information on the ESA is included *infra* Appendix 1: Federal Laws and Policies.

C. Safety Issues Associated with Vegetation Removal

1. Conformance with Vegetation Removal Requirements Could Hinder LMAs from Completing Other Levee Safety Projects

California levees are in large need of repair. The State Plan of Flood Control (SPFC) collectively refers to "the state and federal flood control works, lands, programs, plans, polices, conditions, and mode of maintenance and operations of [flood control projects in California's Central Valley]."[175] Of the levees contained in the SPFC area, there are about 300 miles of "urban" levees, or levees protecting urban areas with high human population levels.[176] Of those urban levees, about half do not meet current engineering design criteria set by either USACE or DWR.[177] It should also be noted that many other non-SPFC levees are part of a USACE federal project and must also meet USACE safety standards.[178]

Of the 1,230 miles of nonurban SPFC levees, about sixty percent have a "high potential for failure" at the assessment water surface elevation.[179] Of the approximately 1,016 miles of SPFC channels evaluated, about half have potentially inadequate capacity to convey design flows and require additional

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173 16 U.S.C. § 1538 (1973).

174 16 U.S.C. § 1532(19) (1973).

175 CENT. VALLEY FLOOD MGMT. PLANNING PROGRAM, STATE PLAN OF FLOOD CONTROL DESCRIPTIVE DOCUMENT Guide-1 (2010), https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Flood-Management/Flood-Planning-and-Studies/Central-Valley-Flood-Protection-Plan/Files/2010-State-Plan-of-Flood-Control-Descriptive-Document.pdf; CAL. WATER CODE § 9110(f) (2007).

176 *See* CAL. PUB. RES. CODE § 5096.805(k) (defining "urban area" as "any contiguous area in which more than 10,000 residents are protected by project levees"); CVFPP, *supra* note 5, at 1-12.

177 CVFPP, *supra* note 5, at 1-12.

178 *See id.* at 2-4.

179 *Id.* at 1-12.

evaluation to assess conditions.[180]

Given the large need for system-wide levee repair in California, as well as limited funding and resources, many advocate that prioritizing vegetation removal is a misuse of government resources.[181] The theory is that given the dispute over whether woody vegetation poses any threat to the structural integrity of levees and given the numerous hazards that clearly pose threats to levee integrity, resources should be allocated to the worst threats first.[182] The State of California has repeatedly voiced this opinion.[183]

Following the initial release of USACE's vegetation-free policies, DWR publicly criticized the policy, primarily based on the above concern.[184] Because of these threats, they argued that there was an immediate and imperative need to update California levees, but focusing on vegetation was distracting from real threats that can be fixed. A letter set forth by DWR in response to USACE vegetation removal policies states, "The Corps' new approach to managing vegetation impairs our collective ability to improve public safety by diverting significant funds from more important repairs and improvements, increases the likelihood of erosion in some areas, and already is delaying important and much needed repairs and improvements."[185]

This view is shared by many policymakers in California, including Congresswoman Doris O. Matsui, who spoke at the 2012 Levee Research Symposium. The Congresswoman stated her concerns with the USACE vegetation removal policy as follows:

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[180] *Id.* at 1-14.

[181] *See* CAL. DEP'T OF WATER RES., *supra* note 36 ("The extremely high costs of levee construction and mitigation required under the new proposal (estimated to be in the several billions of dollars) will divert limited resources from the remediation of well documented critical risk factors, with little or no improvement in public safety."); *See also* Cal. Dep't of Fish & Game's Complaint at 13, Cal. Dept. of Fish & Game v. U.S. Army Corps of Eng'rs, 2012 U.S. Dist. LEXIS 168259 (E.D. Cal. 2012) (No. 2:12-cv-01396-JAM-JFM) ("The state agencies informed the Corps that compliance with ETL No. 1110-2-571 would cost the State of California up to $7.5 billion dollars, and divert funding from other higher priority flood risk reduction efforts.")

[182] *See* CAL. DEP'T OF WATER RES., *supra* note 36 ("Whereas overtopping, underseepage, through-seepage, erosion and other modes of failure are well-documented and understood in the Central Valley, DWR has not seen evidence that well-managed vegetation poses significant risks in the Central Valley. Existing vegetation that currently provides erosion protection and soil reinforcement would be eliminated, increasing the risk of water-side scour and slope failures."); *see also* Cal. Dep't of Fish & Game's Complaint, *supra* note 181,
at 13 ("[C]ompliance with ETL No. 1110-2-571 would cost the State of California up to $7.5 billion dollars, and divert funding from other higher priority flood risk reduction efforts.")

[183] *See* CAL. DEP'T OF WATER RES., *supra* note 36; Letter from Lester A. Snow, Secretary for Natural Resources, to Jo-Ellen Darcy, Assistant Secretary of the Army (Nov. 3, 2010) at 2 (on file with author) ("Public safety will be impaired: Extremely high costs of levee construction and mitigation will divert limited resources from the remediation of critical risk factors.")

[184] CAL. DEP'T OF WATER RES., *supra* note 36.

[185] *Id*.

> [USACE's vegetation removal policy] could force thousands of trees to be pulled out and the levees to be rebuilt. This would result in the loss of shaded habitat for both aquatic and terrestrial species. But most importantly to me, in a time of shrinking federal, state, and local budgets, it could lead us down a path that makes levee improvements too costly to implement. It very likely could divert our attention away from necessary levee fixes to secondary issues that, while important, are not nearly as pressing.[186]

Thus, State maintainers and policymakers voiced strong concerns that uniform enforcement of vegetation removal requirements unnecessarily diverts funds and prevents other necessary levee repair projects from moving forward.

Local maintainers have also voiced concerns that complying with vegetation removal requirements is infeasible because it conflicts with State and other federal laws. As part of Roundtable discussions, participants "on all sides of the issues" mentioned that some significant projects were suspended because they "have not been able to find an acceptable project design that will simultaneously meet the [USACE] vegetation standards and the resources agencies' environmental permitting requirements."[187] This exemplifies one enormous problem with the current regulatory landscape: levees are in dire need of maintenance and repairs, but maintainers are unable to act for fear of violating one policy or another.

2. Complying with Vegetation Removal Policies Could Decrease Safety

Recent studies suggest that removing woody vegetation from levees may not improve levee integrity or performance, and in some cases decreases levee safety.[188] This indicates that USACE's vegetation policy should be reversed, because removing vegetation may make levee systems more vulnerable to flood events, risking life and property. This theory posits that woody vegetation on levees helps improve slope stability through the root systems by adding cohesion to the levee, and removing root systems from the landside or waterside levee slope can negatively impact slope stability.[189]

The most recent and pertinent research on levee vegetation has been conducted in the past few years, and has been summarized into a comprehensive report released by CLVRP in January of 2016 (the Synthesis Report, referenced

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[186] Congresswoman Doris O. Matsui, Fifth Congressional District of CA, U.S. House of Representatives, Welcome Address (Aug. 28, 2012), http://www.safca.org/symposium_2012_documents/2012_Symposium_Matsui_Transcript.pdf.

[187] KAPLAN, *supra* note 5, at 13.

[188] SHIELDS, *supra* note 8, at 15-3.

[189] *See* DANIELE CAZZUFFI & ENRICO CRIPPA, CONTRIBUTION OF VEGETATION TO SLOPE STABILITY: AN OVERVIEW OF EXPERIMENTAL STUDIES CARRIED OUT ON DIFFERENT TYPES OF PLANTS (2005), https://ascelibrary.org/doi/10.1061/40781%28160%299.

and described in greater detail *infra* in Appendix 4).[190] As a result of this research we now have a better understanding than ever before as to the real threats posed by woody VEGETATION on levees.

General threats posed by woody vegetation can be to actual levee performance, maintenance actions, or flood fighting response.[191] As compared to known major threats to levee performance, like burrowing animals, risks posed by woody vegetation are generally less significant.[192] Trees growing on or immediately adjacent to levees create pits when overturned and uprooted, and this can happen from water flow or windthrow.[193] The research has shown that the threat of tree overturn due to windthrow is less likely to occur in the Central Valley, as California winds do not frequently meet the level required to overturn large enough trees to compromise levee integrity.[194] More research is needed to address the force of water flow that can cause trees to be overturned and uprooted, however the research from winching tests does demonstrate that forces required to topple trees are directly proportional to tree size, as are the areas of pits left from overturned trees.[195] Large trees generally produce larger pits, and larger pits pose the greatest hazard to levee integrity.[196] To topple large trees, there must be conditions of several simultaneous events, including "high winds, wind infirm trees, a flood event, and perhaps local scour."[197] This information can be used to identify and manage the few trees that truly pose a threat to levee integrity.

The research has also shown that, given the sandy soil types found in many Central Valley levees, there is little risk of decaying roots causing piping and erosion in levees, with a few exceptions (such as fruit and nut trees).[198] Woody vegetation appears to discourage most burrowing mammal activity, which could result in safer levees.[199] Further, woody vegetation has in some cases been shown to provide benefits to levee integrity in terms of mitigating the effects of

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190 *See infra* notes 914-1248 and accompanying text.

191 *See* SHIELDS, *supra* note 8, at 1-8 ("Objections to woody vegetation on levees stems from the following concerns, which have a range of evidentiary support: Aboveground portions of woody plants might obscure visual inspection and obstruct access for maintenance and flood fighting. Vegetation might facilitate through-seepage by creating macropores associated with living and dead roots. Vegetation might negatively affect slope stability as a result of potential impacts associated with the weight of the vegetation, wind action on the upper parts of the vegetation, and enhanced seepage and infiltration.")

192 SHIELDS, *supra* note 8, at 15-2–15-3.

193 *Id.* at 7-1.

194 *Id.*

195 *Id.*

196 *Id.*

197 *Id*. at 7-12.

198 *Id.* at 15-3.

199 *Id.*

water erosion and promoting slope stability.[200]

However, impacts to flood fighting activities are less understood.[201] Vegetation on the landside of levees could prevent visual observations of any issues to the levee's integrity, and therefore prevent timely flood fight response.[202] Vegetation on the waterside and landside levee slopes or toes can similarly prevent routine maintenance from occurring, by physically restricting where inspectors can move.[203] There are few studies of the risks that vegetation can pose to maintenance and flood fighting activities, and this is an area where greater research is needed.[204]

The Synthesis Report included research demonstrating that mass clearing or cutting of woody vegetation could have deleterious effects on levee slopes and must be done very carefully, if at all.[205] This is because generally, if one tree dies or is cut, decaying roots are quickly replaced by nearby live tree roots, given the opportunistic nature of tree root growth.[206] However, tree cutting on a massive scale leaves the rotting roots in the ground with no live roots to replace them and can create the potential for seepage.[207] Thus, mass clear cutting of trees and other woody vegetation, as prescribed in the vegetation-free policy can threaten levee integrity.[208] Further, soil typical of the Central Valley does not support the decay of tree roots causing preferential seepage paths, further reducing the likelihood that existing trees on California levee slopes could threaten levee integrity.[209] Research and models regarding levee vegetation, including the Synthesis Report, are discussed in greater detail *infra* in Appendix 4.

NMFS, as well as State and local agencies, have advocated for reversal in the USACE anti-vegetation policy because requiring the vast removal of woody vegetation on levees could decrease levee safety, putting lives and property at risk.[210]

D. USACE Vegetation Removal Policy and State Policy

Another significant reason for bringing greater attention to this issue is the fact that, as they currently stand, the USACE and State policies regarding levee

200 *Id.*
201 *Id.* at 15-8.
202 *Id.* at 12-4.
203 *Id.* at 13-1.
204 *Id.* at 13-5.
205 *Id.* at 5-2.
206 *Id.*
207 *Id.*
208 *Id.*
209 *Id.* at 5-6.
210 See CAL. NATURAL RESOURCES AGENCY, *supra* note 36, at 1.

vegetation are arguably in contradiction, although the full extent of contradiction between the policies remains a contested issue. Following the release of USACE vegetation-free policies, the State argued strongly against them, citing above issues of risk prioritization, limited funding, safety issues and environmental consequences.[211] The State has since reduced the degree of their critique, noting that their own vegetation management policies can be compatible with USACE vegetation-free requirements.[212] While state views federal policies and their own policies as potentially compatible, an objective review and analysis of the policies can indicate otherwise. The guiding state document for levee management in California is the 2012 CVFPP (described in greater detail *infra* in Appendix 2, including its applicability to state and local levee sponsors). The 2012 CVFPP includes the State's Levee Vegetation Management Strategy (LVMS), described in greater detail above, as well as *infra* in Appendix 2. The LVMS generally allows additional vegetation recruitment on the lower waterside slope of existing levees, and for existing vegetation to remain on all other portions of the levee prism, subject to maintenance requirements.[213]

Pursuant to the LVMS, newly constructed levees shall meet USACE vegetation-free requirements.[214] State and federal vegetation policies are, however, difficult to reconcile for existing levees. LVMS presumes woody vegetation retention on most parts of the levee prism with additional recruitment on the lower waterside slope, while USACE policy does not. The 2012 CVFPP attempted to reconcile the policies by stating:

> Compatibility between the State levee vegetation management strategy and USACE vegetation policy is *potentially achievable* when framed in the following context: Through long-term implementation of [LCM] on the landside slope, crown, and upper waterside slope of SPFC levees, the CVFPP levee vegetation management strategy will gradually (over a period of decades) result in levees clear of woody vegetation, consistent with USACE vegetation policy, except for lower waterside vegetation—which is mostly the same part of the levee where USACE has indicated that variances can be appropriate.[215]

Thus, through the LVMS, which includes LCM, state and federal policies could potentially be reconciled. The State assumes reconciliation through variance approval and the passage of time. However, this assumes the passage of many decades, allowing most of the vegetation on existing levees (except for the lower

[211] *Id.*

[212] Email from George Qualley, Principal Engineer, Cal. Dep't of Water Res. to author (December 2016) (on file with author).

[213] CVFPP, *supra* note 5, at 4-13.

[214] *Id.* at 4-15.

[215] *Id.* at 4-16 (emphasis added).

waterside slope) to die off. Given the fact that only a few years have passed since DWR's implementation of LCM, this potentially achievable situation may theoretically come to pass years down the road, but likely not in the near future. This also assumes a successful variance from USACE for retention and additional recruitment of vegetation on the lower waterside levee slope. However, realistically obtaining a successful vegetation variance from USACE is unlikely due to the time-consuming and cost-prohibitive nature of the variance approval process, as discussed in more detail below.

The State has also voiced compatibility between federal and state policies based on a shared view of risk prioritization. The State's LVMS allocates resources first to pressing issues such as seepage, erosion, and slope failure, and then focuses resources on vegetation removal compliance.[216] Similarly, USACE's SWIF (mentioned above, and described in detail *infra* in Appendix 1) would prioritize limited resources by allocating funds to the most pressing threats to levee integrity first, addressing issues such as vegetation once more pressing threats have been addressed.[217] However, inconsistencies in the key aspects of state and federal policies remain. While the SWIF would allocate limited resources to problems other than levee vegetation first, it would still require eventual vegetation removal.[218] Conversely, the LVMS allows retention of existing vegetation on existing levee slopes and allows additional recruitment of new vegetation on the lower waterside slope of the levee prism.[219] Even assuming eventual die off of legacy vegetation, the LVMS still retains and allows additional recruitment of woody vegetation on the lower waterside levee slope.[220] USACE allows retention of this vegetation only if a variance has been approved, and this rarely happens for a variety of reasons as discussed in greater detail below. Although there have been efforts by the State to argue compatibility between state and federal vegetation management policies, there remain clear distinctions and conflicting mandates between the two.

The conflicting federal and state policies should be alarming for many reasons. First, this creates uncertainty for LMAs, especially those that are part of the SPFC and subject to state regulations, but that also seek eligibility in federal programs like PL 84-99. Many of these LMAs are essentially stuck and have no option but to violate one regulation or another, or else seek expensive and time-consuming variances.

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216 See Email from George Qualley, *supra* note 212.

217 U.S. ARMY CORPS OF ENG'RS, *supra* note 76.

218 *See supra* notes 75–80 and accompanying text.

219 CVFPP, *supra* note 5, at 4-14.

220 *Id.* at 4-14.

E. USACE Vegetation Policy Implications for PL 84-99 Eligibility

The USACE PL 84-99 program is a federal rehabilitation assistance program designed to provide federal aid in the event of flooding.[221] Greater details on the PL 84-99 program can be found *infra* in Appendix 1. WRRDA 2014 (also discussed in detail *infra* in Appendix 1), and two California District court orders (discussed in greater detail *infra* in Appendix 3) directed USACE to revisit and reissue vegetation management guidelines on levees. To date, USACE has failed to do so within the timeframe provided by WRRDA 2014, and the result has been confusion as to what the current USACE standards are. Section 3013 of WRRDA 2014 explicitly states that in the "interim," or while USACE undergoes the activity of revisiting and reissuing their vegetation guidelines, they cannot require state or local entities to remove vegetation per ETL requirements in order to gain or maintain PL 84-99 eligibility.[222] Hence, currently USACE may not eliminate state or local maintaining agencies from the PL 84-99 program due to vegetation nonconformance, nor may they deny a state or local agency eligibility into the PL 84-99 program based on vegetation issues. However, there is much confusion on what USACE requires in terms of vegetation management during this "interim" period. Inquiries to local maintainers yields different answers with regard to USACE vegetation requirements.

The USACE-issued interim guidance from March 2014 attempts to clarify USACE's stance on the issue of vegetation conformance for PL 84-99 eligibility. This guidance is only temporary while USACE undergoes the process of issuing new formal vegetation policies.[223] The guidance reflects the mandate of WRRDA 2014, Section 3013, stating that vegetation management may not be the determining factor for PL 84-99 eligibility during this interim period (while USACE undergoes its larger vegetation policy update).[224] ETL 1110-2-583, issued in April 2014, provides additional details on this interim policy. ETL 1110-2-583 mirrors the previously released policy of ETL 1110-2-571 and requires vegetation free zones on the entirety of the levee, plus fifteen feet on either side of the levee toe.[225] ETL 1110-2-583 includes vegetation compliance as a factor for PL 84-99 eligibility analysis, but if the State or LMA is only deficient in terms of levee vegetation removal requirements, it will not lose eligibility in the PL 84-99 program.[226] This differs from the previously released policy of ETL 1110-2-571, which stated that the State and LMAs must conform to vegetation-free requirements, or obtain a variance, in order to

221 U.S. ARMY CORPS OF ENG'RS, *supra* note 49.

222 Water Resources Reform and Development Act § 3013(g)(1).

223 U.S. ARMY CORPS OF ENG'RS, *supra* note 114, at 1-2.

224 *Id*. at 2; *see also* Water Resources Reform and Development Act § 3013(g)(1).

225 ETL 1110-2-583 *supra* note 1 at 2-1–2-2.

226 *Id.* at 1.

maintain PL 84-99 eligibility.[227]

It should be noted that although vegetation is not a factor that will, in and of itself, determine PL 84-99 eligibility status, it is still a factor considered and analyzed in determining PL 84-99 eligibility.[228] Thus, local agencies may view vegetation removal as a requirement for PL 84-99 eligibility, whether or not that is USACE intent. Further, although ETL 1110-2-583 precludes ineligibility from the PL 84-99 program based on vegetation nonconformance alone, ETL 1110-2-583 nevertheless lists detailed vegetation removal requirements.[229] Because detailed procedures for vegetation removal requirements are included in the guidance itself, some view vegetation removal as an informal requirement for federal programs.[230]

The confusion over whether vegetation removal is actually required for PL 84-99 eligibility, and if so, to what extent, is problematic for state and local maintainers. This is especially difficult in rural and agricultural areas, where maintainers may already be disillusioned with the PL 84-99 program. Many of the rural-agricultural LMA's have foregone PL 84-99 eligibility by choice in recent years, citing limitations in its usefulness.[231] Limitations of the program expounded by rural-agricultural LMAs include the fact that rehabilitation projects must be economically justified with a benefit-to-cost ratio of 1.0 or greater to justify federal involvement.[232] It can be difficult to achieve this requirement in rural-agricultural areas in the Central Valley[233] LMAs may also point to the fact that funding for PL 84-99 rehabilitation assistance is generally very limited and that funding for significant damage repairs usually also require special appropriation by Congress.[234] Further, there is no mechanism to obtain reimbursement or credit when a nonfederal sponsor performs repairs, or pays USACE to perform repairs.[235] Most notably for the context of woody vegetation issues, LMAs find the increasingly stringent USACE maintenance requirements, including the expensive and confusing requirements for encroachment and vegetation removal, difficult to meet and unaffordable.[236] Therefore, many rural-

[227] ETL 1110-2-571, *supra* note 66.

[228] ETL 1110-2-583, *supra* note 1 at 2-1–2-2.

[229] *Id.* at 2-1–2-3.

[230] This statement is based on the author's conversations with local levee sponsors and is offered as anecdotal support.

[231] This statement is based on the author's conversations with local levee sponsors and is offered as anecdotal support.

[232] U.S. ARMY CORPS OF ENG'RS, PUBLIC LAW 84-99 (PL 84-99) 1 (2012), http://www.mvs.usace.army.mil/Portals/54/docs/emergencymanagement/FloodRecovery/PL8499-02-03-2012.pdf.

[233] CVFPP, *supra* note 5, at 3-28.

[234] *Id.*

[235] *Id.*

[236] This statement is based on the author's conversations with local levee sponsors and is offered as anecdotal support.

agricultural LMAs have concluded that it is in their better interest to decline involvement in the PL 84-99 program, rather than work with USACE to obtain PL 84-99 eligibility.[237]

This is problematic in that LMAs, especially rural and agricultural LMAs, generally lack funding necessary to undergo emergency flood fighting and rehabilitation projects following a major flood event.[238] Lack of clarity or certainty concerning woody vegetation requirements, as well as the expensive cost of implementing vast woody vegetation removal projects, have all contributed to LMA withdrawal from the PL 84-99 program.[239] This demonstrates the severe need for reconciliation and clarity on the levee vegetation issue.

F. Unintended consequences in the WRRDA 2014 Interim

Another problem with the current system of dealing with levee vegetation lies in unintended consequences from WRRDA 2014 requirements. Section 3013 of WRRDA 2014 requires that in the "interim" period, or until such time a USACE revisits and reissues vegetation-removal guidelines and variance guidelines (i.e., the ETL and PGL), they may not require the removal of existing vegetation on levees by any state or local maintainer, unless that vegetation poses an unacceptable threat to the integrity of the levee.[240] In other words, as it now stands, USACE may not require vegetation removal by state maintainers or LMAs to gain acceptance into any federal program (i.e., PL 84-99 rehabilitation assistance). However, USACE may require vegetation removal if they demonstrate that the vegetation in question poses an unacceptable threat to the levee.

Theoretically, based on the above guidelines the presumption should be to maintain vegetation on levees and removal should only be required where vegetation is proven to pose a threat. However, in practice, there are no impartial guidelines in place to determine which trees pose an actual threat to levee integrity. Instead, it often comes down to a lengthy and contentious tree-by-tree analysis where the burden is placed on maintainers to demonstrate that existing vegetation does not pose a risk to levee integrity.[241] If maintainers wish to avoid this lengthy analysis, they can instead assume that all trees within the construction area pose a threat to levee integrity by the nature of their existence on the levee prism. Thus, maintainers can be incentivized to engage in circular

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[237] This statement is based on the author's conversations with local levee sponsors and is offered as anecdotal support.

[238] This statement is based on the author's conversations with local levee sponsors and is offered as anecdotal support.

[239] *See* CENT. VALLEY FLOOD PROT. BD., EXECUTIVE OFFICER'S REPORT 4 (2017).

[240] Water Resources Reform and Development Act § 3013(g)(1).

[241] Interview with H. Brown, *supra* note 58.

analysis and presuppose that woody vegetation within the construction footprint always poses a threat to levee integrity.

NMFS officials report seeing instances of such circular analysis, where the applicant demonstrates that trees must be removed from the riparian corridor because their roots exist on the levee prism, and without additional justification for their removal.[242] The presumption of removal of critical habitat without additional justification is problematic for many reasons, including that it lacks the scientific analysis using the best available science required by the ESA. Assumptions and assertions that trees must be removed because they exist clearly lacks any scientific analysis, let alone the best available science required per the ESA.

In addition to violating the ESA's best available science mandate, mass tree removal resulting from this perverse incentive also has dramatic consequences for the environment and levee safety. Environmental and safety consequences of mass tree removal from levees are described in more detail above.

The status quo incentivizes levee maintainers to determine that all trees pose an unacceptable threat to levee integrity with little science to back up that assertion. This is problematic because even though levee maintainers may not be legally required to conform to vegetation-free requirements, they are still highly encouraged to, essentially creating a de facto policy of vegetation removal during an interim period where such a policy has been expressly prohibited by the legislature and court orders.

G. Cost

Another significant issue with the status quo is the cost of complying with USACE vegetation-removal requirements. In March 2010, DWR released the report: *Fiscal Impact Report of the U.S. Army Corps of Engineers' Vegetation Management Standards and Vegetation Variance Policy for Levees and Flood Walls*.[243] The report includes cost estimates of applying USACE vegetation removal requirements to 116 critical levee repairs performed from 2006 through 2008 and the cost estimate of applying USACE requirements to the entire 1,600 miles of project levee system by extrapolation.[244] The report estimated the cost to comply with USACE policy ranged from $6.5 billion to $7.5 billion.[245] This is more than ten times the USACE $30 million estimated annual assistance for levee rehabilitation under PL 84-99, based on expenditures for past flood events.[246]

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242 *Id*.

243 CAL. DEP'T OF WATER RES., *supra* note 130.

244 *Id.* at 12.

245 *Id.*

246 *See* CVFPP, *supra* note 5, at 3-28.

Further, in their Complaint as part of the FOR lawsuit (discussed in greater detail *infra* in Appendix 3), plaintiffs referenced DWR figures and the high cost of bringing non-compliant project levees into compliance with USACE vegetation-free standards.[247] The FOR lawsuit also acknowledged the extreme cost of successfully applying for a variance from USACE vegetation-removal requirements by referencing SAFCA's Natomas Levee Improvement Project, discussed in greater detail below.[248] As part of the Natomas project, SAFCA applied for a variance from USACE vegetation-removal requirements.[249] This project ultimately cost SAFCA about $180 million more than originally projected.[250]

The financial cost of removing vegetation along levee corridors is prohibitive for most areas. The financial cost of obtaining a variance from vegetation removal requirements is similarly impractical and prohibitive. This further demonstrates the problems associated with the status quo and extreme timely need to revisit vegetation management guidelines on California levees.

H. Variance Requirements

The variance process should ideally provide a pathway for state and local maintaining agencies to obtain an exemption from USACE vegetation removal requirements, if the maintaining agency can demonstrate that vegetation removal in that particular area is unnecessary and will not threaten the integrity of the levee. However, in practice, the process of obtaining a variance is highly confusing and expensive, and therefore rarely happens.

First, there is a great deal of confusion as to what guidelines govern when applying for a variance and if there are currently any guidelines in place. The most recent governing document on variance procedure is codified in the PGL and is discussed in greater detail *infra* in Appendix 1. This is still the presumptive guiding document for obtaining a vegetation variance, but contains the provision that all levees meeting the PGL requirements, "will have one year from the date of this memorandum [2012] to submit a letter of intent to their respective USACE District expressing intent to . . . submit a vegetation variance request . . ."[251] This clearly suggests that the cut-off date for submitting a variance request to USACE occurred one year from the PGL's release date (in 2012), and has long since passed. It remains an open and unanswered question

[247] First Amended Complaint for Declaratory and Injunctive Relief at ¶ 72, Friends of the River v. U.S. Army Corps of Eng'rs, 870 F. Supp. 2d 966 (E.D. Cal. 2012) (No. 2:11–CV–01650 JAM–JFM).

[248] *Id*.

[249] *Id.* at ¶ 47.

[250] *Id.*

[251] Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls, 77 Fed. Reg. 9637, 9640 (Feb. 17, 2012).

whether USACE is accepting other variance request applications or not, or if they will only do so as part of a SWIF (also discussed in detail *infra* in Appendix 1).

Furthermore, USACE was directed by WRRDA 2014 and court orders to revisit and reissue the policy guidelines for obtaining a vegetation variance,[252] but it is similarly unclear how far along USACE is in this process. State and local maintaining agencies are not sure whether to wait for new guidelines, attempt to obtain a variance through the PGL, embark on the time consuming and expensive process of developing a SWIF, or to simply remove all woody vegetation and forego the vegetation variance process altogether.[253]

The Natomas Levee Improvement Project exemplifies the arduous process for obtaining a variance. Following Hurricane Katrina and the subsequent attention brought to flood protection systems, Natomas had just been remapped by FEMA into a more rigorous flood plain.[254] This required those living behind Natomas levees to purchase mandatory flood insurance, unless the local maintaining agency for the area (Sacramento Area Flood Control Agency or "SAFCA") could demonstrate a flood protection plan at greater than 100-year level protection.[255] SAFCA proposed a project to fix the Natomas levees "in place," or strengthen the levees as they were currently situated.[256] They proposed a project to build a slurry wall within the levee system, creating an impervious layer throughout the entirety of the center of the levee to alleviate any potential seepage problems.[257] However, SAFCA soon realized that in doing so, they would also be required to come into compliance with USACE vegetation-removal requirements.[258] In exploring the legal consequences of removing vegetation along the Natomas levee system, SAFCA engaged in conversations with NMFS to ask about ESA ramifications.[259] NMFS expressed concern about the proposal to remove vast amounts of critical habitat for endangered fish along riparian corridors of Natomas levees.[260] Therefore, it also became clear to SAFCA that it would be impossible to comply with USACE vegetation-removal requirements without destroying ESA critical habitat. As such, it was very unlikely that SAFCA could legally comply with both USACE requirements and ESA obligations.

Consequently, SAFCA proposed a different project to build predominately

252 Water Resources Reform and Development Act § 3013(a)–(b).

253 This is based on confidential interviews with anonymous state and LMA officials.

254 Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 2; Interview with Peter Buck, Director, Sacramento Area Flood Control Agency (November 1, 2016).

255 Interview with Peter Buck, *supra* note 254.

256 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at ¶ 51.

257 *Id.*

258 *Id.*

259 Interview with Peter Buck, *supra* note 254.

260 *Id.*

adjacent levees behind the currently existing levee system. This is similar to the "setback" levee design in many ways, as a new levee was constructed outside of the existing levee. However, "setback" levees typically refer to new levees that have been further set back from the existing levee. (For greater discussion on levee designs see *infra* Part VII.)

This adjacent levee design would theoretically enable SAFCA to build strong levees and protect communities at risk without touching vegetation on existing levees, because this vegetation was now removed from the new adjacent levee prism. SAFCA also employed extra-wide levee designs in some areas. An extra-wide levee typically provides for a crest width greater than an average levee, extending the entire levee prism towards the landside.

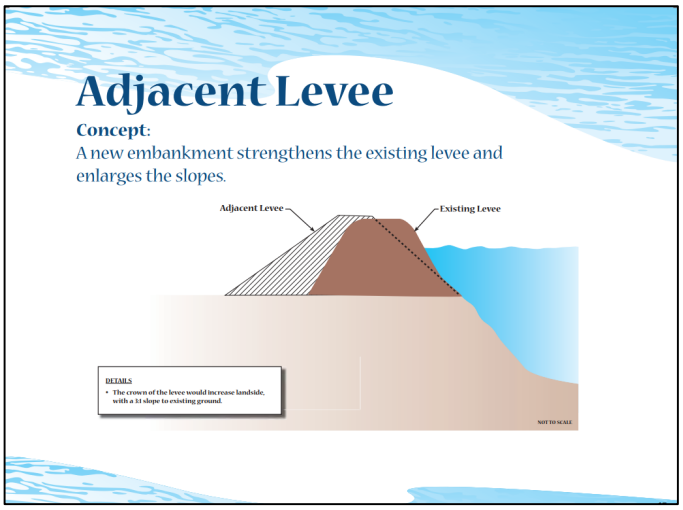

Figure 7: Basic Visual Representation of Adjacent Levee Design[261]

Even with these enlarged levee designs, this plan still came with many obstacles, including a few landowners whose property would now be pushed out of the protected area to the waterside of newly constructed levees.[262] This was extremely expensive and time consuming but was presumably the only way that SAFCA could obtain a variance from USACE vegetation removal requirements.[263]

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[261] SOUTHPORT SACRAMENTO RIVER EARLY IMPLEMENTATION PROJECT, FINAL ENVIRONMENTAL IMPACT STATEMENT 45 (2015), http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/408_Documents/Southport_EIS_Appendix_A_Scoping_Reports.pdf.

[262] Interview with Peter Buck, *supra* note 254.

[263] CAL. DEP'T OF WATER RES., EXHIBIT B U. S. ARMY CORPS OF ENGINEERS VEGETATION REMOVAL POLICY EFFECTS ON FLOOD RISK REDUCTION PROJECTS 3-4 (2012), https://www.water.ca.gov/LegacyFiles/floodsafe/leveeveg/levee_documents/Exhibit-B_PGL-

SAFCA submitted a variance request to USACE for the adjacent levee design, which USACE eventually agreed to.[264] Overall, the extra cost to SAFCA for undergoing the variance process was about $180 million and took years longer to complete than the original proposal.[265] The only way that SAFCA could obtain a variance was through the adjacent levee design, which is not feasible in many areas because it often involves widening the levee system into privately held lands.

The variance process is currently confusing, expensive, and not practically feasible for most maintaining agencies. This is a huge problem, and must be addressed, especially in the Central Valley where a variance is the only option for maintaining agencies who must comply with federal law (i.e., the ESA) and USACE vegetation-removal requirements. This is problematic for local agencies because if there is no practical means of obtaining a variance, they may be forced to remove riparian habitat and violate the ESA.

III. OTHER PROBLEMS WITH THE STATUS QUO

As demonstrated above, many problems exist with our current regulatory framework. These are due to federal vegetation-removal requirements, including: destruction of critical habitat, violation of other federal laws like the ESA, diversion of limited funds from pressing levee safety issues, potential contribution to structurally deficient levee slopes, potential confliction with state vegetation management guidelines, confusion with regard to the extent of removal required for PL 84-99 eligibility, unintended consequences of WRRDA 2014 while USACE revisits their vegetation guidelines, high cost of compliance with vegetation requirements, and a costly and potentially unworkable variance policy.

In addition to problems caused directly from vegetation-removal requirements, other significant issues exist with our current regulatory framework relative to vegetation management on levees. This includes issues related to operations and maintenance guidelines and policies, Section 408 applicability, and the disbanding of interagency discussions, which were originally established to address levee vegetation issues in California. Operations and maintenance guidelines are outdated and can conflict with federal and state laws and policies, making conformance unattainable for many levee maintainers. This could result in structurally deficient levees and greater risk for flood-prone communities. Section 408 and its recent resurgence has

Effects-on-Flood-Proj_2012-0412_FINAL.pdf.

[264] *See* W. SACRAMENTO AREA FLOOD CONTROL AGENCY, MEETING OF THE CENTRAL VALLEY FLOOD PROTECTION BOARD STAFF REPORT, ATTACHMENT H (2016), http://cvfpb.ca.gov/docs/07.22.2016_Board_Meeting/Item7A_18313_3_StaffReportandAttachments.pdf.

[265] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at ¶ 51.

been presented as time consuming, confusing, expensive, and possibly disproportionately enforced. An interagency group convened to address levee vegetation issues demonstrates competing ideologies with respect to levee vegetation. A deeper look into these competing ideologies demonstrates the difficulty in reconciling viewpoints, as each ideology stems from positive intentions and a desire to create safe, strong flood systems.

A. Operations and Maintenance Policy Updates

Federal guidelines regarding operations and maintenance (O&M) duties contradict other state and federal environmental laws and policies, which can make compliance with O&M guidelines unattainable for levee maintainers. California's newly released Draft Conservation Strategy describes conflicting O&M mandates placed on LMAs, including the flood system maintenance criteria codified in the Code of Federal Regulations, chapter 33, section 208.10 (described in greater detail *infra* in Appendix 1).[266] This section was last updated by the Flood Control Act of 1944, and establishes national standards for operation and maintenance of levees and the greater flood system.[267] For O&M duties, the inherent conflict between state and federal environmental laws versus regulations prescribed in section 208.10 is due to the outdated nature of the regulations. These federal regulations do not adequately reflect updates in federal environmental laws, including the passage of the ESA, Clean Water Act (CWA), Clean Air Act (CAA), and NEPA, nor do they reflect updates in state levee maintenance decisions. This creates a myriad of problems for levee maintainers. As described in the Draft Conservation Strategy, "In some cases, it is not possible to comply with both federal project maintenance and environmental protection imperatives."[268]

Operations and maintenance programs are intended to keep flood management facilities, including levees, in good, serviceable conditions so they are able to continue to function as designed.[269] These activities usually include channel maintenance (including hydraulic assessments, sediment removal, channel clearing, and vegetation management); erosion and levee repairs; levee inspections, evaluation and maintenance; and the repair and replacement of hydraulic structures.[270] As O&M duties become deferred, levee systems suffer and require additional upkeep beyond routine maintenance. Therefore, the term "O&M" is increasingly used as shorthand terminology to refer to a host of

266 CAL. DEP'T. OF WATER RES., *supra* note 135, at 6-1.

267 33 C.F.R. § 208.10 (1944).

268 CAL. DEP'T. OF WATER RES., *supra* note 135, at 1-3.

269 CAL. DEP'T OF WATER RES., STATE PLAN OF FLOOD CONTROL DESCRIPTIVE DOCUMENT UPDATE 8-2 (2016), https://water.ca.gov/LegacyFiles/cvfmp/docs/SPFC-DescriptiveDoc-Draft-Compiled-2016.pdf.

270 *Id.*

activities included in Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities. Once flood systems are built and certified by USACE, there is an agreement in place appointing a state or local entity as the "Responsible Agency" for O&M for that flood system.[271] The Responsible Agency takes full responsibility for all O&M activities for that portion of the flood control system and must abide by all applicable USACE manuals and all applicable environmental laws.

Two standard O&M manuals present requirements apply to maintaining agencies that operate and maintain levees in the Central Valley.[272] These O&M manuals, provided by the USACE, both date back to the 1950's. This is problematic in many respects. First, the O&M manuals fail to include ecological, scientific and technological updates from the past sixty years. Second, these manuals predate the ESA, and therefore the USACE never underwent ESA consultation in promulgating these guidance documents. Because of this, local maintainers in the Central Valley often have no way of consulting with NMFS for O&M activities, which can result in take violations. As discussed above, absent a "federal nexus," through Section 7 of the ESA, local maintaining agencies are unable to consult for their actions, because there is no "federal action." Thus, if any part of the action harms a listed species or its habitat, the local agency is liable for an ESA take violation.

The outdated O&M manuals also have serious consequences for the environment. For example, the manuals prescribe burning of unwanted vegetation (annual growth) on levees,[273] an outdated and potentially hazardous method of clearing levee vegetation, as it can result in burning woody vegetation (such as trees and bushes) as an unintended consequence. Section 208.10 also requires maintainers to clear the flood channel of debris, weeds, and wild growth, and to maintain the capacity of the channel by reducing the formation of shoals.[274] This goes against most modern environmental policies, including the federal and State Endangered Species Acts.[275] Further, the environmental mandates included in section 208.10, as well as in both regional manuals for the Central Valley, predate almost all major environmental laws. Consequently, local maintainers are once again caught between complying with these outdated

[271] CAL. DEP'T. OF WATER RES., *supra* note 175, at 5-1–5-3.

[272] These include: (1) Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project (USACE, revised May 1955); and (2) Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California (USACE, April 1959).

[273] U.S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT, *supra* note 10, at 13; U.S. ARMY CORPS OF ENG'RS, SACRAMENTO RIVER FLOOD CONTROL PROJECT, *supra* note 10, at 13.

[274] 33 C.F.R. § 208.10 (1944).

[275] *See* 16 U.S.C. § 1536 (1973) (prohibiting the degradation of designated critical habitat for listed species).

regulations, or modern environmental laws. To complicate matters further, in taking responsibility for O&M on levee systems, local maintainers are directed by their agreement with USACE to abide by all environmental laws,[276] which is sometimes impossible to do concurrently with the directives of the manuals.

The high cost of O&M activities is also problematic for local maintainers and the safety of the flood system. The cost of routine O&M has risen dramatically in recent years, and funding has been insufficient to keep up.[277] Inspections alone can be quite costly, as each project feature is required to be inspected prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and at such intermediate times as may be necessary to insure the best possible care of the protective works.[278] Intermediate inspections may also be required for fish passage, depending on the flood control system location with respect to listed fish.[279] Inspections occur to detect possible deviations from the original design, and if detected, to determine if they are substantial enough to require maintenance.[280] The maintaining agency must also submit semi-annual maintenance reports on inspections.[281] The maintaining agency is in charge of emergency operations, including general actions to prevent damage due to heavy storms, and to alert the public of the possibility of flooding if necessary.[282] This also includes emergency flood fighting procedures, which are detailed in the maintaining agency's O&M agreement with USACE.[283] Additionally, local maintainers are being increasingly encouraged by USACE to remove all vegetation on levees, pursuant to recent USACE guidelines such as the ETL.

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[276] *See* U.S. ARMY CORPS OF ENG'RS, LEVEE OWNERS MANUAL FOR NON-FEDERAL FLOOD CONTROL WORKS (2006), http://www.nws.usace.army.mil/Portals/27/docs/emergency/Levee OwnersManual(final).pdf; U.S. ARMY CORPS OF ENG'RS, ENGINEERING REGULATION 200-2-3 (2010), https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_200-2-3.pdf?ver=2013-09-08-233208-800.

[277] CAL. DEP'T OF WATER RES., FLOOD SYSTEM LONG-TERM OPERATIONS, MAINTENANCE, REPAIR, REHABILITATION, AND REPLACEMENT COST EVALUATION 5-7, 5-23–5-24 (2017), https://www.water.ca.gov/LegacyFiles/cvfmp/docs/OMRRR_TM_Jan_2017.pdf (Urban local levee maintainers in the Sacramento River Basin spend approximately $53,104 to $82,000 per levee mile for urban levee O&M; Urban local levee maintainers in the San Joaquin River Basin spend approximately $50,000 per levee mile per year. Total future O&M, repair, rehabilitation and replacement costs are estimated at $131 Million annually, and current local and state expenditures are about $30 Million annually, leaving approximately $100 Million deficit.).

[278] *See, e.g.*, U.S. ARMY CORPS OF ENG'RS L. A. DISTRICT, OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION MANUAL, SANTA PAULA CREEK CHANNEL IMPROVEMENTS 5 (2011).

[279] *Id.*

[280] *Id.*

[281] *Id.*

[282] *Id.* at 8.

[283] *See* CAL. DEP'T OF WATER RES., SUPERINTENDENTS GUIDE TO OPERATION & MAINTENANCE OF CALIFORNIA'S FLOOD CONTROL PROJECTS (2013), http://sutterbutteflood.org/wp-content/uploads/2013/09/13_Superintendents-Guide-to-OM.pdf

Removal of all woody vegetation is extremely costly, as past federal guidelines encouraged woody vegetation growth on levees in California.[284] Therefore, to comply with these requirements, state and local maintainers must spend vast amounts of money to remove old growth, or "legacy vegetation," over vast portions of Central Valley levees.

If O&M falls behind due to lack of funding, so does the integrity of the entire flood system. O&M activities are imperative to assess and repair levee deficiencies, which could otherwise worsen and eventually threaten the integrity of the levee. Therefore, this issue is significant, and policymakers must address the difficulties faced by levee maintainers in attempting to carry out O&M activities. This is especially timely in terms of the controversy over levee vegetation because funding directed at vegetation removal could otherwise be used towards O&M activities. It should be noted that currently some maintainers are incentivized to spend limited funding on total vegetation removal so as to more easily and more quickly assess the levee for possible deficiencies. However, as discussed above, this can be quite problematic in terms of environmental laws, especially the ESA, and can leave the maintaining agency liable for ESA Section 9 violations. Regardless of one's view of safety issues posed by woody vegetation on levees, this exemplifies the problems with the status quo, and need for the issue to be addressed.

Local levee maintainers are also given conflicting directives in terms of O&M requirements set forth in section 208.10 and other USACE guidelines. As discussed above, section 208.10 and the local manuals for the Central Valley all prescribe that, where practicable, certain woody vegetation shall be encouraged and planted on the waterside slope of levees to prevent bank erosion.[285] However, other recently-released USACE guidelines, including the ETL, directly contradict this directive, and mandate that the maintaining agency remove all woody vegetation from the entirety of the levee, as well as 15 feet from each levee toe (landside and waterside).[286] Local maintainers are unable to comply with both requirements, as both arguably contradict each other, and so remain in a perpetual state of incompliance in one form or another. This can once again lead to confusion, fatigue at the impossible government mandates, and even anger, on the part of local agencies, who may in exasperation decide to forgo government requirements altogether.

Many point to the inconsistency in O&M requirements as a chief reason why so many local maintainers are out of compliance with the PL 84-99 program.[287] The 2011 USACE periodic inspections showed that 39 of 116 LMAs have lost eligibility for PL 84-99 rehabilitation assistance, for reasons other than

[284] *See* CAL. DEP'T OF WATER RES., *supra* note 36.

[285] 33 C.F.R. § 208.10(b)(1) (1944).

[286] ETL 1110-2-583, *supra* note 1.

[287] CAL. DEP'T OF WATER RES., *supra* note 277, at 3-3–3-4.

vegetation.[288] Rather than comply with federal policies that mandate conflicting maintenance objectives, local maintainers around the state are choosing to take their chances outside of the PL 84-99 program.[289] In this situation, if there is a major flood event, the LMA may be ineligible to receive federal funds or federal aid in rehabilitation activities. This can have drastic consequences for those with property behind these levees, who may not be guaranteed federal rehabilitation assistance in the case of a flood event. In most cases, the LMAs do not have enough reserve funds to rebuild after a serious flood activity, so this is a serious and very risky chance to take on the part of local maintainers, reflecting the harsh regulatory framework that pushed them into this situation.

B. Section 408 Applicability

Many also see the current regulatory environment as problematic because of Section 408 applicability. United States Code, chapter 33, section 408 ("Section 408," described in detail *infra* in Appendix 1) is an old law from the late 1800s and was not used in modern times until very recently. A few years ago, USACE issued an Engineering Circular (EC) stating that Section 408 was applicable and provided guidelines for compliance.[290]

Section 408 requires certain construction proponents to demonstrate to USACE that two criteria are met: (1) that the project's usefulness is not impaired; and (2) the construction is not injurious to the public interest.[291] This applies to anything deemed an "alteration" to a USACE civil works project.[292] "Alteration" includes any occupation, use, encroachment, improvement, movement, occupation, building, or any action that "otherwise affects the usefulness, or the structural or ecological integrity, of a USACE project."[293] The definition of "alteration" is quite broad and includes any action that USACE in its discretion deems will affect the civil works project. The broad nature of this definition is potentially problematic, as Sacramento local maintainers have complained of uneven application of Section 408. Some have voiced concerns that certain types of projects, including habitat enhancement and restoration projects, are required to undergo the Section 408 process while others, including agricultural and certain construction projects, are not.[294] This has created some distrust of federal agencies and a sense of unfairness for some maintainers.

Section 408 could also be problematic because it requires compliance with all USACE design and construction standards, which presumably includes USACE

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288 *See* CVFPP, *supra* note 5, at 3-28–3-29.

289 This is based on confidential interviews with anonymous LMA officials.

290 EC 1165-2-216, *supra* note 118.

291 33 U.S.C. § 408 (1899).

292 *Id.*

293 EC 1165-2-216, *supra* note 118, at 2.

294 This is based on confidential interviews with anonymous LMA officials.

vegetation-free requirements.[295] Therefore, for any project that falls under the purview of Section 408, the project applicants must ensure compliance with USACE vegetation-free standards. It is difficult to know what the current standards are, given the confusion over ETL applicability while WRRDA 2014 is in the "interim" (for more details on WRRDA 2014, see *infra* Appendix 1). Because the current vegetation standards are murky and confusing, this also places additional stress on project proponents who must undergo Section 408.

Maintainers have also voiced concerns in that the procedure for undergoing Section 408 consultation is lengthy and time consuming.[296] The consultation process begins with pre-coordination between the requester, sponsor and USACE, followed by a written request.[297] Among other things, the applicant must provide documentation demonstrating compliance with all applicable environmental laws, reasonable alternatives, public input, and a description of any impacts to the floodplain.[298] USACE then leads an Agency Technical Review (ATR) to determine if all requirements have been met, and then issues a Summary of Findings with approval or denial of the project.[299] They may conduct additional review, if required.[300] The length of this process differs depending on the complexity and impacts of the project proposal.

In sum, concerns over Section 408 exist as to its uneven applicability, its reference to other vegetation-removal requirements, and the long process for gaining approval.

C. Roundtable Dissolution

As it currently stands, USACE policies seem to encourage substantial vegetation removal from levees and apply uniformly throughout the country. A project applicant may apply for a variance, but the process for applying for a variance is considered overly burdensome by local levee maintainers, and it is unclear whether the variance policies set forth in the PGL are applicable at this time. Federal and state policies are considered by some local maintainers to be irreconcilable. At the center of the controversy is the debate over whether woody vegetation on levees poses a substantial risk.

During the initial stages of this debate, there was an attempt at compromise between stakeholders, with the formation of the California Roundtable for Central Valley Flood Management (Roundtable), in August 2007. The Roundtable was formed to analyze concerns and interests associated with the

295 EC 1165-2-216, *supra* note 118, at 5.

296 This is based on confidential interviews with maintainers.

297 EC 1165-2-216, *supra* note 118, at 2.

298 *Id.* at 8-13.

299 *Id.* at 8.

300 *Id.* at 13-14.

issue of woody vegetation on flood control levees and suggest productive ways to move towards a resolution.[301] As part of this effort, a neutral facilitator was hired to improve Roundtable functionality and move the group towards a productive resolution. The facilitator guided the group towards the production of the California Levees Roundtable Framework, released in 2009.[302] The facilitator also released an Assessment Report, which documented points of agreement and debate amongst Roundtable participants.[303]

In the Assessment Report, the facilitator noted that all parties to the Roundtable agreed that woody vegetation on levees could potentially cause levee safety issues, and that vegetation as a risk factor should be thoughtfully addressed.[304] All parties also agreed that levee vegetation poses smaller risks than other critical levee deficiencies, and that remediating vegetation risks should be part of improving the flood safety system as a whole.[305] Further, all parties agreed that the greatest risks to levee integrity should be fixed first and given priority over lesser risks.[306] All parties also agreed that levee vegetation in California, especially shaded riverine aquatic (SRA) habitat, is important habitat for many species, and all levee projects should adhere to applicable environmental laws.[307] All parties also felt "a compelling moral obligation to protect communities behind levees."[308]

The three main issues that members of the Roundtable had with the USACE vegetation-removal policy include the following: (1) the policy diverts limited resources away from more pressing safety needs to the low-priority problem of vegetation; (2) the policy promotes widespread mass removal of woody vegetation, which could substantially impair the structural integrity of levees; and (3) there is no clear way to mitigate for the impacts of vegetation removal on endangered species who depend on woody vegetation and SRA in riverine systems surrounded by levees.[309]

As part of the Roundtable discussions, it also became clear that USACE is strongly committed to its role in promoting and enforcing safe levee designs and maintenance standards and in preventing flood emergencies to the greatest extent possible.[310] It is this concern for safety, and tendency towards a precautionary approach to protect lives and property, that has resulted in the current USACE vegetation policy.

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301 KAPLAN, *supra* note 5, at 6.

302 *See* CAL. LEVEES ROUNDTABLE, *supra* note 7.

303 *See* KAPLAN, *supra* note 5.

304 *Id.* at 6.

305 *Id.*

306 *Id.*

307 *Id.*

308 *Id.* at 12.

309 *Id.*

310 *Id.*

Because of the strong conviction that minimum standards cannot be reduced, USACE representatives also expressed their "firm belief that the minimum standard represented by the ETL that disallows all woody vegetation cannot in good conscience be compromised just because solutions are politically difficult and/or expensive."[311] Some of the greatest concerns that USACE officials voiced during Roundtable discussions included that woody vegetation can interfere with levee inspections and flood fighting, and that it may interact with and accelerate other failure mechanisms (such a seepage, slope failure, and erosion).[312] Further, there was a general sentiment that "unpredictable biological organisms that eventually die and rot have no place growing into engineered structures," and the hope that California would eventually "do the right thing" and bring levees into compliance with USACE vegetation removal policies.[313]

Other stakeholders expressed competing views that in order to maintain safety for those living in areas protected by levees, limited funds should be focused elsewhere, where there have been proven threats to levee integrity. State officials voiced the opinion that diverting funds to the "non-issue" of woody vegetation would effectively remove funding needed to address more critical levee deficiencies.[314] The resource agencies voiced concerns related to species recovery, especially for SRA habitat, which is critical for several protected species.[315] Absent scientific clarity regarding whether woody vegetation actually poses a threat to levee integrity, resource agencies communicated that they are bound by law and cannot support policies that would remove the last remaining critical habitat for protected species.[316]

The Roundtable discussions are best memorialized in California's Central Valley Flood System Improvement Framework (Roundtable Framework), which provided interim standards for local agencies managing vegetation to maintain PL 84-99 eligibility.[317] As part of the framework, local agencies were given a three-year "grace period" whereby, if they abided by the trimming and thinning vegetation requirements set out in the Roundtable Framework, they would maintain PL 84-99 eligibility.[318] This relieved local agencies from needing to remove vegetation as part of their normal operations and maintenance activities. These interim guidelines closely mirror the notion of lifecycle management (LCM, discussed *infra* in detail in Appendix 2). LCM was a policy later adopted

311 *Id.*
312 *Id.*
313 *Id.*
314 *Id.* at 13.
315 *Id.* at 11-12.
316 *Id.* at 12.
317 *See* CAL. LEVEES ROUNDTABLE, *supra* note 7, at 4-5.
318 *Id.* at 5-6.

as part of the State's Levee Vegetation Management Strategy (LVMS).[319] Initially, state officials took the position that woody vegetation on levees was not a risk factor that required any change in policies. However, DWR ultimately adopted the LCM policy as part of their LVMS. Through LCM, existing "legacy" vegetation on the upper waterside and landside levee slopes will slowly be phased out over time.[320]

Similarly, USACE employed principles voiced in the Roundtable, including the "worst first" approach to vegetation management. USACE included the "worst first" theory in their SWIF guidelines, embracing the notion that flood control funding should first be apportioned to the most critical threats to levee integrity.[321] (SWIF policies are discussed *infra* in greater detail in Appendix 1).

Thus, both state and federal officials attempted to negotiate and come together as part of the Roundtable exercise, and officials from both sides of the debate implemented strategies from the Roundtable in their policies and regulations. However, there remained a substantial barrier to any true compromise, which was each participant's integrity and fierce desire to "do the right thing."[322] On one side, USACE officials presumably saw the issue as one where competing science suggested woody vegetation could be positive or negative in terms of levee safety.[323] In the absence of scientific certainty, they saw little choice but to maintain and enforce national standards of vegetation-free zones on levees to protect life and property.[324] On the other hand, the state and resource agencies likely saw the issue as one where national laws were being improperly applied to California.[325] The resource agencies, in particular, have a legislative mandate through the ESA to protect endangered and threatened species, and in the absence of scientific clarity could not support a policy that could threaten the continued survival of listed species.[326] In their view, they had no choice but to push back on policies which could threaten the last remaining habitat of listed species.[327] State agencies were generally concerned with limited resources and could not in good conscience support policies that would divert funds from pressing threats to levee integrity, to issues like levee vegetation, which they saw as a very low threat based on the most recent scientific evidence.[328]

Eventually, USACE declined to meet with the Roundtable any longer, following the initiation of the DFW lawsuit against USACE for violation of

319 CVFPP, *supra* note 5, at 4-13–4-16.

320 *Id.* at 4-14.

321 *See* U.S. ARMY CORPS OF ENG'RS, *supra* note 75.

322 KAPLAN, *supra* note 5, at 12.

323 *Id.* at 12-13.

324 *Id.*

325 *Id.* at 13.

326 *Id.*

327 *Id.*

328 *Id.*

NEPA, ESA and APA in promulgating their vegetation policies (see *infra* Appendix 3). After USACE officials removed themselves from Roundtable discussions, the remaining participants chose not to continue meeting, as USACE was such a key player in levee vegetation policy discussions.

IV. SOLUTIONS

As demonstrated above, the current regulatory framework surrounding levee vegetation is problematic in numerous respects and must be changed. There are several viable options to pursue to address issues resulting from the current regulatory framework. These solutions may be pursued individually, but greater large-scale positive change will likely occur as solutions are considered and pursued in tandem. Possible solutions include: engineering and designing levees creatively to allow for woody vegetation while ensuring levee stability is maintained, implementing uniform models and methodology to better evaluate vegetation risks, implementing regionally-based policy solutions and promoting small-scale multi-benefit projects, development of a California SWIF in tandem with a programmatic variance, adopting legislation to improve our regulatory framework, using litigation as a tool to spur new policies, using ESA mandates to avoid habitat removal, voluntary change of vegetation guidelines from USACE, updating O&M policies, and reconvening an inter-agency group similar to the Roundtable.

A. Engineer Design Solutions

One possible solution to address the issue of levee vegetation is to design and engineer levees in innovative ways. Creative designs may allow vegetation to safely exist on levees, providing riparian habitat without compromising levee safety or integrity. The CLVRP Synthesis Report (discussed *infra* in greater detail in Appendix 4) included research that explored the possibility of experimentally designing levees in a way that deals with uncertainty associated with vegetation.[329]

The biggest concerns over maintaining woody vegetation on levees include: problems posed by root penetration in the levee embankment, creating preferential flow pathways and leading to internal erosion; windthrow of trees that may remove enough material from the levee prism to degrade levee safety; and woody vegetation obscuring views from inspectors conducting routine inspections or otherwise hindering flood fighting activities. Engineers have been attempting to tackle these concerns through upgraded levee design features. "These . . .include overbuilt embankments and plastic or metal root barriers

[329] SHIELDS, *supra* note 8, at 14-1–14-11.

inserted into the levee structure."[330]

Overbuilt embankments include planting berms, for which USACE has existing guidelines on dimensions and restrictions. USACE guidelines allow planting berms to be added to levee slopes under certain limitations. These include:

(i) planting berms are limited to the landside of the levee;
(ii) planting berms consist of earth fill in excess of the minimum section needed to satisfy stability requirements;
(iii) the planting berm must be of sufficient depth to accommodate any proposed vegetation and preclude root penetration into the root-free zone;
(iv) design must include consideration of any internal drainage or seepage control system;
(v) no vegetation is permitted on any "overbuild" section that has a system-reliability function except in planters (e.g., concrete vessels), and;
(vi) adequate access between the levee toe and the levee crown must be maintained for inspection and flood fighting, and specifically, visual access is required for inspection of the toe area and physical access is required for flood fighting activities involving personnel and heavy equipment.[331] The root-free zone in the levee prism must be three feet thick at a minimum.[332]

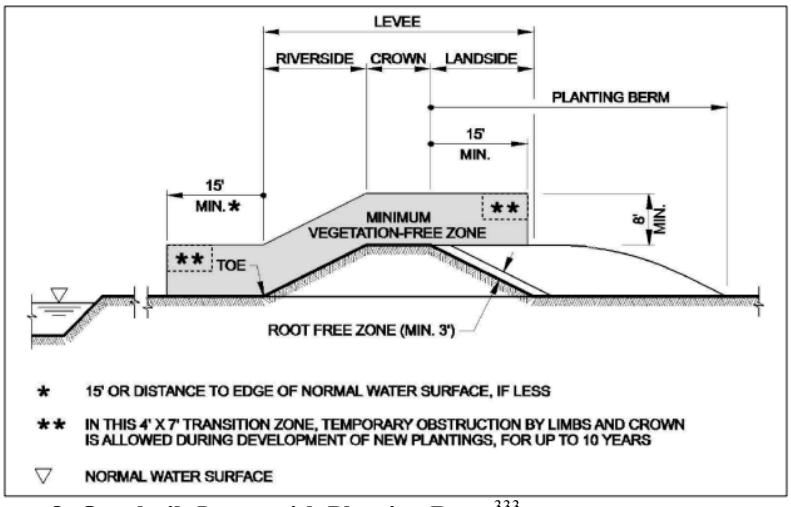

Figure 8: Overbuilt Levee with Planting Berm[333]

330 *Id.* at 14-1.
331 ETL 1110-2-583, *supra* note 1; *see also,* SHIELDS, *supra* note 8, at 14-1–14-2.
332 ETL 1110-2-583, *supra* note 1; *see also,* SHIELDS, *supra* note 8, at 14-1–14-2.
333 ETL 1110-2-583, *supra* note 1, at A-9.

Although the above USACE procedures guide the inclusion of planting berms on levees, these guidelines do not address one of the most pressing problems encountered by vegetation-free requirements. Namely, removing vegetation from the waterside slope of the levee slope presents issues with regard to the riparian corridor and removal of limited endangered species habitat. Including a planting berm on the landside of the levee does little to address this. Thus, USACE guidelines promoting planting berms are an important start, but USACE should also accept planting berms on the waterside slopes of levees if this engineering solution will effectively alleviate the most pressing environmental problems associated with vegetation removal.

Researchers in Austria have recently investigated the performance of alternately designed levees with certain types of woody vegetation.[334] The objective is to develop levees with woody vegetation that provide benefits in terms of slope stabilization and erosion protection, but without the perceived disadvantages of woody vegetation due to windthrow, seepage and scour.[335] The investigation produced preliminary conclusions, including the fact that willows seemed to provide mostly positive effects ". . .on soil water balance, reducing soil water content relative to an unvegetated levee but similar to grass cover."[336] Shrubby willows seemed to be an appropriate vegetation form for well-compacted levees, had no significant impact on seepage, did not pose problems with respect to root impacts, and were small enough to allow for visual inspections.[337] Further development is the subject of ongoing research. California levee engineering designs should reference recent studies such as this and include woody vegetation types that have demonstrated to help, rather than hurt levee stability and integrity.

Setback levees refer to a design where newly constructed levees are set back further from the river than existing levees.[338] Rather than narrowly confining a river by close levees, setback levees allow the river to flow into its natural floodplain immediately adjacent to the river. This approach is considered the most environmentally ideal by many,[339] as it allows for natural floodplains and

[334] SHIELDS, *supra* note 8, at 11-1.

[335] *Id.*

[336] *Id.* at 14-4.

[337] *Id.*

[338] *See Set-back levee*, SACRAMENTO RIVER: A GUIDE TO RECREATION AND PUBLIC ACCESS, https://www.sacramentoriver.org/glossary.php?glossary_id=66 (last visited June 15, 2018).

[339] Interview with H. Brown, *supra* note 58; *see also* Irv Schiffman, *Restoring Floodplains at Setback Levees*, 14 RIVER PARTNERS J. 3 (Fall 2017), http://www.riverpartners.org/documents/journal/Journal_2017_v14n1.pdf; TONI D. KRAUSE ET AL., EVALUATION OF LEVEE SETBACKS AS A SUSTAINABLE SOLUTION ALONG THE MISSOURI RIVER, https://acwi.gov/sos/pubs/3rdJFIC/Contents/4E-Krause.pdf; *Levees,* WATER EDUC. FOUND., http://www.watereducation.org/aquapedia/levees (last visited June 23, 2018).

compliance with environmental laws, while maintaining USACE vegetation-free zones on levees situated far away from the naturally flowing river.[340]

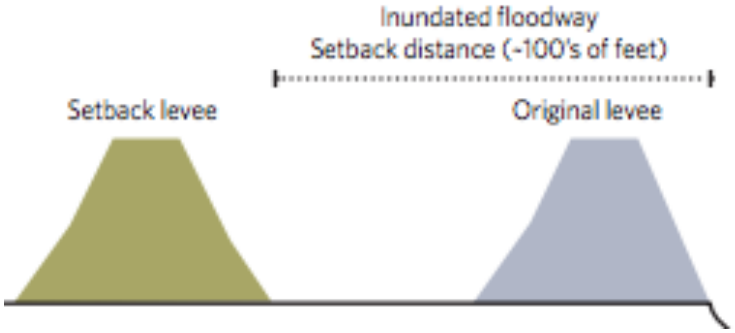

Figure 9: Setback Levee[341]

An adjacent levee is similar to a setback levee in that it involves constructing a new levee behind an existing levee.[342] This can be beneficial in terms of allowing vegetation to remain on the lower riverside slope of the existing levee, so long as the vegetated portion of the existing levee lies outside of the vegetation-free zone of the newly constructed levee prism. However, this design is less optimal than a setback levee, as it does not provide the habitat benefits of inundating the floodplain, instead maintaining narrowly confined rivers surrounded by closely aligned levees.

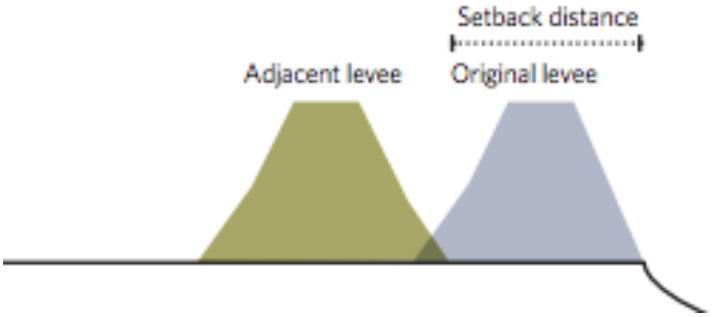

Figure 10: Adjacent Levee[343]

340 Schiffman, *supra* note 339.

341 JESSICA DAVENPORT ET AL., IMPROVING HABITATS ALONG DELTA LEVEES: A REVIEW OF PAST PROJECTS AND RECOMMENDED NEXT STEPS 5 (2016), http://deltacouncil.ca.gov/sites/default/files/2016/06/Improving%20Habitats%20Along%20Delta%20Levees%20Issue%20Paper.pdf.

342 *Id.*

343 *Id.*

An overbuilt levee design generally refers to a levee that has been widened to shift the overall levee prism toward the landside slope.[344] This can create more space for habitat improvement near the riverward slope and safer levees for greater flood protection. However, this does not create additional connective floodplain habitat, as setback levee designs can.

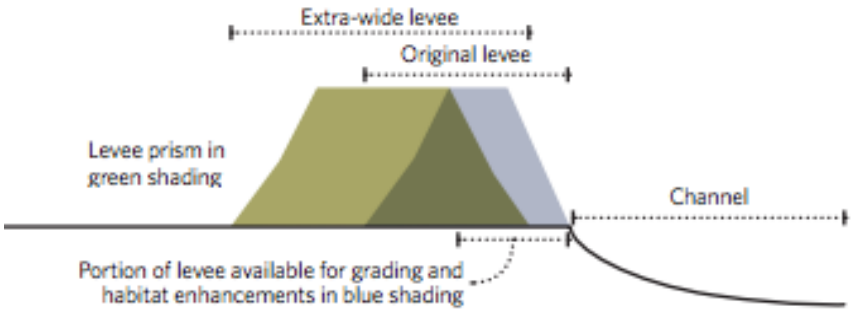

Figure 11: Overbuilt Levee[345]

Along with the adjacent levee design, this method was developed for certain areas in the Natomas Basin Levee Improvement Program in an attempt to strengthen the Natomas levees while still retaining waterside vegetation, described in more detail above. As part of this design, USACE required a distance of ten feet from the waterside slope of the basic levee section to the crown of the waterside hinge point, resulting in a levee with a crown width of 44 feet and a 3:1 landside slope.[346] This design ultimately enabled the levee maintainers to obtain a vegetation variance,[347] since maintaining vegetation that was now outside of the newer levee slope would not threaten the stability or structural integrity of the levee system.[348]

344 *Id.*

345 *Id.*

346 SHIELDS, *supra* note 8, at 14-4–14-5.

347 *See* Chris Graygarcia, *Corps Approves Sacramento-Area Levee Vegetation Variance*, Army Worldwide News (June 24, 2010), https://www.army.mil/article/41389/corps_approves_sacramento_area_levee_vegetation_variance.

348 SHIELDS, *supra* note 8, at 49-50.

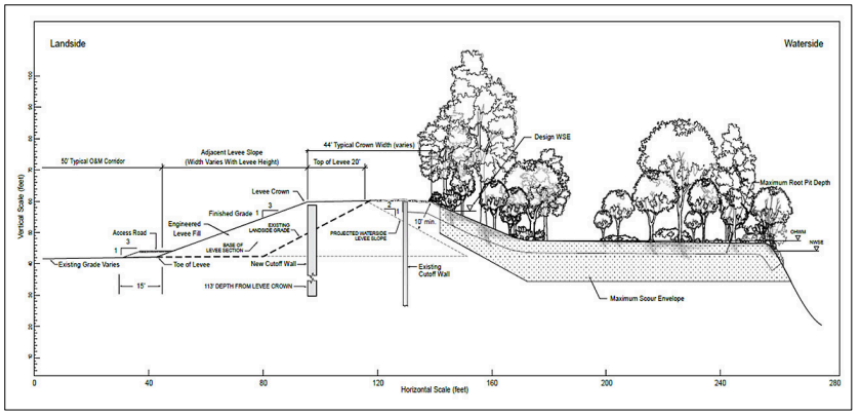

Figure 12: Adjacent Levee[349]

Overbuilt levees, adjacent levees and setback levees could theoretically be replicated in other areas, allowing more geographic regions to be protected by strong levees while retaining ecologically important and aesthetically valued vegetation. However, realistically this is unlikely to be replicated elsewhere because of the extreme cost associated with these levee designs, essentially building twice the amount of the existing levee system. As mentioned above, Natomas Basin Levee Improvement Project cost SAFCA an additional $180 million than the original proposal to fix the levees in place. Additionally, community acceptability can prohibit the construction of setback levees because it generally requires acquiring private property or repurposing public lands for floodplains. Further, in the Central Valley many agricultural lands extend to the landside of levee toes, and these lands could also be affected by setting back levees. It could take agricultural land out of production, reducing the revenue for farmers as well as levee maintaining agencies.

Another possible engineering solution to problems posed by woody vegetation on levees is the inclusion of root barriers. Mechanical or biological barriers may be used to prevent roots from penetrating embankments. USACE guidelines allow for root barriers, but also make clear that, "[root barriers] should not be a substitute for adequate distance between plantings and root-free zones."[350] Biological root barriers are commercially available and generally economically feasible.[351] Cutoff walls can also be included in levees to prevent seepage. Existing levees can be retrofitted to include cutoff walls using the

[349] *Id*. at 14-6.

[350] ETL 1110-2-583, *supra* note 1; *see also id.*

[351] *See* SHIELDS, *supra* note 8, at 14-5 (referencing products such as porous geotextile that slowly releases the herbicide trifluralin, plastic mesh or panels that provide a mechanical barrier to roots, and soil moisture).

slurry-trench or in-situ mixing method. Per this method, slurry walls (usually made of mixtures of soil and bentonite, and in rare cases cement) are built through the bottom center of the levee prism. These walls reduce seepage through the levee and control underseepage to the depth of the base of the wall. Even if the wall becomes compromised by cracks, they can still partially protect the levee from seepage riverine erosion because the slurry wall material can be resistant to the riverine erosion itself.[352]

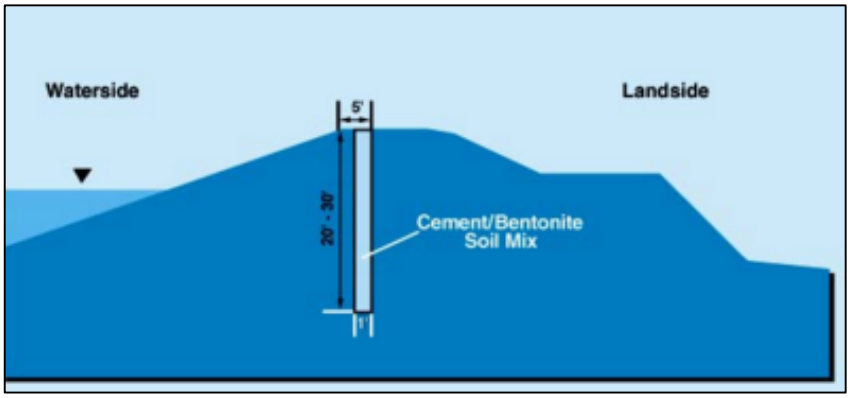

Figure 13: Cut-Off Wall[353]

One recent study conducted in the Central Valley included excavations of old slurry walls (constructed in 1991) along the Sacramento River.[354] These excavations showed that the old slurry walls were partially effective as root barriers. Observations showed that tree roots tended to grow alongside slurry walls in most instances, and sometimes grew in slurry wall cracks. Given the opportunistic nature of tree roots, it is not surprising that they tend to fill cracks created in cutoff walls. Another study suggested that the composition of the cutoff walls can affect their susceptibility to desiccation, shrinkage, and

[352] *Id.* at 14-5–14-8.

[353] GOVERNOR'S FLOOD EMERGENCY ACTION TEAM, FINAL REPORT OF THE FLOOD EMERGENCY ACTION TEAM 199, 204 (1997), http://wdl.water.ca.gov/pubs/flood/flood_emergency_action_team_final_report__1997__pdf_version_/governor's-flood-emergency-action-team-feat-may10-1997-ocr.pdf.

[354] LESLEY F. HARDER ET AL., INVESTIGATION OF TREE ROOT PENETRATION INTO A LEVEE SOIL-CEMENT-BENTONITE SLURRY CUTOFF WALL (2010), http://www.safca.org/Protection/NR_Documents/CLVRP_Tree_Root_Penetration_into_a_SCB_Slurry_Cutoff_Wall_Part-1_(Final).pdf; LESLEY F. HARDER ET AL., INVESTIGATION OF TREE ROOT PENETRATION INTO A LEVEE SOIL-CEMENT-BENTONITE SLURRY CUTOFF WALL—PART II (2011), http://www.safca.org/Protection/NR_Documents/CLVRP_Tree_Root_Penetration_into_a_SCB_Slurry_Cutoff_Wall_Part-2_(Final).pdf; *see also* SHIELDS, *supra* note 8, at 14-8.

cracking.[355] There is an ongoing debate as to whether tree roots penetrate slurry cutoff wall cracks after the walls have cracked due to other forces, or whether tree roots cause slurry walls to crack. Further, modern cutoff walls rarely use cement, and instead use a soil-bentonite mixture that are theoretically self-healing and not susceptible to cracks (and therefore not vulnerable to roots from woody vegetation).

In order to improve the efficacy of slurry cutoff walls to tree root penetration, the slurry walls themselves should be less prone to cracking in the first place, because once they do crack, tree roots will generally fill the remaining voids. The performance of modern, thicker cutoff walls as root barriers is unknown, but some European levee designs include sheet pilings inserted into cutoff walls to act as root barriers and barriers to burrowing animals.[356] However, sheet pilings can result in roughly double the cost of soil-bentonite slurry cutoff walls.[357] This remains an important area for further study and analysis.

Newly constructed levees or levee rehabilitation projects could also include a soil trench or planting box to safely incorporate woody vegetation on the waterside slope. Under this design, woody vegetation on the lower waterside levee slope can help with erosion concerns and provide essential riparian habitat, while not threatening the structural integrity of the levee. This would incorporate requirements for fish, including shade and instream woody material, while also allowing for cautious safety designs, such as rock (rip-rap) on the waterside slope between trees.

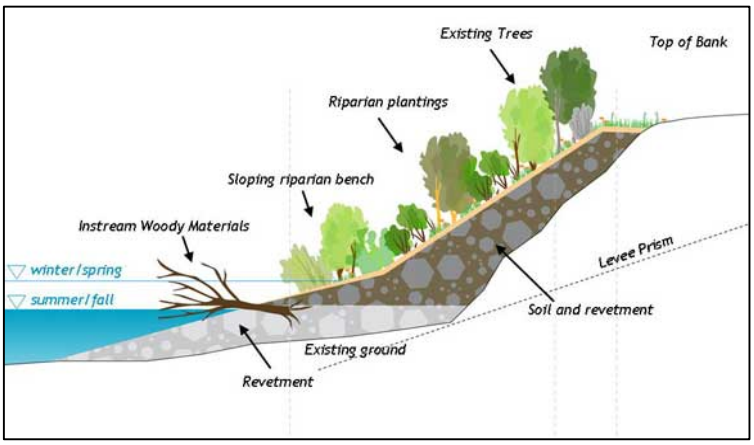

Figure 14: Levee with On-Site Riparian Bench[358]

[355] SHIELDS, *supra* note 8, at 14-9.

[356] *Id.*

[357] *Id.*

[358] *Sacramento River Bank Protection Project – Levee Erosion Sites*, STILLWATER ECOSYSTEM, WATERSHED AND RIVERINE SCI., http://www.stillwatersci.com/case_studies.php?cid=59 (last

B. Using Uniform Models and Methodology to Evaluate Vegetation Risks

As described *supra* in Part II, one major issue with the status quo is the lack of commonly accepted methodology for evaluating when woody vegetation actually poses a risk to levee integrity.[359] Absent a universally accepted methodology, many levee maintainers are incentivized to determine that all vegetation present on the levee poses a threat, with little analysis supporting their conclusion. This is problematic because it leads to more vegetation removal than is necessary to comply with vegetation requirements, creating negative consequences for endangered species habitat and maintainers who become open to liability under the ESA. To combat this problem, USACE and levee maintainers should ideally use peer-reviewed risk models to evaluate vegetation risks.

There are currently several models in development that could help illuminate the risks posed by trees on levees, discussed *infra* in more detail in Appendix 4. One such tool, the CLVFP's Levee Tree Assessment (LTA), would provide a uniform methodology for determining when woody vegetation might pose a risk to levee integrity.[360] This should ideally be used only for trees that are already being considered for removal because they may pose a threat to levee integrity. Rather than conducting a tree-by-tree assessment of every tree on the levee, there should be a presumption of retaining woody vegetation on levees, as per the directive of WRRDA 2014 and multiple court orders. When a certain tree throws up red flags, or when there is uncertainty as to whether a specific tree may pose a risk to levee integrity, levee maintainers may apply this neutral set of standards to determine what risk the tree poses, if any, and if removal is necessary.

This is preferable to the current approach, which instead presumes that all trees on the levee pose a threat to levee integrity and places the burden on levee maintainers to demonstrate otherwise. The current approach is, in part, due to confusion and uncertainty over how to determine whether trees pose a threat to the levee. The employment of clear standardized guidelines to determine possible threats posed by woody vegetation will help ensure that the spirit of WRRDA 2014 is maintained. Standardized guidelines will help ensure that woody vegetation is not removed unnecessarily while USACE undergoes the exercise of revisiting and reissuing vegetation guidelines. Therefore, the LTA (as it is released) or a similar peer-reviewed tool should be used to evaluate vegetation risk. However, the soon-to-be-released LTA cannot be expected to be

visited Feb. 25, 2018). For a digital version of the image, see the gallery tab on webpage).

[359] *See supra* notes 239–241 and accompanying text.

[360] Interview with C. Musto, CLVRP Program Manager Div. of Flood Mgmt. Cal. Dep't of Water Res. (December 2017); *see also California Levee Vegetation Research Program: Current Projects and Research*, CAL. DEP'T WATER RESOURCES, http://wdl.water.ca.gov/floodsafe/leveeveg/curr_proj_research.cfm (last visited Mar. 8, 2018).

a perfect fix for determining when to keep a potentially problematic tree or not, and other similar tools should be developed.

Other studies evaluating the overall risk posed by woody vegetation presence on levees are needed, and the results should be reflected in levee policies. A study currently being conducted by UC Berkeley (discussed *infra* in Appendix 4) seeks to evaluate the incremental probability of levee failure due to the effects of woody vegetation, as compared with other risks to levee failure.[361] Policymakers from state and federal government agencies should pay close attention to the results of studies like this, and include results in permitting decisions.

Including the best and most recently available science will ensure that levee designs are as safe as possible, and that critical habitat for endangered species is not removed unnecessarily. There are some important studies currently underway that policymakers should particularly be aware of, including the aforementioned LTA and UC Berkeley incremental risk study. The general notion of using neutral models and methodology to evaluate levee vegetation risks should be an ongoing priority of all policymakers involved in permitting and maintaining California levees.

C. Regionally-Based Policy Solutions

Another approach to dealing with levee vegetation issues would be to support policy solutions already underway or in the development stage. One approach could be to employ successful policies from elsewhere to California's Central Valley. For example, the 2007 Levee Vegetation Research Symposium included a speaker who presented on the Dutch experience, where strict levee vegetation policies exist on paper but are not uniformly enforced.[362] Instead, each water board has developed its own localized standards regarding vegetation on levees.[363] A similar approach based on regional standards would be helpful in California, where localized environmental conditions could influence vegetation management decisions. However, an updated variance policy program would be necessary for this approach to be successful, so local maintainers would not be at risk of violating the law. Not following national standards, as the Dutch do, could leave LMAs vulnerable to loss of rehabilitation funding and possible legal action under other national environmental laws.

Another approach to the levee vegetation issue is to start at the local or regional scale, making change "from the bottom" of the policy spectrum. This

[361] *See California Levee Vegetation Research Program: Current Projects and Research*, *supra* note 360.

[362] Clara Spoorenberg, *Dutch Experience: Scientific basis for Dutch levee vegetation policy*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Spoorenberg_Transcript.pdf.

[363] *Id*.

approach would include supporting regional compromise and multi-benefit projects done on a basin-wide scale. Different government agencies have specific guidelines as to what constitutes a "multi-benefit" project, but all generally refer to projects that benefit the environment, ecosystem, and preserve endangered species habitat, while simultaneously providing the greatest possible degree of safety and risk reduction to life and property protected by levees. Other benefits included in multi-benefit designs include groundwater recharge and incorporating agricultural operations. The USACE Engineering Circular (EC) 1105-2-404, entitled *Planning Civil Work Projects under the Environmental Operating Principles* describes USACE guidelines for multi-benefit projects.[364] Although the guidance expired in 2004, it still seems to be used by USACE as if it is governing policy for multi-benefit projects, and was utilized in the Hamilton City Flood Damage Reduction and Ecosystem Restoration project (authorized by Congress in 2007), discussed in greater detail below. The USACE guidance sets goals to achieve balance between economic and environmental benefits of a project. The guidance encourages plans that produce economic development benefits and national ecosystem restoration benefits, including principles of avoiding or minimizing significant adverse impacts or damage to the natural ecosystem where practical and supportable.[365]

The USACE guidance for multi-benefit projects identifies federal interest in terms of National Economic Development (NED) Plans, National Ecosystem Restoration (NER) Plans, or Combined NED/NER Plans.[366] Plans that produce economic and ecosystem restoration benefits, such that "no alternative plan or scale has a higher excess of NED plus NER benefits over total project costs" are considered a Combined NED/NER Plan, and thus the most optimal choice in terms of greatest benefit to the economy and ecosystem.[367] NER and NED benefits must both be reasonable and not be at the cost of the other, and financial costs must be feasible in order to qualify as a Combined NED/NER plan.[368] If ecosystem restoration (ER) is a main objective of a study or project, USACE must also obtain congressional authorization.[369] Many principles underlie the USACE approval of multi-benefit projects, but the key principle for economic development benefits is "the potential increases in national outputs of goods and services," and the key principle for ecosystem restoration outputs is "the

[364] U.S. ARMY CORPS OF ENG'RS, PLANNING CIVIL WORKS PROJECTS UNDER THE ENVIRONMENTAL OPERATING PRINCIPALS (2003), https://planning.erdc.dren.mil/toolbox/library/ECs/EC1105-2-404.pdf [hereinafter ENGINEERING CIRCULAR 1105-2-404].

[365] *Id.* at 2.

[366] *Id.*

[367] *Id.*

[368] *Id.*

[369] U.S. ARMY CORPS OF ENG'RS, *Ecosystem Restoration Authorities,* http://www.nae.usace.army.mil/Missions/Public-Services/Ecosystem-Restoration-Authorities (last visited Feb. 25, 2018).

restoration of significant ecosystem resources."[370]

The United Nations Educational, Scientific and Cultural Organization (UNESCO) also proposes what they refer to as "strategic basin planning," which essentially mirrors the goals of multi-benefit planning. UNESCO defines strategic basin planning as, "a coherent multidisciplinary approach to managing basin water resources and their users in order to identify and satisfy social, economic and environmental priorities."[371] The UNESCO report on strategic basin planning describes the importance of rivers to humanity in terms of water supply, waste assimilation, fisheries, energy production, flood attenuation, spiritual, cultural and recreational benefits.[372] Rivers also support habitat for a wide range of ecosystems.

The UNESCO strategic basin planning guidance offers additional background into the general idea of regional, multi-benefit planning. In the beginning and middle of the twentieth century, the concept of water management was largely one of "water resources development planning," which is characterized by "primarily a technical activity that can be undertaken by engineers, with the objective of optimizing the benefits derived from infrastructure development and operation."[373] In other words, in the past we have globally attempted to solve water-planning problems in river basins from a technical standpoint, where engineers have attempted to optimize water allocation and infrastructure development for human use and consumption. However, in the late twentieth century, it became clear that new approaches were needed, as more information was gathered on the importance of functioning aquatic ecosystems and technical solutions to water allocation were exhausted with the fast-growing human population. The UNESCO report prescribes moving forward from an era characterized by single-purpose engineering fixes to flood system conveyances, to a multi-purposed approach that considers all economic, social and environmental objectives within a water basin.[374]

This regionally scaled, multi-benefit approach is beneficial for many reasons, including the ability to take localized environmental conditions into account, creating safer levees and precluding unnecessary removal of essential habitat. However, for similar reasons noted above, this approach should be accompanied by USACE-granted vegetation variances in some form or another, so as to not leave levee maintainers vulnerable to policy violations, and so levee maintainers can gain or remain eligible for rehabilitation programs. Therefore, multi-benefit

370 ENGINEERING CIRCULAR 1105-2-404, *supra* note 364, at 2.

371 GUY PEGRAM ET AL., RIVER BASIN PLANNING: PRINCIPLES, PROCEDURES AND APPROACHES FOR STRATEGIC BASIN PLANNING 3 (2013), http://unesdoc.unesco.org/images/0022/002208/220866e.pdf.

372 *Id.* at 3.

373 *Id.*

374 *Id.*

regionally scaled projects should be encouraged, but as part of a greater effort to revisit larger levee vegetation issues, rather than as solutions in and of themselves.

Multi-benefit regionally scaled projects can be particularly helpful as large "experiments," or to test out levee designs or policy configurations before attempting to apply similar theories at the statewide or national scale. Further, these projects can promote improved flood protection by increasing permitting efficiency and certainty. Multi-benefit regionally scaled projects can improve public safety while ensuring the future of endangered and threatened species, preserve and protect agriculture, and include stakeholder involvement and collaboration throughout the permit development process.[375] For LMAs, a regionally scaled project can help reduce the overall time and cost for permitting, help achieve compliance with state and federal laws, and incorporate optional conservation measures into activities and projects. This could benefit LMAs by decreasing maintenance costs, improving flood management efficiency, and increasing public safety.[376] For environmental interests, this regional approach could improve the efficiency and effectiveness of conservation efforts and guide comprehensive conservation planning, including promoting the recovery of species and creating system-wide conservation benefits.[377]

One example of a successfully completed multi-benefit project is the Hamilton City Flood Damage Reduction and Ecosystem Restoration Project. The project aims to enhance and restore the ecosystem while providing increased flood protection for Hamilton City.[378] It will do so through the construction of 6.8 miles of setback levees, reconnecting segments of the river to the natural floodplain, and restoration of about 1,500 acres of native habitat between the new setback levee and the Sacramento River.[379] A Feasibility Study was completed in 2004 for the Project, and construction was scheduled to begin in 2016.[380] Assuming appropriate levels of funding are made available in the

375 CAL. DEP'T OF WATER RES., FEATHER RIVER REGIONAL ENVIRONMENTAL PERMITTING PROGRAM, http://www.water.ca.gov/conservationstrategy/docs/cs_feather_fact.pdf (last visited Aug. 9, 2016).

376 *Id.*

377 *Id.*

378 *See Hamilton City Flood Damage Reduction & Ecosystem Restoration Project*, SACRAMENTO RIVER FORUM, http://www.sacramentoriver.org/forum/index.php?id=hamilton_city (last visited Aug. 18, 2016).

379 *Id.*

380 U.S. ARMY CORPS ENG'RS, FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT (2004) https://www.sacramentoriver.org/forum/lib/library/docs/Hamilton_City_Feasibility_Final_Report_(2004).pdf; Tyler Stalker, *Corps Awards Contract to Kick Off Hamilton City Levee Work*, U.S. ARMY CORPS ENGINEERS (Aug. 3, 2015) http://www.spk.usace.army.mil/Media/News-Releases/Article/611942/corps-awards-contract-to-kick-off-hamilton-city-levee-work/.

future, major construction should be finished by 2018.[381]

The flood damage reduction benefits of the Hamilton City project are expected to be significant, with an increase from a 1-in-10 chance to a 1-in-75 chance of flooding in any given year.[382] This also translates to a reduction of average of $577,000 in annual flood damages.[383] The ecosystem restoration benefits include the restoration of about 1,500 acres of native habitat, of which 1,000 acres is riparian, 100 acres is grassland, 150 acres is savannah, and 250 acres is scrub.[384] This will also restore floodplain connectivity in the Hamilton area.[385] This has been an example of a truly multi-benefit project and was successfully planned due to high levels of engagement from local officials and environmental NGOs, participation by USACE staff, and overall strong partnerships and communication.

The idea of "regional permitting" has been largely embraced by DWR, and the agency has plans to permit more of these regionally based projects in the future.[386] Permitting each individual project separately, as has been the status quo, has associated inefficiencies, high cost and unpredictable outcome (explored *supra* in more detail in Part II). It has also created a system where small isolated mitigation areas exist in locations far removed from the action, which are difficult and costly to manage. As such, DWR has attempted to facilitate development of "regional permits," which would allow for compliance with environmental laws at a broad, regional scale, over longer time periods than traditional permitting approaches.[387] Ideas for regional permits include permitting that covers routine operations and maintenance activities, and multi-benefit conservation/flood protection projects. Multi-benefit actions for the State include flood protection systems that also restore and enhance the ecosystem and critical habitat such as levee setbacks, removing fish passage barriers, and other similar ecosystem restoration and enhancement actions. The state also considers multi-benefit objectives to include improvements to water supply, water quality, navigation, recreation, open space, and commercial fisheries.

One of these regional permitting efforts is focused on the Feather River region. Here, DWR is leading an effort to obtain permits through implementing the Feather River Corridor Management Plan.[388] The goal of the plan is to

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[381] *See Hamilton City Levee Update*, RECLAMATION DIST. 2140 (2016), http://rd2140.org/hamilton-city-levee-update/.

[382] *Hamilton City Flood Damage Reduction and Ecosystem Restoration*, SACRAMENTO RIVER FORUM (2004), https://www.sacramentoriver.org/forum/lib/library/docs/Hamilton_City_COE-TNC_Partnership-presentation_(2004).pdf

[383] *Id.*

[384] *Id.*

[385] *Id.*

[386] CAL. DEP'T OF WATER RES., *supra* note 5, at 7-1–7-18.

[387] *Id*. at 7-8–7-9.

[388] *See* CAL. DEP'T OF WATER RES, LOWER FEATHER RIVER CORRIDOR MANAGEMENT PLAN

permit the Feather River region holistically, with a focus on integrating ecosystem improvements into flood risk management projects.[389] Eventually, DWR hopes to regionally permit flood improvement projects in the region with a focus on ecosystem and habitat restoration.[390] In order to do so, regional permits under consideration include a Habitat Conservation Plan (HCP) to satisfy ESA; an Incidental Take Permit through Section 2081 to satisfy CESA, a Regional General Permit through USACE to satisfy Clean Water Act (CWA) Section 404 and Rivers and Harbors Act Section 10, a Central Valley Regional Water Quality Control Board CWA Section 401 Certification; CDFW and Wildlife Master Streambed Alteration Agreement to satisfy California Fish and Game Code Section 1600, a Programmatic Agreement through National Historic Preservation Act (NHPA) Section 106, and a Joint Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) through CEQA and NEPA.[391] Discussions are currently underway to begin the process of creating an HCP to satisfy ESA, but to date, this proposal is in its infancy.

The Sacramento River Flood Control Project General Reevaluation Report (Sacramento River GRR) is another substantial effort to assess flood risk management capabilities and ecosystem opportunities within the Sacramento River flood conveyance system.[392] This includes all levees and other flood control mechanisms in the Sacramento River Flood Control Project (SRFCP), which contains approximately 980 miles of levee protecting 2.3 million people within 50 communities. One million acres of land and nearly $38 billion worth of infrastructure.[393] This effort could present a similar opportunity to employ true multi-benefit project goals of flood risk reduction, ecosystem restoration and habitat protection.

The Sacramento River GRR is "a study to reevaluate the SRFCP to determine whether modification of the authorized project should be recommended due to changes in physical, economic, or environmental conditions."[394] The project seeks to integrate multi-benefit goals, improving the flood management system while also taking proactive steps to restore the riparian ecosystem.[395] It is

(2014), http://wdl.water.ca.gov/floodmgmt/fmo/docs/LFRCMP-Final-June2014.pdf

389 *See id*. at ES-1.

390 *Id.*

391 CAL. DEP'T OF WATER RES., FEATHER RIVER REGIONAL ENVIRONMENTAL PERMITTING PROGRAM: EFFICIENT IMPLEMENTATION OF FLOOD MANAGEMENT PROJECTS 2, https://www.water.ca.gov/LegacyFiles/conservationstrategy/docs/cs_feather_fact.pdf (last visited May 28, 2017).

392 *Sacramento District: Sacramento River General Reevaluation Report*, U.S. ARMY CORPS ENGINEERS, http://www.spk.usace.army.mil/Missions/Civil-Works/Sacramento-River-GRR/ (last visited Aug. 8, 2016).

393 *Id.*

394 U.S. ARMY CORPS ENG'RS, SACRAMENTO RIVER GENERAL REEVALUATION REPORT: REPORT SYNOPSIS 2 (April 2016).

395 *Id.* at 20.

intended to account for system-wide hydrologic, hydraulic, and economic effects throughout the SRFCP area through the use of system-wide models and analyses.[396] In April 2016, a draft Report Synopsis for the Sacramento River GRR was released, providing a tentative timeline for the project.[397] As of the date of the Synopsis release, a feasibility cost share agreement was in place, scoping charrette completed, and scoping for NEPA/CEQA had been done to define and inform alternatives for the project. Public review of NEPA/CEQA documents is anticipated to take place in May 2017, and the final EIS is tentatively planned to be submitted to the US Environmental Protection Agency (EPA) in September 2018.[398] Plans are also underway to include ER into the "purpose" of the SRFCP, so that USACE may have Congressional authority to pursue a multi-benefit project.[399]

Some of the largest efforts to permit projects on a basin-wide scale are State-led Basin-Wide Feasibility Studies (BWFS's) and locally-led Regional Flood Management Plans (FRMPs). The BWFS's are large in spatial scale, based on the two major river basins in the Central Valley, where RFMPs are more detailed plans based on subdivisions of those larger river basins. DWR initiated two BWFS's as part of the effort to implement goals of the 2012 CVFPP, including the goal to address flood risk management in the Central Valley on a systemwide scale.[400] This was done in close coordination with development of the Conservation Strategy. The two BWFS's are for the Sacramento River Basin and San Joaquin River Basin. These studies evaluate the feasibility of different alternatives for improving the flood management system, including expanding the flood bypass system, integrating ecosystem enhancement objectives, and combining regional improvements.[401] The studies present options which are evaluated based on their ability to meet objectives for flood risk management, ecosystem functions, agricultural stewardship, cost, and other benefits. Recommended options will be refined through the development of the 2017 CVFPP. Overall, the BWFS's recommend long-term improvements over a large physical area, where RFMPs identify more specific projects and strategies to address local and regional flood risk management needs. Locally-led RFMPs develop strategies for regional projects. DWR will review the plans and offer input consistent with the objective of promoting multi-benefit projects.

The State of California is also embarking on an effort to obtain environmental permitting for all O&M activities occurring on levees directly under state

396 *Id.* at 7.

397 *See id*.

398 *Id.* at 1.

399 *Id.* at 3.

400 CAL. DEP'T OF WATER RES., BASIN-WIDE FEASIBILITY STUDIES (2016), http://www.water.ca.gov/cvfmp/bwfs/.

401 *Id.*

control.[402] This effort is in the initial stages and has not progressed into an actual plan to date but is commonly referred to as Environmental Permitting Operations and Maintenance, or "EPOM."[403] DWR is currently undergoing CEQA analysis as part of this effort.[404] Following CEQA analysis, they will initiate consultation under the CESA with CDFW. Following this, a second phase of the effort will involve federal consultations.[405] It is not presently clear which path DWR will take as a "federal nexus," but it will likely either include development of an HCP for all of their maintenance areas, or the development of a SWIF. If successful, this EPOM effort would be groundbreaking and could benefit LMAs and State maintainers enormously by relieving them of common problems and confusions around O&M permits (described *supra* in Part II).

Although regionally-scaled multi-benefit projects hold enormous potential in terms of increasing flood system safety and improving the ecosystem, these projects also have substantial challenges. The challenges commonly associated with such projects include the lengthy process, cost, policy issues, need for new technical expertise, and lack of local support. The duration of the process and associated cost are perhaps the biggest impediments to project development.[406] For example, the Hamilton City project started as a concept in 1998, with a feasibility study completed in 2004, and construction to begin in 2016.[407] The entire process may take longer than two decades to complete. Further, sources of federal and local funding are difficult to obtain. It is often hard to justify the value of a multi-benefit project with abstract ecological benefits, whereas one that simply targets flood damage reduction can be easily defined in terms of dollars. Politics also plays a role in funding agreements. Deeply ingrained mistrust of environmental interests, agricultural interests, and other stakeholder interests can lead to deadlock over crucial funding decisions. Finally, smaller communities are often unable to pay for such expensive projects.

Policy is also a prohibitive factor from implementing multi-benefit projects. For example, the leading USACE policy on multi-benefit projects has expired, but still seems to be used by the federal government. This can be confusing

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[402] See CAL. DEP'T OF WATER RES., ENVIRONMENTAL PERMITTING FOR OPERATIONS AND MAINTENANCE DRAFT ENVIRONMENTAL IMPACT REPORT (2017), https://www.water.ca.gov/LegacyFiles/floodmgmt/fmo/docs/EPOM-DEIR-January2016.pdf

[403] *Id.*

[404] *Id.*

[405] *See* CAL. DEP'T OF WATER RES., PRESENTATION TO THE MEETING OF THE CENTRAL VALLEY FLOOD PROTECTION BOARD COORDINATING COMMITTEE: ENVIRONMENTAL PERMITTING FOR OPERATION AND MAINTENANCE (EPOM) (2017), http://cvfpb.ca.gov/docs/PostDocs-01.30.2017/EPOM%20coordination%20comittee%20presentation_01252017%20FINAL2.pdf

[406] *See* U.S. ARMY CORPS OF ENG'RS, HAMILTON CITY FLOOD DAMAGE REDUCTION AND ECOSYSTEM RESTORATION, CALIFORNIA: FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT Summary-1 (2004), https://www.sacramentoriver.org/forum/lib/library/docs/Hamilton_City_Feasibility_Final_Report_(2004).pdf.

[407] *Id.*

when communities approach government agencies about potential multi-benefit projects. Further, state policies that divert from federal policies and USACE vegetation-removal requirements can be problematic in terms of permitting a multi-benefit project. These projects also require technical expertise. Biologists and engineers must inform the design process to ensure multi-benefit objectives are truly being met, but the requisite level of expertise can often be difficult to obtain. Finally, multi-benefit projects typically include some sort of acquisition of lands, easements, and/or rights of ways, which locals may adamantly oppose. This can halt or slow a multi-benefit project at the local level.[408]

D. Re-form Roundtable

Another possible solution to levee vegetation issues could be to re-form the California Levees Roundtable with the involvement of a neutral facilitator. The Final California Central Valley Flood System Improvement Framework ("Framework Agreement") released by the California Levees Roundtable recommended that: "The participating agencies should endorse this Framework and commit to collaboratively work together as partners in upcoming years during implementation of this Framework and the Central Valley Flood Protection Plan to improve public safety and environmental sustainability."[409]

The neutral facilitator for the California Levees Roundtable also recommended that the Roundtable participants move forward with a Regional Solutions Team.[410] This was a key recommendation included as part of the recommended next steps for Roundtable participants. The vision for such a team is to reconvene Roundtable participants to "explore the feasibility of various possible technical remediation treatments or engineering designs to address woody vegetation risks."[411] The facilitator saw the benefits of continuing Roundtable discussions with a focus on technical solutions to levee designs. This would include suggestions for levee designs that would retain waterside vegetation while also maintaining strict safety standards and would help establish designs that would be generally acceptable for USACE variance requests. One such example could be setback levees, leaving the existing waterside levee slope intact and building a new active levee prism adjacent to the landside of the levee, outside of the rooted zone. Another potential solution could be to install a floodwall or slurry wall in the center of the levee to reduce the likelihood of seepage or root penetration. The recommendation also includes encouraging the team to explore new designs that could be acceptable to all

[408] *See* SACRAMENTO RIVER CONSERVATION AREA FORUM, PROJECTS AND RESOURCES COMMITTEE (PARC) MEETING NOTES 2-3 (2015), http://www.sacramentoriver.org/forum/publications/parc/2015-03-12_PARC_Meeting_Notes.pdf.

[409] KAPLAN, *supra* note 5, at 76.

[410] *Id*. at 61-62.

[411] *Id.* at 7.

stakeholders and balance ecosystem and safety needs.

The reconvening of the Roundtable to generally discuss levee vegetation issues may lead to a similar dissolution as the first Roundtable discussions. This is because every stakeholder feels as if they are doing the "right thing," and pushing strongly for policies that support their main objective, whether it is maintaining strict national safety standards for levees or ensuring that the last remaining critical endangered fish habitat survives. However, if Roundtable participants were to convene over a specific project, more productive progress could be made. It is often easier to compromise over a specific project with tangible outcomes, rather than to discuss solutions or changes to policies in the abstract sense. Thus, there may be more hope in convening a Regional Solutions Team that would focus on technical solutions to specific project proposals.

Roundtable participants from the original Roundtable could convene, following a specific flood system and ecosystem restoration proposal by an applicant. This group could discuss problems associated with that particular project application and discuss and propose technical solutions. This would ensure cooperation by government agencies and provide project proponents with clarity and guidance on what should be expected of them. This would also help project proponents with developing a vegetation variance, if needed, and would combat the incentive to forgo obtaining a variance due to perceived confusion, costliness and length of time to obtain a variance. If this group were to convene, they should also involve a neutral facilitator to ensure that conversations stay on task and productive.

Although the convening of a Regional Solutions Team could provide potential significant benefits, it may also be unlikely, due to a variety of prohibitive factors. This includes how the Roundtable initially disbanded, following the lawsuit brought by state agencies against USACE for their vegetation management policy. Although years have passed since dissolution of the Roundtable, lingering emotions may still be at play and there may be a general hesitance from participating agencies to try to reconvene. Further, the structure of some agencies may reduce the effectiveness of the team. For example, federal agencies are often structured in such a way that regional policymakers are prohibited from making important planning decisions without first going through headquarters in Washington D.C., which can take significant time. This can make discussions frustrating, because regional representatives from these agencies cannot commit to any acceptable designs during Roundtable meetings, and must go back and forth trying to relay intricacies discussed in Roundtable meetings with officials in headquarters.

E. Develop SWIF/s for California's Central Valley

Another possible solution would be to develop a System-Wide Improvement Framework (SWIF) or multiple SWIFs specific to California's Central Valley.

The framework for developing a SWIF is discussed *infra* in greater detail in Appendix 1. The theory behind a SWIF is for state or local maintainers to develop a plan to fix the worst levee deficiencies first, eventually getting to a point where all levees will be brought into compliance with USACE engineering criteria. However, while maintainers bring the levees into total compliance, they will maintain PL 84-99 eligibility and not be seen as violating vegetation standards for purposes of other permits and approvals.

The SWIF does not create any vegetation variance in and of itself, but it does allow vegetation flexibility based on two opportunities. First, the SWIF allows maintainers to fix the least threatening factors to levee safety last. Levee maintainers can focus primarily on issues like burrowing animals, seepage and erosion control, and then years down the road (once all major threats to levee stability have been addressed) they may focus on bringing levee vegetation into compliance with USACE engineering criteria. This addresses issues of limited funding and resources allocated to low priority threats like vegetation. It ensures that limited funds will be used for severe levee threats, and only once those severe threats have been addressed will limited funds be used to address levee vegetation, widely acknowledged as an overall low threat to levee stability.

The second way a SWIF can allow vegetation flexibility is to be used in conjunction with a variance. The SWIF guidelines state that a SWIF may be used in conjunction with a vegetation variance, obtained pursuant to the terms of the PGL.[412] The overall intent of the SWIF policy is to provide a regional solution to bring levees into compliance with all USACE requirements. These requirements can include a vegetation variance, so long as the applicant gets a formal variance approval through USACE.

Finally, a SWIF can provide a federal nexus for ESA Section 7 purposes. As discussed above, local levee maintainers generally have no federal action associated with regular O&M activities, and therefore can be liable for Section 9 take violations under the ESA.[413] However, if the local maintainers successfully develop a SWIF and that SWIF is approved by USACE, USACE has engaged in a federal action and provided a federal nexus, triggering Section 7 of the ESA. Section 7 requires the federal action agency to undergo consultation with the consulting agency, and the consulting agency can provide take coverage for the action,[414] alleviating the local agency of potential liability. The ESA is discussed *infra* in greater detail in Appendix 1.

One example of a successful SWIF is the SWIF developed by the King County Flood Control District (King County SWIF) for the Lower Green River.[415] The King County SWIF covers about 42 miles total of the Lower

412 U.S. ARMY CORPS OF ENG'RS, *supra* note 75, at 8.

413 *See supra* notes 172-173 and accompanying text.

414 16 U.S.C. § 1536 (1973).

415 *See generally* KING COUNTY FLOOD CONTROL DIST., GREEN RIVER INTERIM SYSTEM-WIDE

Green River shoreline, including 16 miles of levees already enrolled in the PL 84-99 program, 12 miles of non-PL 84-99 levees/revetments, and 14 miles of shoreline with no facilities.[416] The King County SWIF contains information on: an overview of the King County levee system, identified levee deficiencies needing corrective action to retain PL 84-99 eligibility, a plan to resolve PL 84-99 deficiencies that cannot be corrected through routine maintenance and operations actions, vegetation recommendations, interim risk reduction measures, and a funding strategy.[417]

The King County SWIF describes in detail each area and its associated deficiencies identified by USACE. In 2014, the District underwent extensive vegetation removal to identify and track levee deficiencies.[418] The largest category of deficiencies was categorized as Unwanted Vegetation Growth (115 sites out of 456 deficiency sites).[419] Other deficiencies included Animal Burrows (39 sites), Encroachments (61 sites) and Other-Culverts (56 sites).[420] Chapter Two of the SWIF contains the Deficiency Action Plan, or the plan to bring the system into PL 84-99 compliance based on a "worst-first" approach.[421] The deficiencies that pose the greatest threat to Lower Green River levee integrity include slope stability and culvert deficiencies.[422] As such, those deficiencies are addressed first in the Deficiency Action Plan.[423]

Corrective actions prioritized to be completed in the near-term and mid-term comprise of those to be completed or initiated during the 2016–2021 time period. Near-term actions include actions such as culvert and pipe repairs, stump removals, site assessments, and encroachments. Mid-term actions include site assessments, implementation of a Vegetation Management Plan, and mid-term capital projects. Long-term actions include capital projects that correct current slope stability deficiencies on PL 84-99 segments.[424]

The SWIF includes a programmatic Vegetation Management Plan.[425] This is characterized by an approach that manages vegetation to ensure it does not impede inspection but remains to support habitat and water temperature goals.[426]

IMPROVEMENT FRAMEWORK (2016), http://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/SWIF/green-river-system-wide-improvement-framework-interim-report-february-2016.pdf.

416 *Id.* at 1-3.

417 *Id.* at 1-1.

418 *Id.* at 2-1–2-4.

419 *Id.* at 2-3.

420 *Id.*

421 *Id*. at 2-1–2-9.

422 *Id.* at 1-4.

423 *Id.* at 2-4–2-9.

424 *Id.* at 2-5.

425 *Id.* at 2-8.

426 *Id.*

Removal of stumps located within the levee prism is also a SWIF priority.[427] In 2008-2009, nearly 500 trees were cut to comply with ETL requirements. In 2014, stump removal was initiated for the stumps left over from the cut trees. The removal of these stumps remains a priority for the region, including removal of stumps and roots that exceed ½ inch in size.[428] Levee slopes are replanted, and levee crests paved as appropriate following stump removal.[429] Problems associated with vast vegetation removal include possibilities of seepage, piping, and internal erosion.[430] These problems are discussed *infra* in greater detail in Appendix 4.

The SWIF's Vegetation Management Plan recognizes that "vegetation is no longer one of the deficiency categories by which the USACE determines levee or floodwall eligibility for the PL 84-99 Program" but that "ensuring inspection viability is still a consideration."[431] Thus, the SWIF recognizes that USACE cannot preclude levees from PL 84-99 eligibility based on vegetation non-compliance, but that in practice it becomes more complicated. The Vegetation Management Plan seeks to balance all interests involved, while also ensuring compliance with ESA and the CWA.[432]

As a hallmark of the Vegetation Management Plan, no future tree removals along PL 84-99 shorelines are anticipated, unless an individual tree is determined to pose a safety hazard to levee integrity.[433] The SWIF's Vegetation Management Plan includes references to a report made by the Washington Department of Ecology, which recommended planting additional shoreline shade trees to reduce elevated water temperatures in the Green River.[434] The Vegetation Management Plan also recognizes benefits of carefully planted and stewarded shoreline vegetation, including increased shade to the river channel; native shrubs providing micro habitat and climatic benefits; improved shoreline stability in terms of erosion and slope stability; and improved conditions overall for people, fish, farmers and the community at large.[435]

The Vegetation Management Plan is not intended to be prescriptive, but as a "starting point" for individual projects.[436] As such, the plan encourages site-specific variability.[437] The plan provides these guidelines in terms of Vegetation Management Zones, which were designed to provide guidelines for consistent

427 *Id.*

428 *Id.*

429 *Id.* at 2-8.

430 SHIELDS, *supra* note 8, at 10-14.

431 KING COUNTY FLOOD CONTROL DIST., *supra* note 415, at 4-1.

432 *Id.*

433 *Id.*

434 *Id.* at 4-2.

435 *Id.*

436 *Id.* at 4-3.

437 *Id.* at 4-3–4-4.

maintenance, operations and stewardship of vegetation along shorelines.[438] The PL 84-99 shorelines are grouped into six zones based on specific characteristics related to PL 84-99 eligibility including, levee integrity, environmental characteristics, and public use and safety.[439] Each zone is assigned a target vegetative structure to achieve outcomes relative to: "plant/tree species selection guidance, location (specifically new trees, with respect to the internal levee core prism); vegetation densities; and long-term vegetation maintenance, operations and stewardship practices in the vicinity of current and potential future PL 84-99 shorelines."[440]

The six Vegetation Management Zones are the: landward zone, landward slope zone, crest zone, upper riverward slope, riverward bench zone, and lower riverward slope zone.[441] The Vegetation Management Plan makes recommendations based on these zones, categories, and type of vegetation. For example, large trees would be planted most densely in vegetation management zones on the riverward slope and riverward bench, and less densely in the landward slope.[442] Shade tree planting would be informed by the location of the internal levee core prism, location of trail/access road on the levee crest, or location/depth/type of levee or floodwall.[443] Setback levees are encouraged, where feasible, to allow more space to support large shade trees.[444]

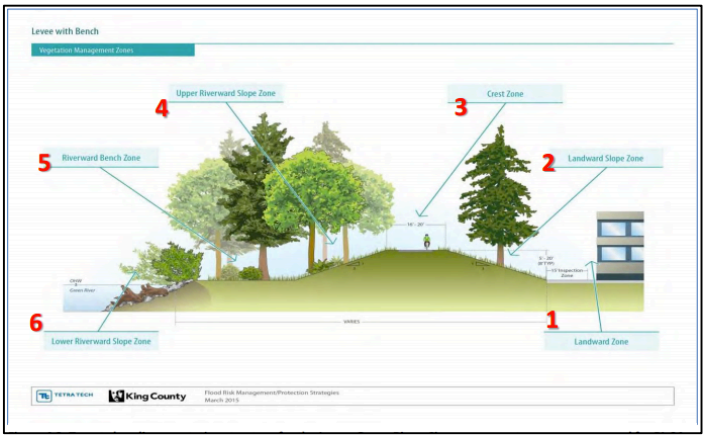

Figure 15: King County SWIF, Showing Target Shoreline Vegetation for Green River with Riverward "Bench" Planted With Trees[445]

438 *Id.* at 4-3.
439 *Id.* at 4-4.
440 *Id.* at 4-3.
441 *Id.* at 4-4.
442 *Id.*
443 *Id.*
444 *Id.* at 4-6–4-7.
445 *Id.* at 4-2.

Levees are further categorized based on shoreline type, when the levee was constructed, how it was constructed, and any recent repairs.[446] Areas characterized as "Shoreline Type A" include levees that were engineered prior to attempts to establish vegetation, often characterized by rock armor filled with invasive plant species.[447] Vegetation management for Type A shorelines includes slope mowing, noxious weed control, tree management for stumps left over from mass tree removal in 2008-2009, and removal of hazardous trees if necessary.[448]

Areas characterized as "Shoreline Type B" include levees that received early bioengineering repairs and "bench back projects," or levee projects that include native vegetation plantings, usually on the waterside slope.[449] Vegetation management recommendations for type B shorelines include: thinning vegetation as needed for inspections, and maintaining inspection zones; conducting inspections during the early spring when shrubs do not have leaves; minimal thinning of willows along the shoreline, but not over the water, to allow light for slower growing trees planted on benches; protection of existing trees and planting new trees in a coordinated manner; removing vegetation except for grass on the levee crest and 8-10 feet down from the levee crest on the riverward slope; and ongoing invasive species and noxious weed management.[450]

Areas characterized as "Shoreline C" include recently planted levee setbacks and floodwall projects. This is the smallest category, and maintenance and stewardship recommendations for type C shorelines include: invasive species control in the bench and riverward slopes; thinning of willows planted at the toe if necessary for inspections; evaluation to incorporate larger shade trees into riverward slopes; watering for plant establishment and noxious weed control; and mowing of the upper riverward slope for trail safety and for inspections.[451]

The plan also encourages balancing vegetation risks and benefits. For example, the plan states that in areas where woody vegetation could pose large benefits in terms of river shading, those benefits might outweigh potential risks, while this might not be the case for areas where woody vegetation does not provide shading functions to the river.[452] Certain trees may require site-specific assessments to determine whether and to what extent they may pose a threat to levee integrity.

The plan includes detailed guidelines for vegetation management based off vegetation zone and category, which are beyond the scope of this review.

446 *Id.* at 4-4–4-5.
447 *Id.* at 4-4.
448 *Id.* at 4-8.
449 *Id.* at 4-8–4-9.
450 *Id.* at 4-9.
451 *Id.* at 4-9–4-10.
452 *Id.* at 4-4.

However, this could provide a helpful example for a similar SWIF specific to California.

Part of what made development of the King County SWIF successful was the high level of interagency collaboration. As part of the SWIF's development, the King County Flood Control District convened two advisory groups. The first was the "Advisory Council," comprised of members from the "leadership level in their respective organizations."[453] The Advisory Council convened five times to provide policy input at project briefings. The second advisory group was the "Technical Advisory Committee," which convened eleven times to provide a technical review of work products, and to provide policy and technical input.[454] Advisors represented the following organizations: King County Flood Control District; King County; the cities of Tukwila, Renton, Kent, and Auburn; Muckleshoot Indian Tribe; State agencies, including Puget Sound Partnership, the Department of Fish and Wildlife, and the Department of Ecology; federal agencies including USACE, NOAA, and FEMA; Water Resource Inventory Area (WRIA) 9; business community members including Boeing, Washington REALTORS, Master Builders Association, and NAIOP Commercial Real Estate Development Association; and environmental groups including The Nature Conservancy and American Rivers.[455]

Development of the King County SWIF also exemplifies challenges associated with planning and implementing a SWIF. One challenge is the length of time it took to plan and implement the King County SWIF. The process started with the submittal of a letter of intent to USACE in 2012. Then King County worked with stakeholder Advisory Council & Technical Advisory Committee to develop final submission material to USACE in February 19, 2016. According to USACE SWIF guidelines, after a letter of intent is approved by USACE, a SWIF must be developed within 2 years.[456] However, development of the King County SWIF took twice that,[457] resulting in the SWIF technically violating the USACE guidelines by exceeding the appointed timeframe. This is indicative of the lengthy time necessary to develop a successful SWIF, perhaps more than USACE intended when they originally designed the process with a two-year development mandate.

The King County SWIF begins with a letter from the King County Flood Control District Board of Supervisors to the Regional USACE Commander, which recognizes the SWIF's limitations.[458] The letter acknowledges that it is

[453] *Id.* at 1-2.

[454] *Id.*

[455] *Id.*

[456] U.S. ARMY CORPS OF ENG'RS, *supra* note 75, at 5.

[457] Interview with M. Grady (April 2016).

[458] KING COUNTY FLOOD CONTROL DIST., *supra* note 415 (see Letter from Reagan Dunn, Chairman, King Cty. Flood Control Dist. Bd. of Supervisors to Colonel John G. Buck, Commander,

intended as a short-term solution to regain eligibility under the PL 84-99 program but does not meet all of the goals and objectives of Green River stakeholders.[459] Rather, King County will try to integrate stakeholder objectives in a larger River Corridor Plan in the future.[460]

In California, it could be feasible to pursue a similar SWIF as King County's. However, California would need a similar commitment of all key stakeholders in order for the effort to be successful. This is possible but would take time and energy and would be more doable if the project had a champion to push the SWIF forward and a neutral facilitator to keep stakeholders focused and on track. California may further be limited because here, we may not be able to conduct a similar extensive vegetation removal to identify deficiencies, like they did in King County, given the little remaining critical habitat that California woody vegetation provides. Instead it is likely that we would need a different assessment tool or assessment system to identify existing deficiencies.

Further, in order to protect critical habitat, the SWIF in California would likely need to be associated with a vegetation variance, although this is unclear given the current state of the regulatory framework. In King County, the district cited interim guidelines that preclude using vegetation removal as the factor that prohibits levees from PL 84-99 eligibility.[461] However, levee vegetation can still factor into PL 84-99 analysis overall. It is unclear whether a similar SWIF policy that retained vegetation would be possible in California without a variance. This is where input from regional USACE leadership would be paramount. If a variance is also required, it is less likely that this would be a feasible option, given the confusion around variance guidelines and procedures. However, with appropriate USACE leadership and guidance, this obstacle could be overcome.

Finally, the California SWIF would need to be developed in an appropriate geographic location to be successful as a test case. Ideally, the SWIF would cover a very large geographic area, but realistically that could be unduly onerous as a pilot project. Instead, a SWIF should be developed in a specific watershed with the opportunity to rebuild or modify levees as well as opportunity for habitat enhancement. This could be an area where landowners are open to setback levee development, likely in non-urbanized areas to avoid resident relocations. This should also be attempted in an area where key leadership is engaged. To be successful, the SWIF would need strong leadership from the levee maintainers and all agencies involved. If successful, the pilot SWIF could provide an example for larger SWIFs to cover the entire Sacramento and San Joaquin River Basins.

Seattle Dist. U.S. Army Corps of Eng'rs).

459 *Id.*

460 *Id.*

461 *Id.* at 2-2.

F. Support Legislation to Improve Regulatory Framework

Another approach to resolving issues described *supra* in Part II could be to support new legislation that would improve the regulatory framework for permitting flood conveyance systems. Recently, legislation was proposed in the Senate's version of Water Resources Development Act (WRDA) 2016 to address some pertinent levee vegetation issues.[462] (The House of Representatives also passed a version of WRDA 2016, which did not address anything related to levee vegetation).[463] The language included in the Senate's version of WRDA 2016 was not included in the final bill (renamed the Water Infrastructure Improvements for the Nation or "WIIN"), but the ideas included in the Senate version can still be used as a foundation for future legislation.

The Senate version of WRDA 2016 proposed language that would update WRRDA 2014, Section 3013(g)(1).[464] WRRDA 2014, Section 3013(g)(1) provides "interim actions" that the USACE shall adhere to, pending the submission of review of the ETL and PGL.[465] The Senate version of WRDA 2016 would have updated the WRRDA 2014, Section 3013(g)(1) language by: (1) Inserting "remove existing vegetation or" after "the Secretary shall not," and (2) Removing "as a condition or requirement for any approval or funding of a project, or any other action."[466]

These proposed changes would have provided greater clarity than the previous language in WRRDA 2014. Without these updates, no legislative authority prevents USACE from removing existing vegetation on levees during the "interim," (or while the USACE carries out a comprehensive review of their vegetation removal guidelines). Rather, WRRDA 2014 only directly prevents USACE from requiring that others remove existing vegetation in order to maintain eligibility for emergency relief programs like PL 84-99.[467] The Senate's proposed language in WRDA 2016 would have clarified and strengthened the spirit of WRRDA 2014, which sought to prevent the removal of existing vegetation on levees until such time as USACE thoughtfully revisits their vegetation removal policies.

Additionally, the language removing confusing qualifiers from the directive that USACE shall not require removal of existing vegetation would have clarified the directive of the law. This proposed language would have made it clear that, until such time that the USACE conducts a thorough review and reexamination of their vegetation removal policies, they may not require removal of existing vegetation from any other person or entity under any

462 Water Resources Development Act of 2016, S. 2848, 114th Cong. § 1027 (2016).

463 Water Resources Development Act of 2016, H.R. 5303, 114th Cong. (2016).

464 S. 2848 § 1027.

465 Water Resources Reform and Development Act § 3013.

466 S. 2848 § 1027.

467 Water Resources Reform and Development Act § 3013(g)(1) (2014).

circumstances, unless that vegetation poses an unacceptable safety risk.

Finally, the proposed language in the Senate version of WRDA 2016 section 1027(b) would have provided much needed consequences for failing to meet deadlines of WRRDA 2014.[468] WRRDA 2014 provided that USACE shall carry out the terms of the legislation and provide revised guidelines within 18 months of the law's enactment.[469] That deadline passed in December of 2015. The Senate version of WRDA 2016 would have required that USACE submit a report, within 30 days, detailing the reasons for failing to meet the WRRDA 2014 requirements, along with a plan for how they will come into compliance.[470] This addition would have been a key means to enforce the terms of WRRDA 2014.

Unfortunately, the above language in WRDA 2016 was not included in the final bill. However, legislative history of the Senate's original version could provide a guide for similar legislation that may be proposed and passed in the near future.

Another bill (AB 2087) was approved by the Governor on September 22, 2016.[471] AB 2087 amends CESA to include regional conservation investment strategies, which encourages planning on a regional basis that includes conservation goals. Under CESA, CDFW may authorize the take of listed species if it is incidental to an otherwise lawful activity and the impacts are fully mitigated.[472] Existing law further prohibits any entity from substantially diverting or obstructing the natural flow of, or substantially changing or using any material from the bed, channel, or bank of any river, stream, or lake, or from depositing certain material where it may pass into any river, stream, or lake, without first notifying CDFW of that activity, and entering into a lake or streambed alteration agreement if required by CDFW to protect fish and wildlife species.[473]

AB 2087 would instead authorize CDFW to approve a regional conservation investment strategy after one or more public agencies request and submit a proposed strategy to CDFW.[474] The proposed strategy would be developed in consultation with applicable local agencies with land use authority.[475] AB 2087 authorizes conservation and habitat enhancement actions that would measurably advance conservation objectives of a CDFW approved strategy to be used as

468 S. 2848 § 1027.

469 Water Resources Reform and Development Act § 3013 (2014).

470 S. 2848 § 1027.

471 Assemb. B. 2087, 2015–16 Leg., Reg. Sess. (Cal. 2016) (adding Chapter 9 to Division 2 of the Fish and Game Code, relating to fish and wildlife).

472 Cal. Fish & Wildlife Code § 2081(b); Cal. Code Regs., tit. 14, §§ 783.2–783.8.

473 Assemb. B. 2087.

474 *Id.*

475 *Id.*

mitigation credits.[476] If so, the conservation strategy must contain additional requirements under the law. Mitigation credits could be used to fulfill state or federal compensatory mitigation requirements for laws like the ESA and CESA, among others. Prior to using the mitigation credits, the submitting person or entity must also enter into an agreement with CDFW to ensure certain additional requirements are met. Although this legislation is not perfect (it includes tough requirements that may be difficult to realistically meet), it does allow public agencies to create mitigation credits with CDFW instead of traditional mitigation banking, adding flexibility to the mitigation process, and creating an opportunity for holistic environmental panning. This bill is also significant in that it allows for flexibility with regard to mechanisms for funding long term O&M of areas used for mitigation, and mechanisms to preserve land in perpetuity. In that sense, AB 2087 is a useful starting point. Overall, legislation such as this would facilitate holistic flood system management and regional conservation. This would help planning at the state level, and useful aspects of AB 2087 could potentially be adapted to similar national legislation.

Other legislation adopted at the state or federal level could advance similar goals as the Senate version of WRDA 2016 and California's AB 2087 by encouraging USACE to follow through with directives of WRRDA 2014, strengthening and clarifying directives of WRRDA 2014, and encouraging regional conservation as a primary goal of flood system management projects.

G. Litigation

Another option to improve problems faced by the current state of woody vegetation policy could be to initiate or reinitiate litigation. Appendix 3 details two major lawsuits brought by the State and environmental NGOs over the promulgation of the USACE vegetation policy, which may violate ESA, NEPA and APA. These cases were both dismissed without prejudice by the Court, following the release of WRRDA 2014, which directed USACE to revisit and rewrite their vegetation policies (specifically the ETL and PGL), taking new science into account and with the advisement of experts in the field.[477]

The deadline that WRRDA 2014 established for USACE to comply with its terms has long passed. If they chose to, the State or environmental NGOs who originally brought the suits against USACE could reinitiate their lawsuits or bring a suit compelling USACE to comply with WRDDA 2014's legislative requirements. It is unclear whether a court would hear the suit on its merits before USACE had promulgated new vegetation management policies, but it does seem as if a court could at least compel USACE to release new guidelines,

[476] *Id.*

[477] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247; Cal. Dep't of Fish & Game's Complaint, *supra* note 181.

per the law's directives. Further, once these guidelines have been released, it is more likely that a court would rehear the State or NGO claims on the merits.

If, in the re-release of the new vegetation guidelines, USACE similarly does not undergo consultation per Section 7 of the ESA and does not undergo the process of developing an EIS per NEPA, it is possible for the plaintiffs from the previous lawsuits to reinitiate their suit. Alternatively, they could bring a new lawsuit with similar allegations. If the previous plaintiffs choose not to do so, a different plaintiff with proper standing could also sue based on the refusal of USACE to undergo ESA and NEPA procedures.

Litigation could be successful in that a court could order USACE to undergo the required environmental consultations and environmental assessments. However, typically in these actions deference is given to the government agency acting as defendant, unless they have blatantly violated the procedure of an environmental law. The outcome in the present situation would be far from clear. Thus, any initiation of a lawsuit would be a risk undertaken by potential plaintiffs, as litigation can take years and would likely be very costly.

Perhaps the biggest reason that litigation may be a poor route to pursue is the large potential for relationship fallout. During the time when the State initiated its lawsuit against USACE, USACE decidedly ended its involvement in the Roundtable discussions. The Roundtable was involved in creating compromise agreements in a productive way, but initiation of the lawsuit brought those discussions to a screeching halt. Litigation often spends large amounts of time and money to create a more polarized debate. Therefore, litigation should only be used as a last resort where alternative resolution cannot be reached.

H. Use Endangered Species Act

The ESA has been described as one of the strongest environmental laws in the United States, in part because it prohibits any act that would result in the "take" of a species or the degradation of its habitat.[478] As such, the ESA has a large potential to provide solutions to the current regulatory framework regarding woody vegetation on levees. This includes using strong, consistent reasonable and prudent alternatives (RPAs) during formal consultations for large levee projects; usage of the "no RPA" alternative for consultation on large levee projects when there is no equivalent habitat present and a vegetation variance is demonstrably infeasible; and referencing state planning tools to use as Best Available Science in RPAs.[479] For additional background and information on the ESA, see *infra* Appendix 1.

As the "consulting agency" (FWS and/or NMFS, depending on the species) undergoes a formal consultation with the "action agency" (the agency

[478] 16 U.S.C. § 1538 (1973).

[479] *See* 50 C.F.R § 402.02 (2015); 16 U.S.C. § 1538 (1973).

undertaking the federal action) per Section 7 of the ESA, the consulting agency and action agency must agree on a determination as to whether or not the action results in jeopardy to the listed species in question.[480] If the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, then the formal consultation is characterized as a "jeopardy biological opinion."[481] In the case of a "jeopardy" biological opinion, the biological opinion (BiOp) must include reasonable and prudent alternatives (RPAs).[482] If the consulting agency is unable to develop RPAs, "it will indicate that to the best of its knowledge there are no [RPAs]."[483]

RPAs are identified during a formal consultation, and offer alternative actions consistent with the action's original purpose that will avoid the likelihood of jeopardizing the continued existence of listed species or the destruction or adverse modification of designated critical habitat.[484] RPAs must also be economically and technologically feasible.[485] In formulating RPAs, the consulting agency must use the "best scientific and commercial data available" and "give appropriate consideration to any beneficial actions taken by the federal agency or applicant, including any actions taken prior to the initiation of consultation."[486]

One possible solution to the levee vegetation issue could be for a consulting agency to recommend strong RPAs for levee improvement projects. Large, programmatic levee improvement projects that propose large-scale tree removal would likely result in a jeopardy opinion and would present such an opportunity. For example, a consultation submission by USACE for a levee improvement project would likely include tree removal as part of the action. If the proposed tree removal is on a large scale, this would likely result in a jeopardy opinion, as it would involve the destruction of critical habitat, particularly critical fish habitat. As such, the consulting agency could include strong RPAs in the project's BiOp. As described above, these RPAs are constrained in that they must be economically and technologically feasible, they must avoid the likelihood of causing jeopardy to the species and/or its habitat, and they must be consistent with the project's original purpose. If NMFS and/or FWS were able to recommend strong RPAs within those constraints in the Central Valley, then by definition jeopardy to the species would be avoided and the project's intended purpose could still commence.

Developing an RPA that meets the above requirements would likely

480 16 U.S.C. § 1538(b)(3)(A) (1973).

481 50 C.F.R. § 402.14(h)(3) (2015).

482 *Id.*

483 *Id.*

484 50 C.F.R. § 402.02 (2016).

485 *Id.*

486 50 C.F.R. § 402.14(g)(8) (2015).

necessitate maintaining most of the riparian vegetation and SRA habitat along the waterside of the levee prism, especially along the lower waterside slope, as this provides the most beneficial habitat to listed fish. It should be noted that many applicants are able to mitigate for their actions through purchasing mitigation credits at a "mitigation bank" when a bank exists in the affected species critical habitat and the bank has similar habitat to that being destroyed or affected by the action.[487] However, given the limited available habitat currently in California riparian corridors for Central Valley ESA-listed fish species, it is unlikely that an applicant would be able to fully mitigate for extensive vegetation removal for a large-scale project.

The RPAs would also need to maintain the original purpose of the project, which would likely be to update the levee prism and increase the factor of safety of the levee. In the case of a USACE levee project submission, the consulting agency could suggest an RPA requiring USACE to retain all or most woody vegetation on the levee, while still increasing levee safety and following through with all other goals of the project. In doing so, the consulting agency would be required to use the best available science. The consulting agency could utilize research compiled in the Synthesis Report (for more details on the CLVRP Synthesis Report, see *infra* Appendix 4), as this report presents the most current science on levee vegetation. The consulting agency could also utilize policies implemented by the State of California as best available science. The State has been managing levees with vegetation to ensure levee safety and stability while not sacrificing critical riparian habitat for the past five years. (For more information on state vegetation management policies, see *infra* Appendix 2). State policies are characterized by DWR's Levee Vegetation Management Strategy (LVMS), which includes LCM and allows for thinning of vegetation on upper waterside and landside slopes to maintain inspection accessibility, long-term compatibility with USACE standards, and retention of woody vegetation on the lower waterside levee slope. The consulting agency could borrow from these policies, which arguably represent best available science in terms of woody vegetation management and utilize ideas of the LVMS in an RPA.

If the consulting agency were to refer to research presented in the Synthesis Report and implement innovative ideas for vegetation management, then RPAs for a large project could meet the RPA requirements. A successful RPA would maintain critical habitat, not jeopardize listed species, be economically and technologically feasible, and maintain the original purpose of the project: levee safety. Implementing such an RPA on a large levee segment could have enormous habitat preservation benefits for a particular area.

However, this also comes with challenges, including the fact that USACE would likely require a large variance in order to maintain woody vegetation on

487 *See* 82 C.F.R. § 51382.

levees, even if part of an RPA. As discussed above, applying for a vegetation variance is time consuming expensive, and confusing. If USACE officials were heavily engaged in the process, confusion could be alleviated a successful variance could be issued, but absent clear guidance from officials it is unlikely that another applicant would be able to navigate the variance process.

The consulting agency could also come to a conclusion that no RPAs exist, and so the only option for the applicant would be to cancel the project or refrain from removing vegetation as part of the project description. However, to do so, the consulting agency would need to clearly demonstrate that no RPAs exist. This is unlikely given the demonstrated ability for some previous projects to manage safe levees with woody vegetation (see above examples, such as the Hamilton City Flood Damage Reduction and Ecosystem Restoration project), proving that balancing environmental and safety objectives for levee projects is possible. However, if the consulting agency demonstrates that the action agency is unable to practically obtain a waiver required by USACE, and that a waiver is required in order to maintain woody vegetation on the levee, a "no RPA" conclusion could be an option. In this case, the consulting agency could essentially reject a project proposal from an applicant seeking to remove vast amounts of woody vegetation on Central Valley Levees.

This option would also come with substantial challenges, the foremost of which is that it would result in project deadlock and prevent necessary projects from going forth to fix and update levees. This would result in risk to communities behind the levees to be updated, and as such is a poor choice of policy. However, the consulting agencies are bound by the stringent terms of ESA. Thus, if a variance is necessary but proves impracticable, this could occur.

In addition to utilizing RPAs to effect change, an applicant could also pursue a Habitat Conservation Plan (HCP) as part of a project. A successful HCP must satisfy the following requirements: (i) it must describe the impact resulting in a take; (ii) include steps the applicant is taking to minimize and mitigate impacts that result in a take, and associated funding sources; (iii) describe alternative actions considered by the applicant, and why those alternatives are not being pursued; (iv) and include any other measures the consulting agency deems appropriate.[488] When reviewing the HCP, if the consulting agency finds the following factors have been met, they may approve of the HCP: (i) the taking will be incidental; (ii) the applicant will minimize and mitigate the impacts of the taking to the maximum extent practicable; (iii) the applicant will demonstrate adequate available funding; (iv) the taking will "not appreciably reduce the likelihood of the survival and recovery of the species in the wild;" and (v) any other measures required by the consulting agency pursuant the HCP

[488] 16 U.S.C. § 1539(a)(2)(A) (1988).

requirements will be met.[489]

HCPs can be useful in situations where there is no federal nexus, but the project applicant could potentially take a listed species or adversely modify its critical habitat. For levee project applicants, there is potential to develop creative HCPs to conserve critical riparian habitat in part of the river and allow for limited modification in the action area. In other words, if the applicant finds that in one portion of the river, obtaining a variance is impractical, but the applicant still needs to undergo levee updates, the applicant could develop an HCP to protect critical habitat in another area. Note that for the action area, the applicant would still need to minimize impacts to habitat to the greatest extent practicable, so mass removal of woody vegetation is unlikely to conform to these requirements. However, if an action will result in the removal of relatively small amounts of woody vegetation as critical habitat, then the applicant could work with the appropriate consulting agency (or both, depending on impacted species) to develop an HCP and protect critical habitat elsewhere. This has been a solution explored by the State, described above, for the Feather River Region area.

I. Compliance with WRRDA 2014

USACE could develop new vegetation management policies, including an updated variance policy, per the requirements of WRRDA 2014, section 3013. WRRDA 2014, section 3013 directed USACE to review current guidelines in a way that considers regional variation. The legislation also directs USACE to consider factors such as varied interests, environmental impacts, benefits woody vegetation can provide to levee safety, impacts to levee safety of vast vegetation removal, Native American rights, recent science suggesting little evidence that woody vegetation causes increased flood risk, and economic costs.[490] The legislation further directs USACE to do so with the advice of officials from state and federal government agencies, local and tribal government officials, leaders from NGOs and independent experts.[491] WRRDA 2014, section 3013 directs USACE to do this within eighteen months of the law's passage.[492] This deadline passed last year.

If USACE were to revisit the vegetation guidelines using best available science, with the advice of experts in the field, and taking into account regional variations, it is likely they would come to a conclusion that in California's Central Valley, woody vegetation could be retained in most instances. This is based on recent studies and models demonstrating that in California, woody

489 *Id.* § 1539(a)(2)(B).

490 Water Resources Reform and Development Act § 3013(c)(1) (2014).

491 *Id.* § 3013(d)–(e).

492 *Id.* § 3013(f)(1).

vegetation generally does not pose a significant safety risk to levees. If USACE were to voluntarily comply with the terms of WRRDA 2014, section 3013 and implement new vegetation management policies in California that allow for woody vegetation retention, then essentially all of the problems and conflicts presented *supra* in Part II would be resolved, including potential conflicts between state and federal law, and conflicts between USACE policy and the ESA.

Rather than redoing their vegetation management policy nationwide, another option for USACE could be to implement levee vegetation regulations specific to California. This could take into account the State's region-specific needs and unique levee system, which overlaps with the last remaining critical habitat for endangered salmon. USACE could release engineering guidelines specific to California levees, in light of these regional differences. These guidelines could borrow from state planning guidelines, including LCM, which allows for retention of woody vegetation on the lower waterside slope (the part that provides the most critical habitat to endangered fish), but that over time phases out vegetation on all other parts of the levee.

Finally, USACE could rework the vegetation management guidelines focusing on a workable variance procedure. If USACE deems that the nationwide policy is necessary, they could make a feasible variance process to allow for regional considerations. As of now, the variance process and procedure is lengthy, expensive and confusing, and has been described by local maintainers as generally impracticable. If, however, USACE released clear guidelines that allowed for woody vegetation retention in Central Valley levees, and these guidelines were workable and feasible for local maintainers, then this could also solve the above issues and problems articulated *supra* in Part II.

In should also be noted that in revisiting and reissuing their vegetation management policies, and/or their variance policies, USACE must abide by all applicable environmental laws, including NEPA and ESA. The complaints described *infra* in detail in Appendix 3 contain arguments that USACE violated NEPA and ESA in promulgating the ETL and PGL without the necessary environmental review. Pursuant to NEPA, when a federal agency undergoes any action that significantly affects the human environment, the agency must prepare an environmental assessment (EA)[493] If the EA raises a substantial question as to whether the action may significantly affect the human environment, the agency must prepare an EIS.[494] Given the above discussion and potential for large woody vegetation removal to remove the little remaining critical salmon habitat in California, it is quite likely that in promulgating any woody vegetation regulation, USACE will be required to undergo preparation of an EIS and would

[493] 40 C.F.R. §1501.3 (2005).

[494] *Id.* §1501.4.

be violating NEPA if they fail to do so.

Similarly, under ESA, any federal action agency must consult with the appropriate consulting agency (NMFS and/or FWS) for any action to ensure it is not likely to jeopardize the continued existence of any listed species.[495] In promulgating new vegetation regulations, USACE is required to consult with NMFS and FWS to ensure that the regulations are not likely to jeopardize the continued existence of any listed species or result in the adverse modification of critical habitat. If USACE fails to do so, they would be in violation of ESA Section 7 consultation requirements. Thus, the ESA as well as NEPA and all other applicable environmental laws should be followed if and when USACE complies with WRRDA 2014, section 3013 mandates and reissues their vegetation management policies.

J. Update O&M Regulations

USACE could update their O&M regulations, consisting of section 208.10[496] and two manuals specific to the Central Valley: the *Sacramento River Levee Operation and Maintenance Manual* and *Lower San Joaquin River Levee Operations and Maintenance Manual*. These regulations were originally developed in the 1950s and are now incredibly outdated.[497] Because of this, problems exist regarding confusion over requirements, difficulties for LMAs to meet O&M manual requirements, and inconsistencies between manual requirements and environmental laws, which were passed after the O&M manuals. Also, because these manuals and regulations are so old, they predate the ESA and as such, USACE never underwent the ESA Section 7 consultation process during their promulgation. (These problems are discussed *supra* in greater detail in Part II.)

If USACE were to update the regulations set forth in section 208.10, the manuals based off of these regulations would need to be updated as well. In doing so, USACE would need to undergo the required consultation with NMFS and FWS per ESA Section 7, ensuring that the updated regulations are not likely to jeopardize the continued existence of listed species or adverse modification of critical habitat. This could result in creative solutions during the consultation process to retain woody vegetation as critical habitat on levees, while providing clearer, more up-to-date O&M guidelines for LMAs.

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495 16 U.S.C. § 1536 (1973).

496 33 C.F.R. § 208.10

497 U.S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT, *supra* note 10, at 13; U.S. ARMY CORPS OF ENG'RS, SACRAMENTO RIVER FLOOD CONTROL PROJECT *supra* note 10, at 13.

V. CONCLUSION

Ultimately this issue comes down to the need to address regional differences for levee maintenance with respect to vegetation management. Right now, that is difficult to accomplish. George Qualley characterized it best in a Vegetation Policy Guidance White paper by stating that we need a policy that,

> facilitates risk-prioritized management of legacy levee vegetation that promotes efficient use of public resources in meeting public safety goals while protecting and enhancing important and sensitive habitat within riparian corridors.[498]

This paper has attempted to compile the most current federal policies, state policies, case law and science on California levee vegetation issues. The author recognizes that this is an area where ongoing research will grow and develop, and the most recent science will continue to evolve. Ideally, laws should be informed by science, so that as our understanding of the world evolves, our laws and policies reflect the best available information. Therefore, as the science progresses relative to levee vegetation issues, so should our policies. This is particularly germane to the federal vegetation management policies and USACE guidelines that prescribe a vegetation free zone on levees. Recently compiled levee vegetation research demonstrates that in most instances woody vegetation on levees does not pose a serious threat to levee integrity. USACE policies should be updated to reflect our scientific understanding.

This article also offers arguments for why the current state of affairs is inadequate. This includes conflicting laws, both in terms of potentially conflicting state and federal law and conflicting USACE policy with the ESA; the dire need for levee repair, but levee maintainer's hesitation to do so in the face of confusing and conflicting policies; critical conditions of endangered salmonids and other endangered species in the Central Valley, and the fact that the last remaining three to five percent of riparian habitat is located on levee systems; confusion over O&M responsibilities, and outdated O&M guidelines that conflict with environmental laws as well as with USACE vegetation policies; confusing and costly variance requirements; confusion with current USACE standards in the face of WRRDA 2014, and implications for PL 84-99 eligibility; and the high cost of conforming with USACE vegetation-free requirements. Overall, the current state of affairs is unworkable and must be changed.

Finally, this article offers proposed solutions moving forward. It should be noted that this is far from an exhaustive list, and other creative solutions may provide answers preferable to those presented here. This list of proposed

[498] GEORGE QUALLEY, IMPLEMENTATION OF SECTION 3013 OF THE WATER RESOURCES REFORM AND DEVELOPMENT ACT OF 2014 1 (2014).

solutions was developed in coordination with members of state and federal agencies, local agencies, and experts in the field of levee vegetation science and policy. These proposed solutions include engineering and designing levees that retain woody vegetation but are also acceptable to governing agencies, including USACE, in terms of safety; using peer-reviewed newly developed methods to uniformly and impartially determine when vegetation may pose a risk to levee integrity; encouraging multi-benefit, regionally based projects which can act as test sites for state or federal policies; re-forming a levee vegetation interagency working group such as the Roundtable; developing a SWIF or multiple SWIFs in conjunction with variance/s for the Central Valley; passing legislation that would improve the regulatory framework; using existing tools in the ESA to encourage vegetation retention on levees, including strong RPAs and developing HCPs; re-initiation of litigation; or USACE could simply comply with WRRDA 2014 and revisit and reissue vegetation management guidelines and associated variance guidelines.

Regardless of the method, this issue will ultimately come down to collaboration and cooperation between leaders in the field. True, litigation or new legislation could attempt to compel USACE to issue new vegetation guidelines to resolve conflicts between those guidelines and the ESA as well as with state law. However, it is much more productive and effective for USACE officials to work with California officials, leaders from natural resource agencies, NGOs, and other experts in the field in addressing this problem. This is because passing legislation is quite expensive and takes significant time and resources, as does litigation. Moreover, legislation and court orders compelling an agency to act creates an adversarial relationship between actors and feeds into an argumentative mindset, making future compromise even less likely. If true collaboration could occur, where leaders from their respective organizations with the power to effect change gathered and discussed policy issues using data and conclusions from the best available science, new policies could be born that could address all of the worst issues faced by levee vegetation maintainers.

APPENDIX 1: FEDERAL LAWS AND POLICIES

A. FEMA

USACE and the Federal Emergency Management Agency (FEMA) are the two federal agencies with direct roles and responsibilities related to flood risk management. Flood risk management generally refers to measures taken to reduce the risk of current and future flooding in a community. Such measures can include a variety of actions such as building or zoning requirements, insurance incentive programs, and requirements for constructing and maintaining levees. USACE and FEMA have distinct, but complimentary roles

in levee development and maintenance.

FEMA has a variety of fundamental roles related to flood risk management. FEMA provides guidelines for communities to help reduce the risk of flooding, and damage due to flooding, to the maximum extent possible. One of the greatest tools FEMA uses to encourage implementation of these guidelines is the National Flood Insurance Program (NFIP). The NFIP uses insurance to incentivize communities to adopt and enforce flood management policies.

Local communities at high risk from flood events are referred to as "Special Flood Hazard Areas" (SFHA), and are eligible for federal programs that will financially protect the community against losses due to floods, if the community adopts and enforces FEMA-endorsed floodplain management actions. In order to identify SFHAs and other high-risk areas, FEMA has created a Flood Risk Insurance Rate Map. FEMA's Flood Risk Insurance Rate Map identifies areas of flood control systems with less than 100-year level of flood protection. "100-year flood" means there is a 1 in 100 chance of a flood being exceeded in any given year (also referred to as "1% annual chance flood"). Similarly, a 200-year flood has a 1 in 200 (or 0.5%) chance of being exceeded in any given year.[499]

Areas that exceed the 100-year flood standard are considered "high-risk-areas" and as such have greater development restrictions than other communities.[500] Development in these areas must comply with federal requirements for floodplain management. Additionally, insurable structures in these areas must purchase flood insurance.[501] Flood insurance premiums can be quite costly, and as such FEMA has an incentive based system in place to reward communities that have taken extra steps to reduce risks due to flood damage with a discount on flood insurance premiums. This program is the NFIP's Community Rating System (CRS).[502] Communities that join the CRS can obtain flood insurance premiums ranging from 5% to 45%, based on: (1) the community's additional efforts to reduce flood damage risk, (2) the community's efforts to strengthen insurance aspects of the NFIP, and (3) any other efforts to improve comprehensive floodplain management.[503]

By identifying areas that do not meet the 100-year flood standard, FEMA's Flood Risk Map provides the basis for NFIP regulations and flood insurance requirements.[504] Areas identified as high-risk are more expensive to develop,

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[499] CVFPP, *supra* note 5, at 1-16.

[500] FED. EMERGENCY MGMT. AGENCY, INTRODUCTION TO THE NFIP 2 (2011), https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084_atq_11aug11.pdf.

[501] *See id.*

[502] *Id.* at 6.

[503] *Id.*

[504] *See National Flood Insurance Program: Flood Hazard Mapping*, FED. EMERGENCY MGMT. AGENCY, http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping. (last updated Apr. 16, 2018).

difficult to insure, and subject to flood-proofing or elevation requirements.[505] This could benefit the natural floodplain by discouraging development in naturally flooded areas, and decrease the population at risk from flooding.

For areas already developed in floodplains, this can have the practical effect of adding costly flood insurance premiums to communities at risk.[506] For such communities, this creates a huge incentive to undertake substantial flood risk management and maintenance projects to qualify for the CRS, and thereby avoid expensive insurance premiums.[507]

Communities attempting to qualify for CRS must take significant steps to reduce the risk of damage due to flooding. This almost certainly involves updates and improvements to levees, the first line of defense protecting communities from flooding waters. However, such levee improvement projects place communities trying to qualify for CRS subject to all levee development and improvement laws, policies and regulations. There are a host of federal and state laws, policies and regulations regarding levee development and improvement projects, including USACE's vegetation requirements, which will be discussed at length below.

Communities are thus financially incentivized through flood insurance programs to undertake substantial levee improvement projects to minimize potential risks due to flood events. In so doing, they become subject to federal and state levee improvement policies, including USACE vegetation requirements. This can be problematic for communities, as USACE vegetation requirements may conflict with other state and federal laws, including the Endangered Species Act (ESA). Ramifications of conflicting laws and policies on local communities attempting to retrofit levees are discussed at length in *Part II: Issues Associated with Vegetation Removal Requirements*.

B. National Levee Safety Program

The National Levee Safety Program "addresses a range of operation and maintenance, risk communication, risk management, and risk reduction issues."[508] The program aims to better understand, manage, and reduce flood risks associated with levees through partnering with state and local maintainers to inspect, maintain and upgrade levees, as appropriate.

The National Levee Safety Program keeps and maintains a national inventory of levee systems in the National Levee Database.[509] The program also annually

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505 Interview with Peter Buck, *supra* note 254; *see also* CVFPP, *supra* note 5, at 1-12, 4-6.

506 CVFPP*, supra* note 5, at 1-19.

507 *See* FED. EMERGENCY MGMT. AGENCY, *supra* note 500, at 6.

508 *USACE/FEMA/Community Partnership*, U.S. ARMY CORPS ENGINEERS, http://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/USACE-FEMA-Community-Partnership. (last visited Aug. 17, 2016).

509 *See id.*

inspects and assesses about 2,500 levee systems nationwide, using data gathered from the inspections and assessments to inform and prioritize future flood control actions.[510] Finally, the program works to communicate all risk-related concerns to communities to further reduce the risk from flood events.

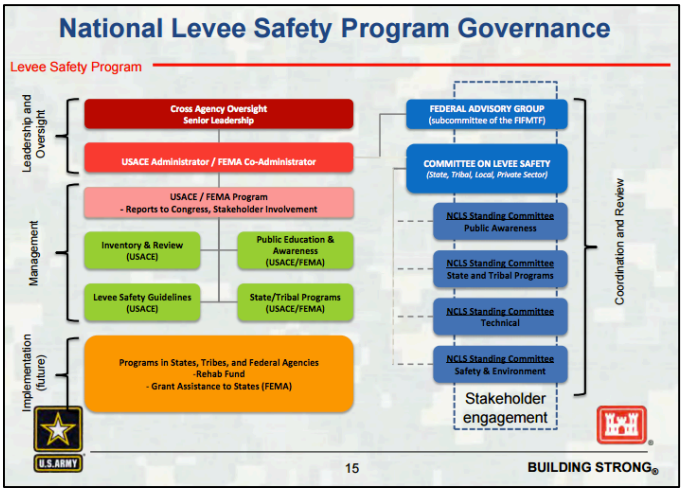

Figure 16: National Levee Safety Program Overview[511]

In 2007, Congress established the National Committee on Levee Safety to develop recommendations for the National Levee Safety Program.[512] The National Committee on Levee Safety is comprised of a FEMA official; eight representatives from USACE; and experts from the private sector, local agencies, and Indian tribes. The committee also includes the Secretary (or designee) and Administrator (or designee) as nonvoting members.[513] The Committee is charged with developing ongoing recommendations for the National Levee Safety Program, including a plan for the program's implementation.[514]

In 2009, the Committee on levee Safety submitted a draft report to Congress with recommended actions for the National Levee Safety Program. The report recommended that federal programs governing levees be closely aligned, and

510 *Id.*

511 ERIC HALPIN, NATIONAL LEVEE SAFETY PROGRAM 30 (2015), http://www.ussdams.org/wp-content/uploads/2016/09/1_Halpin-NLSP-Overview-for-USSDcomp.pdf.

512 National Levee Safety Act of 2007, Pub. L. No. 100-114, § 9003, 121 Stat. 1288 (2007).

513 *Stakeholder Involvement Past and Future*, U.S. ARMY CORPS ENGINEERS, https://www.usace.army.mil/National-Levee-Safety/Developing-the-National-Levee-Safety-Program/Stakeholder-Involvement-Past-and-Future/ (last visited June 28, 2018).

514 *Id.*

that USACE develop national levee safety guidelines with assistance from FEMA. It made additional recommendations for levee safety, including that federal programs provide incentives to nonfederal stakeholders to promote shared responsibilities of flood control structures.

C. USACE White Paper: Treatment of Vegetation with local Flood-Damage-Reduction Systems

In 2007, USACE released a White Paper, "Treatment of Vegetation with local Flood-Damage-Reduction Systems." This paper was notably significant because it signaled a change of course in the USACE levee vegetation management policies.

The White Paper clarified the USACE nationwide policy regarding the removal of vegetation, including wild growth, trees, and other encroachments, as prerequisite for Public Law (PL) 84-99 eligibility. This marked a departure from what had previously been USACE policy, embodied in the USACE "Vegetation variance letter" (August 3, 1949). Prior to the release of the White Paper, the USACE variance policy was described in the letter as follows: "Brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash. Where practicable, measures shall be taken to retard bank erosion by the planting of willows or other suitable growth on areas riverward of the levees."[515]

Similarly, 33 C.F.R. § 208.10, last updated by the Flood Control Act of 1944, remains the most current guidance document for levee Operation and Maintenance. 33 C.F.R. § 208.10 reinforces the USACE policy regarding vegetation prior to the white paper by containing identical phrasing as the 1949 variance letter: "Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees."[516]

Therefore, USACE policies prior to 2007 (and indeed, still embodied in current Operation and Maintenance guidelines) encouraged the planting of certain woody vegetation on levees to promote levee safety and reduce risk of erosion.

Contrastingly, the 2007 White Paper identified two "prevalent deficiencies" in numerous levees, which place the levees at risk for losing PL 84-99 eligibility, and loss of NFIP certification. These deficiencies are described as: (1) the presence of vegetation, and (2) insufficient widths of vegetation-free zones.[517]

The 2007 White Paper continues to describe the risks associated with levee

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[515] CVFPP *supra* note 5, at 3-25 (quoting USACE Vegetation Variance Letter dated August 3, 1949).

[516] 33 C.F.R. § 208.10(b)(1) (2018).

[517] CHIEF OF ENG'G & CONSTR. DIV., *supra* note 53.

vegetation, noting, "[a]ny debate about vegetation will demonstrate both detrimental and beneficial effects on local flood-damage-reduction systems."[518] Although the White Paper describes potential benefits of vegetation on levees (including protecting slopes from rain-induced surface erosion and essential fish and wildlife habitat), the paper concludes that a conservative approach to vegetation management is needed, and recommends updating policies to enforce a vegetation-free zone.[519] The scientific basis for this conclusion is uncertain, but it seems to stem from a precautionary principle-based approach, where in the face of uncertainty or potential danger, one employs the most conservative or cautionary method. Therefore, even though USACE acknowledges that woody vegetation can, in certain situations, promote levee stability, they conclude that a precautionary approach to levee vegetation management is preferable, adopting a uniform, nation-wide policy of vegetation prohibition on levees.[520]

The promulgation of this uniform anti-vegetation approach prompted uproar from many in the flood management and environmental communities. Some flood managers and levee maintainers see certain types of vegetation as beneficial to levee stability. They feared these requirements would lead to mandated removal of massive amounts of vegetation on levees. Such actions would be expensive and could risk levee stability and overall levee integrity. Many environmentalists pointed to potential Endangered Species Act violations and ramifications this uniform policy would have on endangered fish species. Woody vegetation on levees, particularly on the lower waterside slopes of levees, provides shade and water temperature benefits, as well as spawning and rearing habitat for endangered fish. As such it is designated critical habitat under the federal Endangered Species Act, and must be protected to promote the recovery of endangered fish.

The White Paper notably states that, "this guidance is not in agreement with 33 C.F.R. § 208.10, a policy that encourages the planting of willows or other suitable growth on areas riverward of the levees."[521] In other words, the new vegetation policy directly conflicts with the existing USACE operations and maintenance procedures, set forth in 33 C.F.R. § 208.10. This inconsistency led to additional concerns from local levee maintainers over the new USACE policy as articulated in the White Paper. Implications from this inconsistency are discussed in *Part II: Problems Associated with Vegetation Removal Requirements*.

In the 2012 Central Valley Flood Protection Plan (2012 CVFPP), a statewide planning document for levees in the California flood system, the State described

[518] *Id.* at 7.

[519] *Id.* at 2.

[520] *See id.* at 2-3 (detailing findings that demonstrate the USACE's assessment that vegetation management on levees is of paramount importance and should be expanded).

[521] *Id.* at 13.

the release of the 2007 White Paper as, "[in]consistent with the long-standing USACE practice of protecting trees while performing levee repairs on Central Valley levees, and requiring new tree planting in its levee designs, where feasible."[522] Therefore, inconsistencies in the new vegetation policy quickly became apparent to state policymakers.

In effect, the USACE 2007 White Paper marked a major policy shift for maintenance of levees nationwide. The prohibition of vegetation on levees has unique implications California's Central Valley, as noted in the 2012 CVFPP, and which will be discussed in greater detail in *Appendix 2: California State Laws and Policies*.

D. USACE - ETL 1110-2-571 and ETL 1110-2-583

While the aforementioned White Paper announced the USACE intention to change course in terms of its vegetation policy, the release of Engineering Technical Letter 1110-2-571 (ETL 1110-2-571) marked the actual implementation of new vegetation management guidelines. ETL 1110-2-571 established a nationwide vegetation policy, including uniform vegetation-free and root-free zones for levees throughout the United States. This policy prohibits all vegetation, except for grass, on the entirety of the levee prism and within fifteen feet on either side of the levee toe.[523]

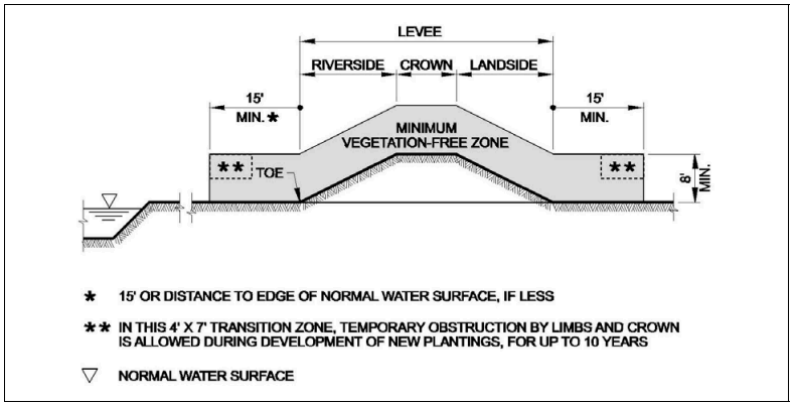

Figure 17: Basic Vegetation-Free Zone Requirements[524]

[522] CVFPP *supra* note 5, at 3-25.

[523] *See* ETL 1110-2-571, *supra* note 66, at 1 ("This ETL applies to all USACE Commands having Civil Works responsibilities and to all flood damage reduction projects for which USACE has responsibility for design, operation, maintenance, inspection, or certification. Applicability to non-federal projects [levees maintained by State or LMA's] is as follows: under the Rehabilitation and Inspection Program (RIP), the USACE performs inspections of non-federal projects (i.e. projects built by local communities then incorporated into the RIP) under ER 500-1-1 and the provisions of Public Law 84-99").

[524] *Id.* at A-2.

The ETL applied to all levee systems under direct USACE control and any levees maintained by the State or Local Maintaining Agencies (LMAs) who needed to comply with certain USACE-issued approvals or permits, or wished to maintain eligibility under Public Law (PL) 84-99.[525] According to USACE, PL 84-99,

> is the discretionary authority given to [USACE] by Congress to act and react to emergencies caused by floods, contaminated water sources, drought, or dam failures. This authority allows [USACE] to repair and/or rehabilitate any qualified flood control project (Levee) whether it is federally constructed or privately owned.[526]

In other words, PL 84-99 provides federal funding for emergency repair and rehabilitation activities. In a Fact Sheet distributed by USACE to clarify PL 84-99, USACE characterizes the program as authorizing USACE,

> to undertake activities including disaster preparedness, Advance Measures, emergency operations (Flood Response and Post Flood Response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated source.[527]

Thus, following the release of ETL 1110-2-571, if the State and LMAs wished to maintain eligibility for emergency rehabilitation relief, they had to comply with the ETL vegetation-free zone requirements.

A second Engineering Technical Letter, "ETL 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures," was released a few years after ETL 1110-2-571, and maintained almost identical requirements regarding the vegetation-free zone[528] The only apparent distinction between the two policies is with respect to compliance in order to obtain PL 84-99 eligibility. While ETL 1110-2-571 clearly stated that conformance with vegetation-free zone was mandatory for PL 84-99 eligibility, ETL 1110-2-583 backtracked slightly. ETL 1110-2-581 instead states, "This ETL is not applicable to determinations for eligibility in the Rehabilitation Program under . . . [PL 84-99]." This suggests that conformance with vegetation-free requirements will no longer be included in any part of determinations for eligibility in the PL 84-99 program. However,

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525 *Id.* at 1.

526 U.S. ARMY CORPS OF ENG'RS, PUBLIC LAW 84-99 REHABILITATION ASSISTANCE FOR NON-FEDERAL FLOOD CONTROL PROJECTS 3 (2009), http://www.spa.usace.army.mil/Portals/16/docs/emergencymgmt/PL84-99-Rehab_Assist_NFFC_Projects.pdf.

527 U.S. ARMY CORPS OF ENG'RS, USACE DISASTER OPERATIONS, PUBLIC LAW 84-99, https://www.hsdl.org/?view&did=774653 (last visited July 3, 2018).

528 ETL 1110-2-583, *supra* note 1.

the ETL later describes detailed vegetation-free requirements for levees, including limited instances where a variance could be issued when "shown to be necessary."[529] This suggests that vegetation-free requirements remain mandatory in the eyes of USACE. The inconsistent messages from ETL 1110-2-581 has resulted in a general consensus that if a levee maintainer is deficient in terms of levee vegetation requirements, but in nothing else, they will not lose eligibility in the PL 84-99 program. However, conformance with vegetation requirements is still technically required, and is included in the overall analysis for PL 84-99 eligibility. This can be a fine, gray line for local levee maintainers to walk and has resulted in recent confusion as to the extent of vegetation-free conformance necessary for PL 84-99 eligibility.

USACE planning documents describe ETL 1110-2-571 and ETL 1110-2-583 (ETL) as a "clarification," of previous guidelines with no change in the vegetation-free zone, which was originally established in an Engineering Manual (EM) 1110-2-301 (January, 2000).[530] Presumably, this description was articulated to alleviate concerns regarding the change in USACE levee vegetation policy. However, the ETL clarified the previous guidance in a way which limited vegetation growth on levees, and in doing so, essentially changed the terms of the previous guidance, which was much more flexible in allowing for levee vegetation.

EM 1110-2-301, distributed by USACE in January, 2000, provides that, "Where the safety of the structure is not compromised and effective flood-fighting and maintenance of the facility is not seriously affected, appropriate landscape planting (trees, shrubs, vines, and grasses) can be incorporated into the design of floodwalls, levees, and dam embankments."[531] In other words, while EM 1110-2-301 promoted vegetation-free zones on levees where woody vegetation posed a threat to levee safety, it also encouraged woody vegetation on levees where the levee structure would not be compromised. This national policy allowed for regional flexibility, especially in locations where woody vegetation has demonstrable benefits to flood risk reduction and critical habitat.

Contrastingly, the ETL established uniform vegetation-free zones on all levees. Specifically, the ETL mandates that all flood reduction systems, including levees, maintain a vegetation-free and root-free corridor on the width of the levee prism, plus an additional fifteen feet on each side, with a height of eight feet.[532] These dimensions are described as "minimum" requirements,

[529] *Id*. at 1-1.

[530] *See* U.S. ARMY CORPS OF ENG'RS, REVISED ETL 1110-2-571—GUIDELINES FOR LANDSCAPING AND VEGETATION MANAGEMENT (2009), http://www.safca.org/protection/NR_Documents/LARTF_2009_Jun_ETL.1110.2.57LARTFBriefingJune2009.pdf.

[531] U.S. ARMY CORPS OF ENG'RS, GUIDELINES FOR LANDSCAPE PLANTING AND VEGETATION MANAGEMENT AT FLOODWALLS, LEVEES, AND EMBANKMENT DAMS, ENGINEERING MANUAL (EM) NO. 1110-2-301 1-1 (2000).

[532] ETL 1110-2-583, *supra* note 1, at 2-1.

where the project design team may require even larger vegetation-free zones beyond that of the minimum.[533]

Thus, the ETL codifies the USACE policy shift in levee vegetation management. It brings the federal government's treatment of levee vegetation from one of regional variation based on site-specific data, to a uniform precautionary policy prohibiting woody vegetation on levees. The vegetation-free zone applies to all levees under USACE control, and all levees where state and local maintainers wish to maintain eligibility for emergency disaster relief. While not determinative for PL 83-99 eligibility, confusion still exists as to the extent of enforceability of the ETL's vegetation-free requirements.

E. Variance Procedures: Policy Guidance Letter (PGL) and Revised PGL

In order to obtain a "variance," or exemption, from the USACE's ETL requirements, a levee maintainer must meet the basic requirements established in the document, "Variance Policy: Policy Guidance Letter (PGL)—Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls."(Dec. 7, 2012).[534] The 2012 PGL replaced earlier guidelines released in the PGL from February, 2010.[535] The 2012 PGL is quite similar to the 2010 PGL in terms of qualifying for a variance from the ETL, but with additional clarifications and requirements for submitted scientific information. This includes that any scientific information regarding levee vegetation included in the submission materials be peer-reviewed and submitted to USACE's Engineer Research and Development Center (ERDC).

The variance program was likely developed in response to public outcry following the release of the USACE vegetation policy, embodied first in the White Paper and later in the ETL. After USACE announced and released the vegetation-free levee requirements, regulators from natural resource agencies and flood maintaining agencies voiced strenuous opposition. Vocal opponents to USACE policies ranged across a spectrum of interests, from those advocating for critical species habitat to LMAs voicing their inability to comply with such requirements. USACE likely released the PGL as a way for levee maintainers to obtain an exemption from vegetation requirements and address stakeholder concerns. The theory behind the variance process is that levee sponsors who meet certain standards can still "comply" with federal requirements, and thus be covered under federal assistance programs like PL 84-99, while being exempted from the ETL vegetation-free requirement. However, in practice, levee sponsors

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[533] *See* ETL 1110-2-583, *supra* note 1, at 2-2 ("Due to specific site conditions and project requirements, many levees, floodwalls, embankment dams, and appurtenant structures will be determined, by the project design team, to require a vegetation-free zone larger than the minimum described here.")

[534] *See* 2012 PGL, 77 Fed. Reg. 9,637 (Feb. 17, 2012).

[535] *See* 2010 PGL, 75 Fed. Reg. at 6,364.

have expressed opinions that complying with the PGL is overly burdensome, and as such, does not actually relieve them from the vegetation removal requirements of the ETL.[536]

1. Basic requirements and exceptions for obtaining a variance

The basic requirements for obtaining a variance, pursuant to the PGL, are situation-specific and differ depending on whether the applicant is the USACE District itself, or another local levee sponsor. The basic requirements may also differ if the levee prism meets certain size requirements, or if a "special consideration" applies.

For consideration of a vegetation variance, the requester must demonstrate that a variance is the *only* reasonable means to achieve the following: (1) comply with applicable law concerning environmental, cultural, or historic preservation; (2) protect the rights of Tribal nations; or (3) address a unique environmental consideration. These are also known as 6.a requirements.[537]

In addition to the 6.a requirements, all vegetation variance requests must demonstrate that the structural integrity and functionality of the levee system are retained. The applicant must also demonstrate retention of accessibility for operations, maintenance, repair, inspection, monitoring, and flood fighting of the levee system.[538]

Separate requirements and some exceptions apply to levees with an existing variance (before December 2012), and for a vegetation variance requested for a planting berm.[539] The variance policy does not apply to embankment dams and their appurtenant structures; channels; or shoreline riverbank protection systems such as revetments, sand dunes, and barrier islands.[540]

In the case of a USACE District attempting to obtain a vegetation variance, they must first obtain a concurrence from the local levee sponsor, but need not meet the 6.a requirements listed above. Instead, the USACE District may obtain a variance in the following situations: (1) federally authorized levees already under construction prior to December, 2012, but where USACE has not provided a notice of O&M duties; (2) existing federally authorized levees, "in which it can be demonstrated that vegetation was previously part of the original design prior to [December 7, 2012]"; (3) existing federally authorized levees with O&M manuals that allow vegetation within the vegetation-free zone; (4) levee systems where USACE is responsible for O&M; and (5) areas with ESA considerations, or where rights of Tribal Nations may be impacted, in which

536 Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 2.

537 2012 PGL, § 6.a, 77 Fed. Reg. at 9,638.

538 2012 PGL, § 6.d, 77 Fed. Reg. at 9,638.

539 2012 PGL, § 6.b, 77 Fed. Reg. at 9,638.

540 2012 PGL, § 9.a, 77 Fed. Reg. at 9,639.

case, USACE District may submit repairs for PL 84-99 consideration that include vegetation for a specific portion of the levee system (where the submittal contains additional requirements).[541]

Regional variances, or variances covering all levees within a geographic area, will not be issued.[542] Further, there is a presumption against approving a vegetation variance request for any portion of the levee in the upper third of the waterside slope, the levee crown, the landside slope, or within fifteen feet of the landside toe.[543] Additionally, approvals for vegetation variances near floodwalls may be limited.[544]

The levee sponsor must also ensure compliance with all applicable environmental laws and requirements before USACE will make a decision on a vegetation variance request. This includes NEPA and the ESA.[545]

The PGL also contains lists of documents and descriptions required for a vegetation variance request to be considered, including engineering analyses, USACE reports, summaries of the levee system performance history, detailed vegetation management plans, NEPA and ESA compliance documents, and other submission requirements.[546] Submittal requirements also include specifications for submission of a cross-sectional analysis. This must demonstrate, among other things, that "no significant roots (those greater than 0.5 in. in diameter) will enter the levee prism or approach 8 feet of structures critical to performance, such as drains or seepage-cutoff walls."[547] Although not included in the "requirements" section of the PGL, this is a notable requirement. In order for a variance request to be successful, the levee prism must remain a root-free zone. Evidence indicates that this requirement is strongly enforced given NMFS officials' reports of variance requests denied for lack of demonstration of a root-free zone in the levee prism.[548]

Among the requirements for a variance, the PGL specifies that the levee structure must, at a minimum, meet the standards as described in all USACE Engineer Manuals (EMs), Engineer Technical Letters (ETLs), and Engineer Circulars (ECs). This imposes a number of additional requirements. It is unclear which EMs, ETLs and ECs pertain to the variance process. This exemplifies both the uncertainty levee sponsors may face when attempting to obtain a variance, and the need for USACE involvement for a variance request to be

541 2012 PGL, § 6.c, 77 Fed. Reg. at 9,638.

542 2012 PGL, § 9.c, 77 Fed. Reg. at 9,639.

543 2012 PGL, § 9.d, 9,639 (explaining that the following will be "carefully evaluated to ensure the requirements in Paragraph 6 are met.").

544 2012 PGL, § 9.e, 77 Fed. Reg. at 9,639.

545 2012 PGL, § 11, 77 Fed. Reg. at 9,640.

546 *Id.*

547 *Id*.

548 Interview with H. Brown and other Nat'l Marine Fisheries Serv. Professionals (July 1, 2017) (Variance requests were denied for multiple levee projects along the Sacramento River.).

successful.

Another element of the PGL that reportedly causes confusion for LMAs is the requirement for levee sponsors to submit a variance request within one year of the distribution of the PGL (December 7, 2012). Shortly after the PGL's release, WRRDA 2014 was passed and two major lawsuits were filed against the USACE.[549] Both WRRDA 2014 and the Courts directed USACE to revisit the terms of the PGL and resubmit guidance for vegetation on levees. To date, the USACE has failed to do so. Absent other guidelines, levee sponsors still seek variances from the ETL's requirements through the PGL, despite the deadline for doing so having passed in 2015. Thus, in practice, the USACE is not enforcing the one-year requirement, as such variances have been granted after December of 2015.

F. "Section 408"

"Section 408" is a shorthand referral to 33 U.S.C. section 408. Passed March 3, 1899, the law is more popularly known as the "Rivers and Harbors Appropriation Act of 1899."

Until very recently, Section 408 was not widely utilized by USACE. The law made a resurgence on July 21, 2014 when the USACE issued the Engineering Circular (EC) 1165-2-216.[550] EC 1165-2-216 stated that the law was still applicable, and provided guidelines on how the USACE would be applying it. Another EC, of the same name, issued by the USACE in 2015 supersedes the 2014 EC, and provides detailed standards, policies and procedures for enforcing Section 408.[551]

The components of Section 408 are quite brief. Generally, Section 408 prohibits alteration of a USACE civil works project (including levees), without permission from USACE.[552] USACE should generally grant permission if two criteria are met: (1) the alteration does not impair the usefulness of the project, and (2) the alteration is not injurious to the public interest.[553]

One goal of EC 1165-2-216 is to allow USACE to grant permission for alterations on civil works projects, including levees. Thus, the issuance of EC 1165-2-216 clarified that any levee sponsor must obtain 408 permission prior to altering a levee.

As stated above, generally USACE has the authority to grant permission for an "alteration" if USACE determines that the activity will not be injurious to the

[549] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247; Cal. Dep't of Fish & Game's Complaint, *supra* note 181.

[550] EC 1165-2-216, *supra* note 118.

[551] *Id.*

[552] 33 U.S.C. § 408(a).

[553] EC 1165-2-216, *supra* note 118, at 2.

public interest nor impair the usefulness of the project.[554] For these purposes, an "alteration" includes "occupation," "use," action deemed an "encroachment" pursuant to 33 C.F.R. 208.10, or "any action by any entity other than USACE that builds upon, alters, improves, moves, occupies, or otherwise affects the usefulness, or the structural or ecological integrity, of a USACE project."[555] In practice, 408 permission is generally required for any proposed encroachment or major modification to a levee system.[556] It should be noted that while the use of Section 408 is a relatively new regulatory process, the CVFPB utilized an encroachment permit process prior to Section 408 implementation.[557]

In addition to the two-pronged analysis set forth in Section 408, the EC imposes design and construction standards for any alteration affecting a civil works project. Pursuant to these standards, the proposed alteration must meet "current USACE design and construction standards."[558] However, a requester is not required to bring any portions of the project not impacted by the alteration up to current USACE design standards.

In other words, any portion of an existing USACE project covered by the alteration must be brought up to date and meet all USACE design and construction standards. This presumably includes vegetation standards. Areas within the same USACE project that are outside of the construction area are not required to meet these standards, only those areas impacted by the alteration. Therefore, any alteration of a levee project covered under the 408 permission process must likely also meet USACE vegetation removal requirements, or obtain a vegetation variance.

G. Operations and Maintenance Policies

1. 33 C.F.R. 208.10

Section 408 governs any alteration not specifically prescribed as O&M in 33 C.F.R. § 208.10, or the O&M manual 33 C.F.R. 208.10, on the other hand, covers all maintenance and operations procedures. In doing this, it specifies the requirements needed for local project sponsors to preserve and protect the federally authorized flood control project.

33 C.F.R. § 208.10 was last updated by the Flood Control Act of 1944, over 70 years ago.[559] It sets rigorous standards for operations and maintenance

554 33 U.S.C. § 408(a).

555 *Id.*

556 This statement is based on the author's experience as a practitioner and is offered as anecdotal support.

557 CAL. CODE REGS. tit. 23, div. 1 (2014).

558 *See generally id.* § 120 (illustrating that California has had a procedure established significantly before Section 408 implementation in 2015).

559 33 C.F.R. § 208.10 (1944), *amended by* 33 U.S.C. 701(c) (1989).

(O&M) of levees and greater flood control systems, but these standards are quite dated.

Among other things, 33 C.F.R. § 208.10's O&M guidelines require local levee sponsors to appoint a permanent committee responsible for O&M of flood control structures "and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States."[560] Thus, USACE requires that local levee sponsors maintain and operate the levee, or other flood control system, to standards specified in 33 C.F.R. § 208.10, and that the local sponsor provide funds to do so. USACE maintains a strict policy that once a levee is certified, USACE has handed off all O&M duties to the local sponsor. The levee then becomes the sole responsibility of that local sponsor, and the sponsor must meet all O&M requirements established in 33 C.F.R. § 208.10.

Among the O&M requirements, 33 C.F.R. § 208.10 prohibits any "encroachments or trespass" on "rights-of-way" that would inhibit the facility's efficient operation, requires a reserve supply of materials for a flood emergency, requires that the USACE District Engineer must retain access at all times to all portions of the facility, and requires that the local sponsor submit a semiannual report to the District Engineer "covering inspection, maintenance, and operation of the protective works."[561]

The regulations also mandate "prior determination," or authorization, by USACE for any "improvement, excavation, construction, or alteration" of the project, or "any change . . . in any feature of the works."[562] USACE must first review the proposed change, improvement, excavation, construction or alteration to ensure that it will "not adversely affect the functioning of the protective facilities."[563] Further, the USACE will only authorize proposed changes that are "in accordance with standard engineering practice."[564] This suggests that local levee sponsors may be required to meet possible vegetation guidelines in the standards set forth in other USACE EMs, ECs, and ETLs.

The regulations also require periodic inspections (immediately before and following the flood season, not exceeding 90 days) to guarantee:

(i) no "sloughing" or loss of grade on the levee cross section has occurred;
(ii) no caving has occurred that might affect levee stability;
(iii) no seepage, saturated areas, or sand boils have occurred;
(iv) toe drainage systems and pressure relief wells are working effectively;
(v) drains are in good working condition;
(vi) no riprap or revetment work has been displaced;

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560 *Id.* § (a)(2).
561 *Id.* §§ (a)(6)–(7).
562 *Id.* § (a)(5).
563 *Id.*
564 *Id.*

(vii) no actions "such as burning grass and weeds during inappropriate seasons" are being undertaken, "which will retard or destroy the growth of sod;"
(viii) access roads are properly maintained;
(ix) cattle guards and gates are working effectively;
(x) levee crown and roadway are well shaped and maintained;
(xi) there is no unauthorized grazing or vehicular traffic; and (xii) there are no encroachments that might affect levee functioning during an emergency.[565]

Further, levee operation requirements specify that during flood periods, the levee shall "be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope." This is an effort to ensure there has been no sloughing, wave wash or scouring, no levee sections have been overtopped, and no other conditions exist that might endanger the levee.[566] Thus, the regulations set out in 33 C.F.R. § 208.10 establish strong safety standards that local sponsors must meet in operating and maintaining flood management systems. USACE technically relinquishes all O&M duties to the local sponsor. However, USACE's involvement in approving local sponsor O&M methodology, regular USACE inspections, and rules that sponsors must meet, show that USACE retains some O&M decision-making authority.

For levee maintenance specifically, the regulations require regular maintenance at a level that will "insure serviceability of structures in time of flood."[567] The levee maintenance regulations also state:

> Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees.[568]

On August 2, 1949, the O&M regulations were updated with the inclusion of a "Vegetation variance letter." This allowed, "brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash."[569]

The O&M policies encourage the planting of certain types of woody vegetation (willows and other suitable growth) to promote levee safety. However, these same policies also require local sponsors to maintain levees in

565 *Id.* § (b)(1)(i)–(b)(1)(xii).
566 *Id.* § (b)(2).
567 *Id.* § (b)(1).
568 *Id.*
569 CVFPP, *supra* note 5, at 3-25.

accordance with standard engineering practices. That suggests required compliance with the ETL, which would prohibit woody vegetation on levees. This contradiction and can place conflicting mandates on local levee sponsors.

2. Sacramento River Levee Operation and Maintenance Manual

While 33 Code of Federal Regulations section 208.10 provides regulations on the operations and maintenance (O&M) for levees nationwide, two manuals specific to the Central Valley provide O&M guidance for California levees. The Sacramento River Flood Control Project has a manual entitled, "Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project" released by the USACE in May, 1955.[570]

This manual covers areas on the Sacramento River "and the lower reaches of its principal tributaries in north-central California."[571] This includes areas "from Ord Bend downstream to Collinsville near the mouth of the river, a distance of 184 miles."[572]

The Sacramento River Flood Control Project provides for general improvements to flood control works and levees in the above area. More specifically, the Project

> provides for the enlargement of the Sacramento River channel below the mouth of Cache Slough (about 20 river miles upstream from Suisun Bay); for making two cutoffs between the mouth of the Feather River and Colusa; for the construction of four bypass weirs and the reconstruction of Tisdale Weir; for construction of outfall gates at the mouth of Butte Slough and at Knights Landing; for levees along certain reaches of the main river and tributaries; for drainage pumping plants on the east side of the Sutter Bypass; for bank protection work and levee set-backs on the main river and tributaries from Ord Bend to Collinsville; for maintenance of the enlarged river channel below Cache Slough during construction, including revetment of the banks of the cut; and for maintenance and operation of gaging stations on navigable rivers and streams during the construction period. The project also includes channel clearing, rectification, snagging, and bank protection along the Sacramento River and tributaries in Tehama County and from Red Bluth southerly.[573]

The Maintenance Manual covers the general rules and procedures for O&M of flood control works that are part of the Sacramento River Flood Control Project. It establishes the State of California as the "responsible local agency"

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[570] U.S. ARMY CORPS OF ENG'RS, SACRAMENTO RIVER FLOOD CONTROL PROJECT, *supra* note 10.

[571] *Id.* ¶ 1-03.

[572] *Id.*

[573] *Id.*

for operating and maintaining flood control works in the Project.[574]

Much of the manual is duplicative of 33 C.F.R. § 208.10 requirements, but it also contains suggestions for complying with 33 C.F.R. § 208.10 requirements. One such suggestion is how the "Superintendent," the head of the designated committee charged with operating and maintaining the system, should train personnel. Other suggestions include recommendations for submitting proposals to USACE for proposed improvements or alterations, submitting the semi-annual report, coordinating with private facilities, safety requirements for patrolling levees, stream flow stage requirements, specific timeframes that periodic inspections must be completed by, inspection checklists, and diagram specification suggestions.[575]

The manual also provides specific methods to be used to repair or reconstruct portions of the levee that have been damaged.[576] In addition, it provides methods for filling dens and runways from burrowing animals, and maintenance for access roads.[577]

In addition to specific suggestions regarding 33 C.F.R. § 208.10, the Manual provides specific information on levee vegetation. 4-05(b), "Care of Vegetation on Levee" provides protocols for the Sacramento River Flood Control Project. In the case of contradictory information, 4-05(b) supersedes the 33 C.F.R. § 208.10 regulations.[578]

Due to site-specific conditions on the Sacramento River Flood Control Project, the manual deems growth of sod on levee slopes impracticable.[579] Further, "brush, trees, and other wild growth" shall be cleared from the levee crown and slopes, but "brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash."[580] The manual also encourages burning of "weeds, grasses, and debris" on the levee "during appropriate seasons" to detect "cracks, holes, burrows, slips, and other damage" and to detect and kill burrowing animals. Finally, the manual encourages mowing of grass and weeds on levee slopes where burning is "dangerous or impracticable" or would "constitute a hazard."[581]

Hence, the manual governing O&M of levees on the Sacramento River Flood Control Project discourages the use of sod, but encourages planting brush and small trees on the waterside slope of the levee to increase the safety and

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574 *Id.* at ¶ 2-01.

575 *Id.* at ¶¶ 3-04–3-11.

576 *Id.* at ¶ 4-05(c).

577 *Id.*

578 *Id*. at ¶ 4-05(b)–(e) (stating that ". . . the following special instructions are furnished in lieu of paragraph 4-02(b)(vii) of the prescribed general regulations").

579 *Id.* at ¶ 4-05(b).

580 *Id*. at ¶ 4-05(b)(1).

581 *Id*. at ¶ 4-05(b)(2).

functionality of the levee. The manual also encourages burning "weeds, grasses, and debris" during appropriate seasons and clearing of "brush, trees and other wild growth." This acknowledges a distinction between woody vegetation that increases levee safety, as opposed to that which decreases levee safety. This suggests that in 1955, there was a recognition that woody vegetation in the Sacramento River Flood Control Project area should be treated on a case-by-case basis.

3. Lower San Joaquin River Levee Operations and Maintenance Manual

The manual for the San Joaquin River is entitled, "Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California" (SJR O&M Manual) and was released by the USACE in April 1959.[582]

The Lower San Joaquin River Levees Project includes areas about 80 miles upstream from the junction of the San Joaquin River with the Stockton Deep Water Channel, to the mouth of the Merced River in Merced County. It includes "distributaries of the San Joaquin River in the Upper Delta, i.e., lower reaches of the Stanislaus and Tuolomne River within backwater limits of the San Joaquin River."[583] In general, the Project regulates, "construction or reconstruction of levees, channel improvement and the provision for bank protection along the Lower San Joaquin River from the mouth of the Merced River to the Delta."[584]

Like the O&M manual for the Sacramento River Flood Control Project, the manual for the SJR O&M Manual builds off the requirements for 33 C.F.R. § 208.10, providing specific suggestions relative to the San Joaquin River. Just as with the Sacramento Project, this includes supplemental guidelines and suggestions for the "Superintendent," hiring and training personnel, submission requirements for proposed improvements or alterations, submission requirements for a semi-annual report, coordination suggestions with private entities, safety requirements, stream flow stage requirements, timeframes specific to San Joaquin for periodic inspections, inspection checklists, and suggestions for O&M diagrams.[585]

For levee maintenance specifically, the manual reinforces the terms of 33 C.F.R. § 208.10, and provides a suggested checklist for reporting inspections of the levee.[586] It provides specific instructions regarding revetment work for the San Joaquin River systems much of the levee system in this area was

[582] U.S. ARMY CORPS OF ENG'RS, LOWER SAN JOAQUIN RIVER AND TRIBUTARIES PROJECT, *supra* note 10, at 13.

[583] ETL 1110-2-583, *supra* note 1, at 1-03.

[584] *Id.*

[585] *Id.* at ¶¶ 3-01–3-11.

[586] *Id.* at ¶¶ 4-02–4-03.

constructed "with stone protection work consisting of quarry stone or cobbles."[587] This includes filling portions of damaged levees with earth, and stone placed on top of the earth.[588]

The manual also provides specific site-by-site directives regarding vegetation management in Section 4-05(b), "Care of Vegetation on Levees." These are identical to those found in the Sacramento River Flood Control System manual. Certain types of woody vegetation are encouraged on waterside levee slopes in the San Joaquin River system to protect levee stability, while other types are discouraged in order to increase the effectiveness of visual inspections and exterminate rodents and other burrowing animals.[589] This also reflects a case-specific, flexible approach to levee vegetation management in the Central Valley.

H. System-Wide Improvement Framework (SWIF)

The System-Wide Improvement Framework policy was released by USACE in 2011. It intends to maintain local levee sponsor's eligibility for federal programs, regardless of conformity with all USACE levee requirements. SWIF policy requires local levee sponsors to submit a plan for future compliance with all USACE requirements.[590] If USACE accepts the plan, the local sponsor will maintain eligibility for federal programs while it works to bring the levee system into full compliance. It follows a "worst first" approach, and establishes guidelines for local sponsors to fix the most dangerous threats to the levee's integrity first, followed later by less immediate threats.[591]

The USACE, established the policy for development and implementation of a SWIF in a memorandum released on November 29, 2011. It declares that SWIF should be used to address major deficiencies that cannot be accomplished through routine corrective actions.[592] Examples provided include: engineering deficiencies, improvements involving multiple levee systems, Tribal considerations, and "complex natural resource considerations that require additional time and coordination to ensure that the imperatives of both levee safety and environmental requirements are adequately served."[593] Complex natural resource considerations include issues related to woody vegetation on levees. As such, the SWIF process is a possible avenue for local levee sponsors to maintain compliance with federal permits and permissions while deferring levee vegetation compliance issues, just like Section 408, 33 C.F.R. § 208.10

587 *Id.* at ¶ 4-05(a).
588 *Id.* at ¶ 4-05(a)(1).
589 *Id.* at ¶ 4-05(b).
590 U.S. ARMY CORPS OF ENG'RS, *supra* note 75, at 2(c).
591 *Id.* at 3(c).
592 *Id.* at 3.
593 *Id.*

and PL 84-99.

The SWIF guidelines require compliance with environmental laws and hold USACE responsible for "assuring compliance with all applicable environmental requirements before it makes any decisions that would affect the environment or other resources."[594]

Under the PL 84-99 program, federally-authorized, locally-operated and maintained levee systems are automatically placed in "Active" status upon construction completion, making the system eligible for rehabilitation assistance. Nonfederal levee systems constructed, operated and maintained by local entities may be placed on "Active" status after an initial USACE eligibility inspection, where USACE determines the levee system meets the minimum eligibility requirements and technical criteria.[595] Levees are continuously inspected "against nationally consistent standards that USACE determined are essential for the reliable performance of the levee system."[596]

Following inspections, levee systems are rated as "Acceptable," "Minimally Acceptable," or "Unacceptable." Levee systems that receive "Acceptable" or "Minimally Acceptable" inspection ratings maintain an "Active" status under the PL 84-99 program, and thus are eligible for rehabilitation assistance. Levee systems that receive an "Unacceptable" inspection rating are immediately placed in "Inactive" status, and are not eligible for rehabilitation assistance.[597]

Levee sponsors with an existing vegetation variance (through the PGL) and a current "Active" status in the PL 84-99 program can use the SWIF process "to transition to a new vegetation inspection standard," while maintaining PL 84-99 "Active" status.[598] After developing a SWIF in coordination with USACE, the sponsors must meet the milestones set forth in their SWIF to maintain their "Active" status.

Levee sponsors with a current "Unacceptable" rating, or that have an "Inactive" status in the PL 84-99 program may use the SWIF process to regain PL 84-99 eligibility.[599] Levee sponsors who have never been eligible for PL 84-99 assistance cannot gain eligibility through the SWIF process.[600]

Development of a SWIF comprises first of submittal of a "Letter of Intent" from the sponsor, describing levee deficiencies and a plan for how the SWIF approach will reduce flood risk. USACE must approve of the sponsor's letter.[601] The requirements for a Letter of Intent are quite long, including demonstration

[594] *Id.*
[595] *Id.* at 4.
[596] *Id.* at 4.
[597] *Id.*
[598] *Id.* at 5.
[599] *Id.*
[600] *Id.*
[601] *Id.*

of adequate non-federal funding, compliance with other environmental laws, ranking of deficiencies with tabulations and categories for each levee segment, public outreach regarding risk, and many others.[602] Once the Letter of Intent has been approved by the USACE, the levee sponsor has up to two years to develop the actual SWIF plan for addressing deficiencies and reducing flood risk.[603] After that, continued eligibility is determined by milestones set forth in the SWIF. The SWIF plan itself includes specific milestones to guide the sponsor's overall progress in reducing flood risk.[604]

The 2011 USACE Memo also establishes detailed requirements. These are for the submittal of the Letter of Intent and the SWIF itself, the process for USACE approval, and the process for reporting and continued eligibility under PL 84-99.[605]

The SWIF process may be used in conjunction with a vegetation variance obtained pursuant to the PGL. According to the 2011 USACE Memo, "The SWIF offers an interagency approach to identify regional solutions and tools that may be useful in development of a vegetation variance request. The end result of a SWIF process will be levees that meet the USACE inspection standards, which may also include an approved vegetation variance."[606]

In other words, the SWIF does not in itself create an exemption from the ETL's vegetation-free zone requirement. However, the SWIF can be used in conjunction with a vegetation variance obtained via PGL requirements if the levee sponsor already has a vegetation variance. Overall, the SWIF's guidelines are not less stringent and the sponsor must still meet all USACE requirements, including those from the ETL. However, the SWIF provides the levee sponsor more time to comply with these requirements, and places the most pressing, non-vegetation related, problems first.

Finally, a SWIF can be used to obtain a "federal nexus" for a nonfederal levee sponsor. If a state or local levee sponsor has successfully developed a SWIF approved by USACE, USACE has engaged in a "federal action," under Section 7 of the Endangered Species Act (ESA).[607] Section 7 consultation can provide coverage for incidental "take" under the ESA, safeguarding the local levee sponsors from liability. This is the primary impetus for preliminary discussions on SWIF development in California undertaken by FWS. More on how a SWIF can be used to provide a "federal nexus" is discussed above in *Part IV: Solutions*.

602 *Id.*
603 *Id.*
604 *Id.*
605 *Id.*
606 *Id.* at 8.
607 16 U.S.C. § 1536(2) (1988).

I. WRRDA 2014

The Water Resources Reform and Development Act of 2014 (WRRDA 2014) is an extensive law governing many aspects of waterway and floodplain maintenance. Section 3013 of WRRDA 2014, "Vegetation Management Policy," directs USACE to "carry out a comprehensive review of guidelines in order to determine whether current federal policy relating to levee vegetation is appropriate for all regions in the United States."[608] In other words, the guidelines' current vegetation policy must be appropriate uniformly throughout the United States. In determining this, USACE is specifically directed to review the ETL and PGL.[609]

USACE is directed by WRRDA 2014 to consider specific factors in this review. These factors include: (i) varied interests and responsibilities in managing flood risk, (ii) including public safety and environmental impacts; (iii) the levee safety benefits that can be provided by woody vegetation; (iv) preservation of natural resources, including habitat benefits provided by woody vegetation on levees and impacts of removing large amounts of woody vegetation; rights of Indian tribes; (v) determining vegetation impacts on a levee system during a storm or flood event; (vi) available science and the historical record of levee vegetation and flood risk; avoiding actions that add significant economic or environmental cost; (vii) and other factors that may be deemed appropriate.[610] Therefore, Section 3013 of WRRDA 2014 directs USACE to take into account regional variation, the potential benefits vegetation may offer in terms of levee safety, the environmental benefits that woody vegetation provides to critical habitat, and potential dangers and costs associated with removing woody vegetation on levee systems.

Section 3013 of WRRDA 2014 also provides factors for consideration in review of the vegetation variance policy set out in the PGL. These include (i) regional or watershed conditions, hydrologic factors, vegetation patterns and characteristics, environmental resources (including endangered and threatened species habitat); (ii) levee performance history; (iii) effects on water supply; (iv) scientific evidence on the link between levee vegetation and levee safety; (v) institutional considerations (including conflicts with State and federal laws); (vi) availability of limited funds for levee construction and rehabilitation; economic and environmental cost of removing vegetation on levees; and (vii) other relevant factors that may be deemed appropriate.[611] Thus, WRRDA 2014 requires USACE to revisit their variance policy in a flexible manner. In doing so, USACE must consider site-specific conditions, benefits vegetation can

608 Water Resources Reform and Development Act § 3013(b).

609 *Id.* § (a)(1)–(2).

610 *Id.* § 3013(c)(1)(A)–(H).

611 *Id.* § 3013 (c)(2)(A)(i)–(xi).

provide to levee safety and environmental resources, potential conflicts with state law and other federal laws, and the associated environmental and financial cost of removing existing vegetation.

Section 3013 of WRRDA 2014 also directs USACE to consult with appropriate representatives from state and federal agencies, local and tribal governments, nongovernmental organizations, and the general public in developing the new policies.[612] Additionally, USACE must consult with independent experts on engineering, environmental, and institutional considerations, and to make the views of independent experts available to the public.[613]

WRRDA 2014 gave USACE eighteen-months to revise the ETL and PGL, followed by a thirty-day public comment period and submittal to Congress.[614] The revised guidelines must also include recommendations received as part of the public participation and consultation requirements.[615]

The revised ETL and PGL are must "provide a practical, flexible process for approving statewide, tribal, regional, or watershed variances from the guidelines" that incorporate regional considerations and "state, tribal, and regional vegetation management guidelines."[616] Hence, USACE must provide a more flexible process for obtaining a vegetation variance on levees, and must also consider state policies on levee vegetation in reissuing the PGL and ETL, pursuant to Section 3013 of WRRDA 2014.

Section 3013 of WRRDA 2014 further provides interim actions and consequences if USACE fails to meet the eighteen-month deadline. Note that at the time of this paper, the deadline has passed and USACE has failed to revisit the ETL and PGL guidelines, as mandated by WRRDA 2014.

Section 3013 instructs the USACE to submit a report to Congress that includes why the deadline was missed, solutions needed to meet the deadline, and a projected date for the submission of the report if it fails to submit a report by the required deadline.[617] Recent inquiries indicate that this report has not been submitted, to date. Furthermore, until such date as USACE revises their guidelines, USACE, " . . . shall not require the removal of existing vegetation as a condition or requirement for any approval or funding of a project, or any other action, unless the specific vegetation has been demonstrated to present an unacceptable safety risk."[618]

Therefore, pursuant to congressionally authorized law, USACE is precluded

612 *Id.* § 3013 (d)(1)–(2).
613 *Id.* § 3013 (e).
614 *Id.* § 3013 (f)(1)(A)–(B).
615 *Id.* § 3013 (f)(1)(A)(ii).
616 *Id.* § 3013 (f)(2)(A).
617 *Id.* § 3013 (f)(3).
618 *Id.* § 3013(g)(1).

from enforcing the vegetation-free policy presented in the ETL. USACE may not require vegetation removal by any levee sponsor to obtain other federal approvals or funding, including eligibility under the PL 84-99 program. USACE may only require vegetation removal from a levee sponsor if they can demonstrate that the vegetation in question poses an unacceptable safety risk to the levee.

The legislative history of the provisions in WRRDA 2014, Section 3013 is also germane to this discussion. The congressional record demonstrates that Section 3013 of WRRDA 2014 was not included in the legislation lightly, but after significant thought and consideration and concern over vegetation-removal mandates.[619]

For example, Congresswoman Napolitano voiced strong support for WRRDA 2014, section 3013, stating, "It changes levee vegetation policy [by considering factors] not previously taken into account, [including] local characteristics, habitats, [and] safety."[620] Congresswoman Napolitano further clarified her support of the law, stating, "I ask unanimous consent to revise and extend my remarks in clarifying that section 3013 of WRRDA will require the corps to perform a new review and revision of levee vegetation policy engineering technical letters."[621] This stresses the congressional intent upon passing WRRDA 2014 that USACE revisit and reissue the ETL's vegetation-free policy.

Congresswoman Napolitano described a brief history of the ETL. She conveyed that most DWR and local flood control districts strongly agree with a characterization of the ETL's vegetation-free requirements, "as not taking into account local characteristics and good science."[622] Congresswoman Napolitano further described the ways that strict conformance with the ETL would damage California, including that it would (1) lead to overall weaker levee systems, (2) displace ESA habitat, (3) fail to include local geologic characteristics, and (4) unnecessarily divert limited funds.[623] She held up Section 3013 of WRRDA 2014 as a tool to solve these problems by requiring USACE to reissue levee vegetation policies "and incorporate regional characteristics, habitat for species of concern, and levee performance."[624] Congressman Matsui echoed the Congresswoman's support of WRRDA 2014, Section 3013, encouraging the condition that "[USACE] shift . . . its one-size-fits-all approach to now consider regional variances to the national levee vegetation policy."[625]

The congressional record further clarifies that ETL 1110-2-583, released

619 160 CONG. REC. H4490 (daily ed. May 20, 2014).

620 *Id.*

621 *Id.*

622 *Id.*

623 *Id.*

624 *Id.*

625 *Id.* at 4493.

shortly after ETL 1110-2-571, does not satisfy the requirements of WRRDA 2014, Section 3013. As described below by Congresswoman Napolitano,

> I would like to clarify for the record the intent of Congress that the Corps' new ETL 1110-2-583 does not satisfy the requirement of Section 3013. Section 3013 requires the Corps to revise its levee vegetation guidelines after performing a comprehensive review taking into account all regions of the United States and their unique habitats and levee structures.[626]

Therefore, the congressional record clearly states Section 3013 was strategically placed in WRRDA 2014 to combat the perceived dangers of the USACE vegetation-free policy. ETL 1110-2-583 had not yet satisfied Section 3013's strong requirements.

A report from the United States Government Accountability Office (GAO) to Congressional Committees entitled, *Levee Safety: Army Corps and FEMA Have Made Little Progress in Carrying Out Required Activities* concluded that little progress had been made in most requirements set forth under WRRDA 2014.

Activity	Implementation status	Statutory deadline	Agency responsible
Reconvene the national committee on levee safety	No action	None	Corps
Continue to develop national levee inventory	Ongoing	None	Corps
Implement multifaceted levee safety initiative			
Develop voluntary national levee-safety guidelines	No action	June 10, 2015	Corps and FEMA
Establish a hazard potential classification system	No action	None	Corps
Provide technical assistance and training	No action	None	Corps and FEMA
Provide public education and promote awareness	No action	None	Corps and FEMA
Issue guidelines that establish minimum components for state and tribal levee-safety program	No action	June 10, 2015	Corps and FEMA
Provide assistance for a state and tribal levee-safety program	No action	None	FEMA
Develop guidelines for preparation of floodplain management plans under the levee assistance programs	No action	Dec. 7, 2014	Corps and FEMA
Provide assistance for a levee rehabilitation assistance program	No action	None	Corps
Submit report on the state of U.S. levees, the effectiveness of the levee safety initiative, and any necessary congressional actions	No action	June 10, 2015, and biennially thereafter	Corps
Submit report, including recommendations, on advisability and feasibility of a joint dam and levee safety program	No action	June 10, 2017	Corps and FEMA
Submit report including recommendations that identify and address legal liabilities of engineering levee projects	No action	June 10, 2015	Corps

GAO Analysis of Corps and Federal Emergency Management Agency (FEMA) information; GAO 16-709 (July 2016).

On March 21, 2014, to attempt to come into compliance with interim requirements from WRRDA 2014, USACE issued a guidance to local levee districts in the Memorandum: Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for Rehabilitation Program Pursuant to Public Law (PL) 84-99. The new interim guidance does not automatically

626 *Id.* at 4491.

disqualify a levee district from PL 84-99 eligibility for simply having levee vegetation present. Instead, the guidance described "interim eligibility criteria" to be used to determine eligibility for rehabilitation assistance under PL 84-99 "until final policy is issued."[627] Rating criteria still evaluate levees as safer when they contain "little or no unwanted vegetation" on the "mandatory" root-free zone in the levee profile.[628] However, the policy also states that, "vegetation management will not be considered in making an eligibility determination."[629] In other words, vegetation is still assessed in the eligibility assessment process, but compliance with vegetation removal requirements will not dictate the final determination as to whether or not the levee is eligible for the PL 84-99 program.

The interim guidance specifically states:

> Eligibility for rehabilitation assistance will be determined pursuant to paragraphs 5 and 6 of this interim policy, which specifies that only a subset of the criteria previously used to determine eligibility will continue to be used to make eligibility determinations during the interim period. Note: vegetation management will not be considered in making an eligibility determination. A final policy will be established through notice and comment rulemaking. Any eligibility criteria eliminated by this interim policy will be restored, if at all, only through a public rulemaking process.[630]

Although the language in WRRDA 2014 is quite clear, its implementation has been anything but. Local levee sponsors in California still feel as though vegetation removal is the current policy and vegetation-free zones are the status quo, despite the above guidance clarifying that vegetation compliance may not be used as a determining factor for PL 84-99 eligibility.[631] This may be because vegetation removal is still articulated as a "mandatory" under the guidance. Further, when levee sponsors push back on the USACE requirements to remove vegetation, they are often confronted with the assertion that all levee vegetation poses an "unacceptable threat" by the nature of its existence and location on the levee prism. Therefore, even though USACE has promulgated interim guidelines in an attempt to conform to WRRDA 2014 requirements, these guidelines do not practically address the mandates of WRRDA 2014 Section 3013. This is because the vegetation guidelines set forth in the ETL have not been reissued and re-written in a flexible manner that takes multi-benefit

627 U.S. ARMY CORPS OF ENG'RS, *supra* note 114, at 2.

628 *Id.*

629 *Id*.

630 *Id.*

631 This statement is based on the author's conversations with local levee sponsors and is offered as anecdotal support.

ecosystem-wide effects into consideration. More on unintended consequences of WRRDA 2014, Section 3013's "unacceptable threat" provision is discussed in *Part II: Problems Associated with Vegetation Removal Requirements*.

J. Endangered Species Act (ESA) Considerations

The Endangered Species Act (ESA) protects plant and animal species from extinction by designating species as "endangered" or "threatened," (taken together, endangered and threatened species are also referred to as "listed" species), establishing critical habitat for listed species, and prohibiting "take," or adverse modification of designated critical habitat. To "take" for ESA purposes means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[632]

For purposes of levee vegetation, the most pertinent section of the ESA is Section 7, which governs actions of federal agencies. Three other sections may also be applicable to levee vegetation issues: Section 2, Section 9 and Section 10. Section 2 establishes Congressional findings and ethical justifications for the ESA.[633] Section 9 prohibits against take from all individuals, including private individuals and public entities.[634] Section 10 provides exceptions to the ESA.[635]

1. Section 2

Section 2 of the ESA establishes the purpose of the act: to preserve ecosystems of endangered and threatened species, to provide listed species with conservation programs, and to engage in international acts and agreements to facilitate conservation. Section 2 includes the provision:

> It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this chapter. . . It is further declared to be the policy of Congress that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species.[636]

This shows the higher standard that federal agencies are held to in terms of conserving species. It also shows that federal directives are not limited to Section 7 of the ESA. Rather, every action a federal agency takes must further the conservation of listed species.

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632 16 U.S.C. § 1532 (1973).

633 *Id.* § 1531.

634 *Id.* § 1538.

635 *Id.* § 1539.

636 *Id.* § 1531(c).

In Section 2, Congress foresaw potential conflict in terms of conserving endangered species and allocating limited water resources. Accordingly, Congress provided that federal agencies should cooperate to resolve these water resource issues with ESA conservation goals in mind. Levee maintenance is closely linked to water allocation, as levees contain and channel the State's water. However, for the purposes of vegetation management, water resource allocation will not be discussed here. Even though Congress could not foresee every possible conflict, they established a precedent by stating that the most controversial of topics must still be handled with the conservation of listed species as a topmost priority. Levee vegetation issues are very similar to water resource allocation issues in that they are controversial and polarizing. Thus, in the context of levee vegetation, the spirit and terms of ESA similarly direct all federal agencies to handle levee vegetation with conservation of listed species as a priority.

2. Section 7

Section 7 of the ESA describes duties specific to federal agencies. Of these duties, all federal agencies are directed to utilize their authorities to conserve listed threatened and endangered species.[637] Federal agencies are also directed to engage in interagency cooperation when the federal agency undertakes any action that might take a listed species or adversely modify its critical habitat. In this situation, the federal agency must consult with the appropriate consultation agency. The consultation agency is either the United States Fish and Wildlife Service (FWS), or National Oceanic and Atmospheric Administration (NOAA) Fisheries National Marine Fisheries Service (NMFS). NMFS' jurisdiction extends to anadromous fish species, whose critical habitat in California overlaps almost completely with California's levee system.[638] Therefore, this paper will focus on NMFS jurisdiction, as it is the most pertinent to the levee vegetation discussion.

California's levee system contains approximately the last three to five percent of riparian forest that was once prevalent along Central Valley river corridors.[639] Riparian forest containing woody vegetation on levees is now designated critical habitat for listed species, and essential for their continued existence.[640] Due to

[637] *Id.* § 1536(a)(1).

[638] Interview with H. Brown, *supra* note 58; *see also* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4, at 20 ("Critical habitat for listed salmonids is comprised of physical and biological features essential to the conservation of the species including…. riparian habitat that provides for successful juvenile development and survival.").

[639] Edwin F. Katihab, Associate Specialist, Dep't of Forestry and Resource Mgmt. U.C., Paper Presented at the California Riparian Systems Conference (University of California, Davis, Sept. 17–19, 1981): A Brief History of Riparian Forests in the Central Valley of California (Sept. 17–19, 1981).

[640] NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4.

the existing location and close alignment of Central Valley levees, the levees essentially form the riverbank and provide hundreds of miles of fish habitat.[641] Therefore, California's Central Valley levees serve two purposes: public safety, and designated critical habitat for listed threatened and endangered species. Any federal guidelines that promote or require the removal of such critical habitat are problematic and may violate the terms of the ESA. As such, NMFS has historically supported and continues to support policies that encourage USACE to reexamine vegetation-free requirements.

The consultation requirement of ESA Section 7 obliges any federal action agency to consult with NMFS and/or FWS prior to engaging in an action that may result in the take of a listed species or the adverse modification of its remaining critical habitat.[642] Accordingly, whenever a federal agency wishes to modify a levee that also acts as designated critical habitat, they must first consult with NMFS and/or FWS to ensure the action does not jeopardize the continued existence of the listed species. If the action may jeopardize the continued existence of a listed species or adversely modify its critical habitat, the acting agency must undergo "formal" consultation with NMFS and/or FWS.

As FWS and/or NMFS undergoes a formal consultation with the action agency per Section 7 of the ESA, the consulting agency and action agency must agree if the action results in jeopardy. If the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, then the formal consultation is characterized as a "jeopardy biological opinion."[643] In a formal consultation, if the action is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, the result is a "no jeopardy" biological opinion.[644] In the case of a "jeopardy" biological opinion, the biological opinion (BiOp) must include reasonable and prudent alternatives (RPAs).[645] If the consulting agency is unable to develop RPAs, "it will indicate that to the best of its knowledge there are no [RPAs]."[646]

RPAs are identified during a formal consultation, and offer alternative actions consistent with the action's original purpose, that will avoid the likelihood of jeopardizing the continued existence of listed species or the destruction or adverse modification of designated critical habitat.[647] RPAs must also be economically and technologically feasible.[648] In formulating RPAs, the

641 *See id.* at 41, 63, 100.
642 16 U.S.C. § 1536(a)(2) (1973).
643 50 C.F.R. § 402.14(h)(3) (2017).
644 *Id.*
645 *Id.*
646 *Id.*
647 *Id.* § 402.02.
648 *Id.*

consulting agency must use the "best scientific and commercial data available" and "give appropriate consideration to any beneficial actions taken by the federal agency or applicant, including any actions taken prior to the initiation of consultation."[649]

For levees, RPAs could include modifications such as retaining or planting riparian woody vegetation. That could include shaded riverine aquatic (SRA) habitat which is critical for endangered fish survival. Conflicts emerge when these ESA recommendations violate USACE engineering specifications. These are discussed in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements*.

In addition to ensuring that individual federal actions will not jeopardize listed species or their habitat, NMFS also issued a Recovery Plan for endangered and threatened species in the Central Valley.[650] This Recovery Plan is meant to guide actions to lead towards the recovery of endangered Sacramento River winter-run Chinook salmon Evolutionary Significant Unit (ESU), the threatened Central Valley spring-run Chinook salmon ESU, and the threatened California Central Valley steelhead Distinct Population Segment (DPS). Recovery refers to a state where listed species and their ecosystems are restored and their future is safeguarded to a point where ESA protections are no longer needed.[651] The Recovery Strategy focuses on two main conservation principles: the need for providing sufficient habitat; and the need for adequate spatial structure, diversity, productivity, and abundance.[652] The Recovery Plan notes that habitat degradation has occurred due to many forces, including "construction of levees and barriers to migration, modification of natural hydrologic regimes by dams and water diversions, elevated water temperatures, and water pollution from agriculture and industry."[653]

Chapter 5 of the Recovery Plan identifies high priority threats and recovery. The recovery actions were scored 1-3 based on priority. A score of 1 connotes an action of the highest priority. The actions NMFS rated as a priority demonstrate that they hold the implementation of restoration vegetation and habitat in Central Valley levee systems as a priority The following actions were rated "1": "[d]evelop and implement State and National levee vegetation policies to maintain and restore riparian corridors" and , "[i]ncorporate ecosystem restoration including breaching and setting back levees into Central Valley flood control plans (i.e., FloodSAFE Strategic Plan and the Central Valley Flood Protection Plan)."[654] Further, NMFS biologists prioritize policies

649 *Id.* § 402.14(g)(8).

650 NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 4.

651 *Id.* at i.

652 *Id.* at ii.

653 *Id.* at i–ii.

654 *Id.* at 113.

that maintain and restore vegetation and riparian habitat on levees, recognizing their necessity to bring about the recovery of listed endangered and threatened fish.

3. Section 9

Section 9 of the ESA describes prohibited acts, and is applicable to all individuals and organizations, including private individuals. [655] It generally prohibits take, transfer or sale of listed species. As described above, the definition of take covers many actions, including the term "harm." Courts have expanded the definition of harm to include any "significant habitat modification or degradation that actually kills or injures wildlife."[656] Thus, private individuals are precluded from directly harming or killing a listed species or from adversely modifying listed species habitat in a way that results in harm to the species. This is significant in the context of levee vegetation. Levee maintainers may violate ESA Section 9 unknowingly while trying to comply with USACE vegetation-free requirements. Attempts to comply with USACE vegetation-free requirements often include removal of riparian vegetation. If a levee provides critical habitat to listed salmon (as much of the riparian vegetation on levees does), removal of riparian vegetation may significantly degrade critical species habitat, a violation of Section 9. Associated problems faced by LMAs with respect to Section 9 are covered in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements*.

4. Section 10

Section 10 outlines exceptions to the ESA, including requirements for Habitat Conservation Plans (HCPs).[657] An actor, including a private actor, may carry out an otherwise lawful activity that results in incidental take to the species if they obtain an "incidental take permit."[658] A private actor can only acquire an incidental take permit through an HCP.[659] An HCP plan must be approved by either USFWS or NMFS, depending on the species in question.[660] The HCP must specify the impact from the taking, plans for mitigation, possible alternative actions considered, and any other important factors.[661] USFWS and NMFS may approve the HCP if they find (i) the taking is incidental, (ii) all impacts of the take are minimized and mitigated by the applicant, (iii) adequate

655 16 U.S.C. § 1538 (1973).

656 Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or., 515 U.S. 687, 708 (1995).

657 16 U.S.C. § 1539 (1973).

658 *Id.* § 1539(a).

659 *Id.* § 1539(a)(2)(B).

660 *Id.* § 1539(a).

661 *Id.* § 1539(a)(2)(A)–(B).

funding is provided by the applicant, and (iv) the take will not reduce the likelihood of survival for the listed species.[662] HCPs are useful for private actors who would otherwise face bars against projects because they could potentially negatively impact a listed species or its habitat. Levee maintainers have the option to pursue an HCP to cover incidental takes associated with riparian habitat removal. This option is discussed in greater detail in *Part IV: Solutions*.

APPENDIX 2: CALIFORNIA STATE LAWS AND POLICIES

A. California Endangered Species Act

The California Endangered Species Act (CESA) largely mirrors its federal counterpart. CESA contains a similar consultation requirement to the federal ESA. The applicant may undertake the CESA consultation requirement in conjunction with a federal consultation if the action potentially affects both state and federally-listed species.[663] CESA also authorizes a consulting agency, here California Department of Fish and Wildlife or "CDFW," to issue incidental take permits for the take of a CESA-listed species.[664] CESA contains a similar provision to ESA Section 9, whereby privately acting individuals are prohibited from any act that will result in "take" of a state-listed species.[665] CESA defines "take" similarly to the federal ESA, however it does not include the terms to "harm" or "harass."[666] Because of this, some find that CESA does not define "take," to include adverse habitat modification as ESA does.[667] CESA also differs from ESA in that it allows more public comment during the petition listing process.[668] CESA is also considered stronger than the federal law in a few ways. For example, it protects candidate species, those in consideration for listing as threatened or endangered, and plants on private lands.[669] Overall, however, the federal ESA is considered by many to be stronger, in large part due to its interpretation and practice.[670]

CESA's consultation process is similar to its counterpart in ESA Section 7.

662 *Id.*

663 CAL. FISH & GAME CODE § 2081 (2018).

664 *Id.*

665 *Id.* § 2080.

666 *Id.* § 86.

667 Lynn E. Dwyer & Dennis D. Murphy, *Fulfilling the Promise: Reconsidering and Reforming the California Endangered Species Act*, 725 NAT. RESOURCES J. 740 (1995) (discussing the difference of interpretations of the definition of the word "take" in the California Endangered Species Act and the Endangered Species Act).

668 *Id.*

669 CAL. FISH & GAME CODE § 2081.

670 Dwyer & Murphy, *supra* note 667, at 742–43.

Under CESA, a state agency must consult with CDFW before it authorizes, funds, or carries out an action that may jeopardize the continued existence of a CESA-listed species, result in the take of a listed species, or result in the adverse modification of essential habitat.[671] Similar to the federal ESA, CESA consultations may be informal or formal. Formal consultations that result in a jeopardy conclusion must include reasonable and prudent alternatives (RPAs) to the action.[672] The RPAs must be incorporated into the project unless the project includes reasonable mitigation measures to minimize the its adverse impacts, or if cost-benefit analysis demonstrates that the project's benefits without the RPAs outweighs the RPAs.[673]

CESA also presents opportunities for public and private individuals to obtain incidental take permits when take may occur but is incidental to the project purpose.[674] Similarly to the federal ESA, CDFW can issue such a permit following the consultation process. Under CESA, permits can also be issued to individuals or institutions if proposed take is for "scientific, educational or management purposes."[675]

B. Responsibilities of DWR and CVFPB – Creation of 2012 CVFPP and description of SPFC

State responsibilities regarding flood management rest principally within the Central Valley Flood Protection Board (CVFPB) and California Department of Water Resources (DWR). Formed in 1911, the CVFPB (formerly known as The State Reclamation Board) is the California State agency charged with reducing flood risk to people and property within the California Central Valley.[676] In 1967, the legislature placed all Board activities under DWR, and the Board was left with essentially no staff. In 2007-2008, the Board was, in a sense, created again with the passage of the Central Valley Flood Protection Act of 2008 (commonly referred to as "SB 5") as the legislature provided funds for the CVFPB to hire a permanent staff.[677]SB 5legally designated the CVFPB as the official nonfederal sponsor for all California levees within the State Plan of Flood Control (SPFC).[678] It also directed DWR to prepare the 2012 Central

671 *Id.* at 746.

672 *Id.* at 747.

673 *Id.*

674 CAL. FISH & GAME CODE § 2081(b).

675 *Id.* § 2081(a); Dwyer & Murphy, *supra* note 667, at 747.

676 *Central Valley Flood Protection Board Enforcement Authority*, CENT. VALLEY FLOOD PROTECTION BD., http://cvfpb.ca.gov/enforcement/ (last visited August 18, 2016) ("The Board at all times shall enforce on behalf of the State the erection, maintenance and protection of such levees, embankments and channel rectification as will, in its judgment, best serve the interests of the state.").

677 CAL. WATER CODE §§ 9600, 9623 (2018).

678 *Id.* § 9602.

Valley Flood Protection Plan (CVFPP) for CVFPB adoption.[679] DWR released the 2012 CVFPP in December 2011 which was adopted by the CVFPB in June 2012.

CVFPB and DWR have special responsibilities for areas protected by the SPFC. This includes the portion of the Central Valley flood management system where the CVFPB or DWR has "provided assurances of nonfederal cooperation to the United States, and those facilities identified in [California Water Code] Section 8361."[680] The California Water Code specifies areas under the SPFC as: Sacramento River Flood Control Project areas;[681] Sacramento River and San Joaquin River Watershed Flood Control Project areas;[682] specific facilities identified in California Water Code Section 8361; and other areas "for which the board [CVFPB] and department [DWR] has provided the assurances of nonfederal cooperation to the United States."[683] Thus, by definition, levees and other flood control projects in the Central Valley are included in the SPFC. CVFPB and DWR are the designated nonfederal sponsors for these projects. A visual representation of SPFC levees is included below as a reference.

679 *Id.* § 9612.

680 *Id.* § 9110(f).

681 *Id.* § 9602.

682 *Id.*

683 *Id.* § 9110(f).

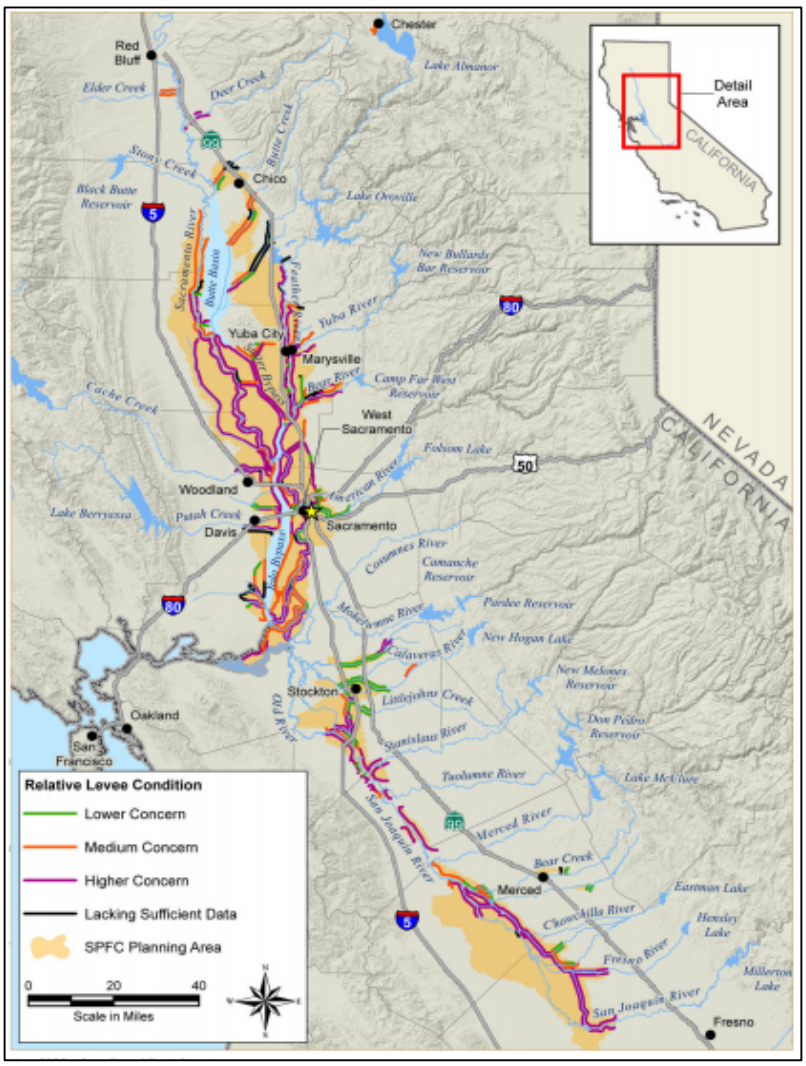

Figure 18: Summary of Physical Levee Conditions in SPFC[684]

[684] CVFPP, *supra* note 5, at 1-13.

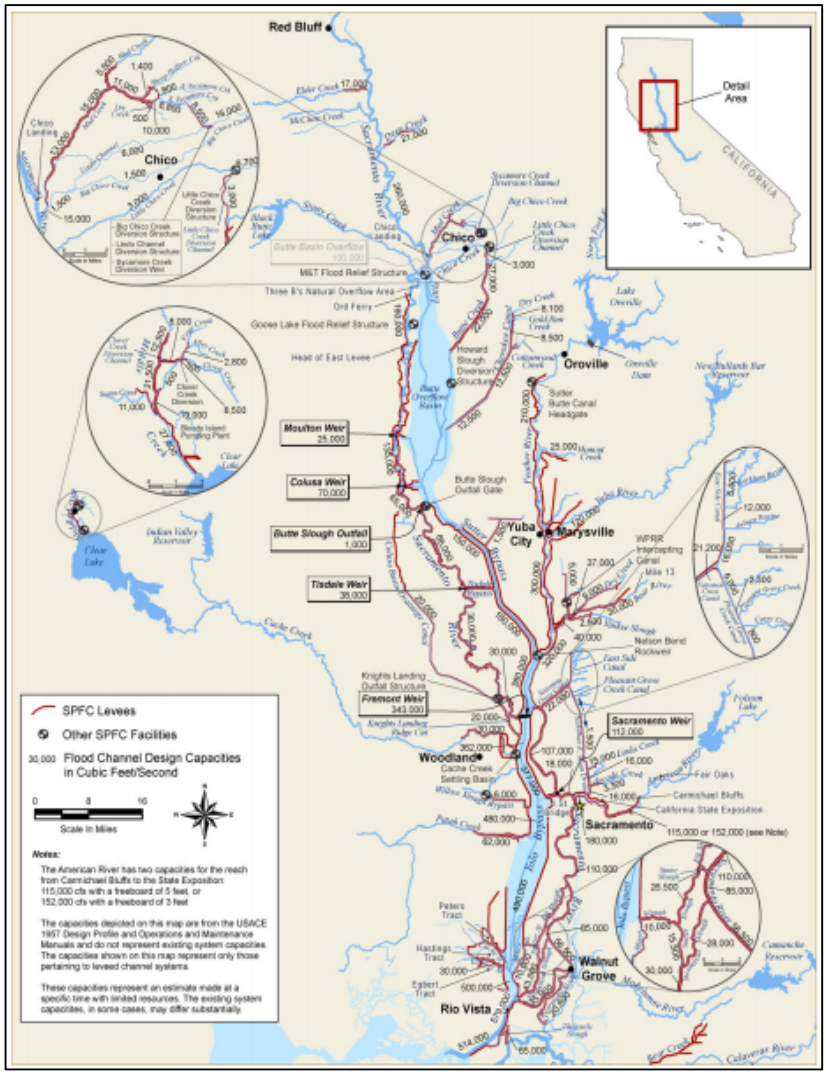

Figure 19: SPFC Facilities – Sacramento River Basin[685]

685 *Id.* at 1-8.

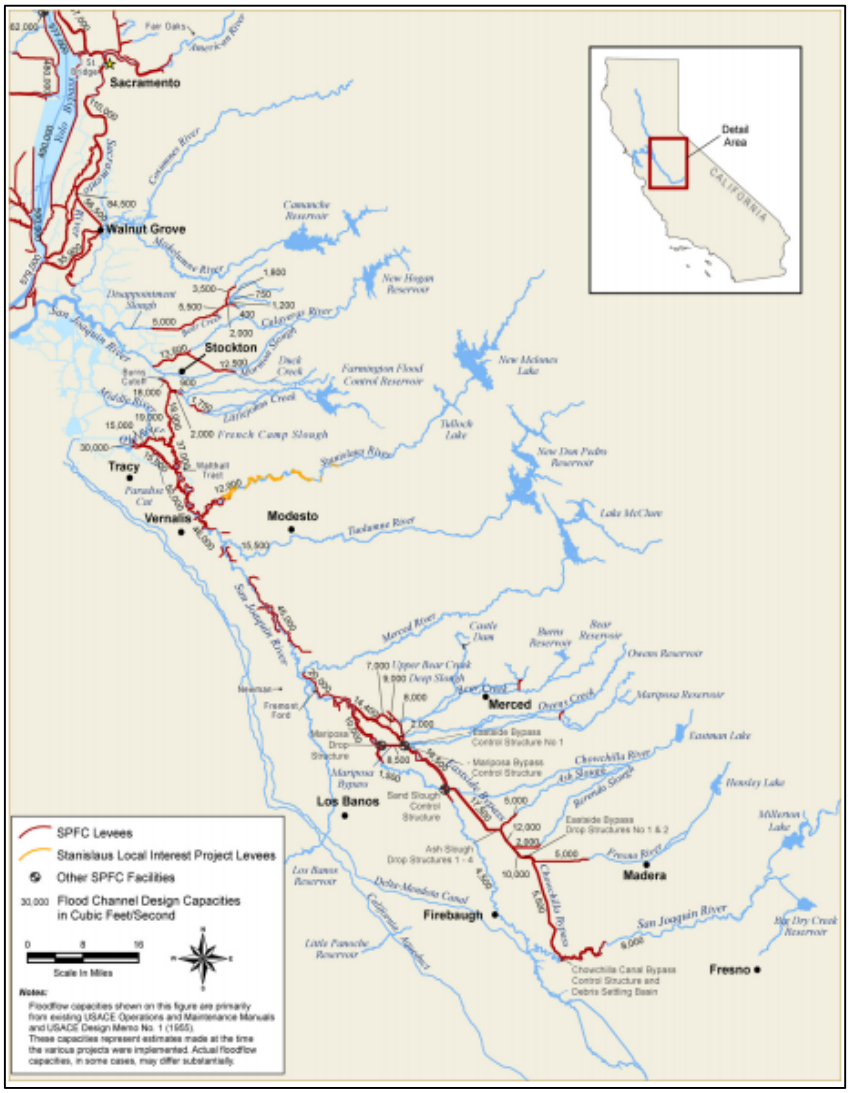

Figure 20: SPFC Facilities – San Joaquin River Basin[686]

686 *Id.* at 1-9.

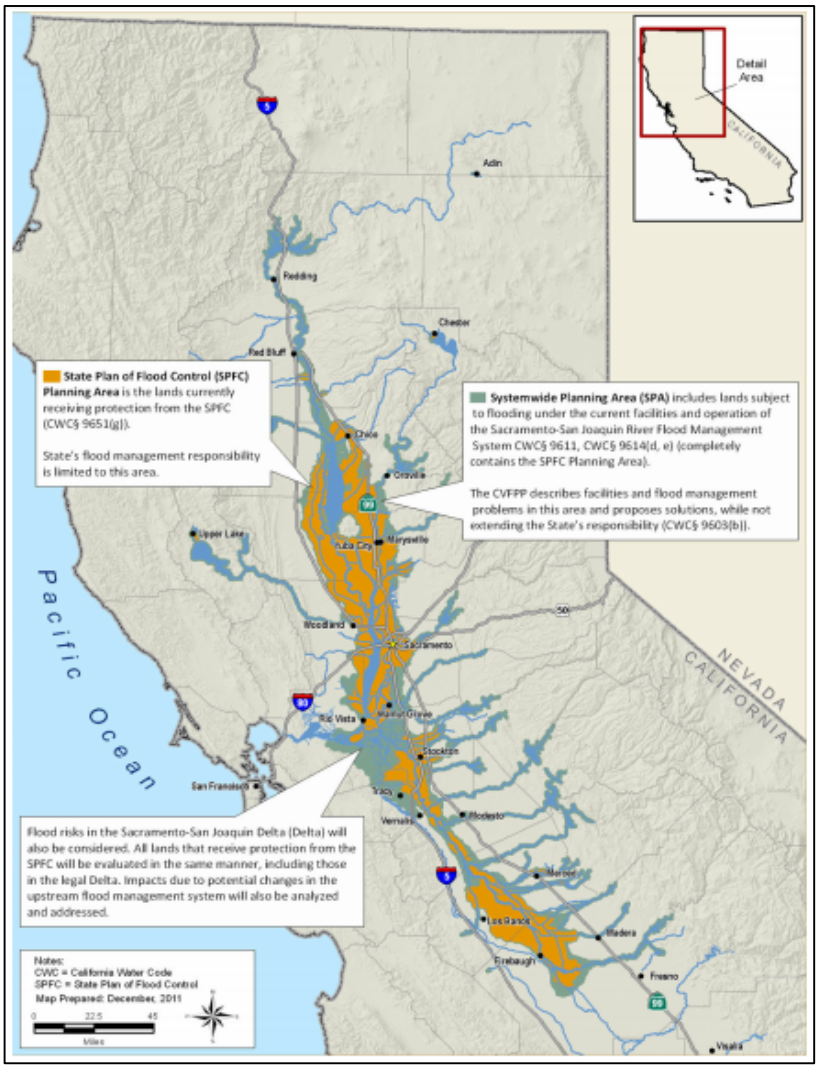

Figure 21: SPFC and SPA[687]

The Sacramento-San Joaquin River Flood Management System comprises all facilities of the SPFC and any levee or other flood management facility that, "does one or more of the following: (1) provides significant systemwide benefits for managing flood risks within the Sacramento-San Joaquin Valley; (2) Protects

687 *Id.* at 1-23.

urban areas within the Sacramento-San Joaquin Valley."[688] DWR may identify and propose facilities from the Sacramento-San Joaquin Flood Management System to be added to the SPFC. Following the DWR proposal, the CVFPB may add these facilities to the SPFC if they agree that the facilities accomplish the purposes identified above.[689]Following a proposal from DWR, the CVFPB can adopt a system into the SPFC. Moreover, any flood management project for which DWR or the CVFPB is the nonfederal sponsor is included in the SPFC.

C. 2012 CVFPP

The 2012 CVFPP "is the most comprehensive flood management planning effort ever undertaken in California, addressing flood risks in an integrated manner while concurrently improving ecosystems, operations and maintenance practices, and institutional support for flood management."[690] It is a comprehensive statewide planning tool highly influential due to a variety of factors. First, as described above, the document was written by DWR, adopted by CVFPB, and outlines flood management risk strategy for areas of the SPFC. Although the 2012 CVFPP "focuses on the areas protected by SPFC facilities, the flood emergency response and operations and management of facilities in tributary watersheds that influence SPFC-protected areas are also considered."[691] The CVFPP is intended to guide management for most of the flood control system in California, including the SPFC, which contains a large physical area and all systems for which DWR and CVFPB are nonfederal sponsors. See Figure 21 above for areas included in the SPFC.

Additionally, DWR and CVFPB follow the plan's guidelines in carrying out their duties as nonfederal levee sponsors. Although the 2012 CVFPP is not "legally binding" (federal sponsors and LMAs have no direct obligation to carry out the specific terms of the 2012 CVFPP) the Central Valley Flood Protection Act of 2008 requires cities and counties in Sacramento and San Joaquin Valleys to incorporate information from the CVFPP into local land use plans and projects.[692] This serves to memorialize its provisions into local planning documents. DWR and CVFPB also encourage LMAs to follow the terms of 2012 CVFPP in their own flood risk management duties. Therefore, the 2012 CVFPP is one of the most prominent state planning documents for flood management in California.

The 2012 CVFPP was released as a public draft in December 2011 and

688 CAL. WATER CODE § 9611(b).

689 *Id.* § 9611(c).

690 CVFPP, *supra* note 5, at III.

691 *Id.* at 1-22.

692 *Id.* at 1-28; CAL. WATER CODE § 9600.

adopted by the CVFPB in a unanimous vote on June 29, 2012.[693] The same legislation that prompted DWR to draft the 2012 CVFPP also directs DWR to draft an updated plan every five years.[694] At the time of this paper, the 2017 CVFPP is in the process of being drafted and a public draft will likely be released at the beginning of 2017.

The 2012 CVFPP has one primary goal and several supporting goals. The primary goal, as stated by the CVFPP is: "to reduce the chance of flooding, and damages once flooding occurs, and improve public safety, preparedness, and emergency response through the following: Identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC. Formulating standards, criteria and guidelines to facilitate implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin river basins and the Delta."[695]

The supporting goals include: improving operations and maintenance, promoting ecosystem functions, improving institutional support and promoting multi-benefit projects.[696] In order to improve O&M, the plan supports modifying systems to make them more compatible with natural processes, and coordinating and streamlining regulatory O&M practices. To promote ecosystem functions, the plan supports integrating recovery and restoration of ecological functions, native habitats and species into flood system improvements. To improve institutional support, the plan advocates developing stable institutional frameworks and protocols that enable effective adaptive and integrated flood management. Finally, in order to promote multi-benefit projects, the plan supports integration of broader water management objectives.

In order to best achieve these goals, the plan outlines three basic strategies. It compares each strategy based on its ability to meet the established goals, economic cost, time of implementation, and other relevant criteria. Ultimately, the plan advocates for one approach above the other two. The preferred approach is, "State Systemwide Investment Approach" (SSIA). SSIA promotes projects that achieve regional flood control benefits for urban areas, small communities, and rural-agricultural areas.[697] Additionally, SSIA proposes larger system improvements to the SPFC providing cross-regional benefits and improving the overall function and performance of the SPFC.[698]

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693 *Central Valley Flood Management Planning Program*, MHW PROJECT FINDER, http://mwh-projects.mwhglobal.com/work/central-valley-flood-management-planning-program/ (last visited February 13, 2018).

694 S. B. 5, 2007–08 Leg., Reg. Sess. (Cal. 2007).

695 CVFPP, *supra* note 5, at 1-26.

696 *Id.* at 1-26–1-27.

697 *Id.* at 3-43.

698 *Id.* at 3-1.

1. Levee Vegetation Management Strategy and Lifecycle Management

The 2012 CVFPP was revolutionary for levee vegetation management, because it proposed and defined "Lifecycle Management" (LCM). LCM is an approach within the State's larger Levee Vegetation Management Strategy (LVMS). The LVMS generally includes a strategy for complying with the USACE vegetation-free zone requirements for newly constructed levees, but it largely works to protect existing vegetation on existing levees.

Under the LCM approach, existing levees will gradually move towards meeting the USACE policy goal of eliminating woody vegetation from the vegetation management zone.[699] This includes the landside slope, crown, and upper waterside slope of levees. According to the 2012 CVFPP this would be accomplished "over many decades."[700] This is because LCM advocates that "legacy levee vegetation," vegetation already in place on most portions of the levee, be allowed to live out the remainder of their normal life cycles. Contrastingly, any new growth is swiftly identified and removed.

The 2012 CVFPP also states that the LVMS will protect and improve riparian habitat by largely preserving existing vegetation, in the "near-term."[701] Additionally, the policies set forth in the CVFPP's description of LCM promote development of additional habitat to offset the gradual die-off and removal of existing trees. LCM also acknowledges the need to revisit the policy in the long term to better protect riparian habitat.[702]

The LVMS policy categorizes vegetation on levees and applies different management rules depending on which category the vegetation falls under.[703] Newly constructed levees will be free of vegetation, and any growth will be removed pursuant to USACE vegetation-free zone requirements. Vegetation existing on the lower waterside slope of existing levees would only be removed when it poses an unacceptable threat to levee integrity. Additional vegetation would be allowed to grow on the lower waterside slope.[704] This is the only area where additional vegetation retention is allowed. The lower waterside slope provides critical habitat to the some of the few remaining endangered fish species in the Central Valley, and vegetation on this part of levee slopes rarely presents threats to levee integrity. In fact, vegetation on the lower waterside slope can provide beneficial functions for levee integrity, such as slowing near shore water velocities, and holding soil in place to reduce erosion.[705] Riparian brush and larger woody vegetation can also provide the greatest erosion

699 *Id.* at 4-14.

700 *Id.*

701 *Id.*

702 *Id.*

703 *See id.*

704 *Id.*

705 *Id.* at 4-13.

protection and stabilize levees through extensive root systems.[706]

Vegetation on the levee system not on the lower waterside slope is to be trimmed to provide for visibility and access, but will not be removed unless it poses an unacceptable threat or creates visibility problems within the vegetation management zone. Through routine O&M, this vegetation is to be evaluated and monitored to identify any changed conditions that could pose an unacceptable threat to levee integrity, based on accepted engineering practice.[707]

LCM advocates an "adaptive vegetation management strategy," by allowing existing trees and other woody vegetation in the vegetation management zone (areas on the levee other than the lower waterside slope) to live out the rest of their normal life cycles. "immature" trees and woody vegetation, or any new growth less than four inches would be eliminated, though.

The LVMS policy further promotes routine inspections multiple times a year which would seek to identify a wide variety of potential problems. These could include trees that may pose an unacceptable threat to levee integrity or cause a visibility problem. Any such threats would be removed.

The LVMS seems to be a productive compromise in the short term for problems faced by levee sponsors and maintainers. However, in the long term, LCM could result in the loss of vast amounts of critical riparian habitat. In order to attempt to deal with this problem, the LVMS includes the establishment of riparian forest corridors, which will result in net gain of riparian habitat.[708] The Conservation Framework, included as an attachment to the 2012 CVFPP, also contains a tree planting program and monitoring plan to ensure that the "quality and quantity of riparian corridors of the Central Valley are maintained and enhanced over time."[709] Finally, DWR promotes research on risks and benefits of trees on levee performance and encourages its own agency and others to "incorporate new information into evolving policies and practices."[710] Therefore, the LVMS presents a compromise-type approach, which would effectively deal with levee vegetation management in the short-term, but DWR recognizes the need to revisit the policy in the long-term, as it is unlikely to sustain adequate vegetation growth over decades of implementation.

2. Conservation Framework

Another significant inclusion in the 2012 CVFPP is the Conservation Framework (CF). Overall, the 2012 CVFPP can be thought of as a framework to guide future state investment in flood risk reduction projects, and as a guide on

706 *Id.* at 4-13–4-14.

707 *Id.* at 4-15.

708 *Id.*

709 *Id.*

710 *Id.* at 4-16.

how to prioritize resources and funding to reduce as much risk as possible. The CF, included as "Attachment 2" to the 2012 CVFPP, describes how environmental stewardship is integrated into flood risk management activities, references environmental elements in the 2012 CVFPP, and provides additional detail on environmental planning.[711]

The Conservation Framework (CF) contains the following ecological goals:

(1) To improve ecosystem process overall. This includes improving the dynamic hydrologic (flow) and geomorphic processes in the SPFC. The CF identifies these ecosystem processes as critical for maintaining species and habitats. Furthermore, the CF recognizes that sustainable fisheries and riverine habitats require a diversity of flows, suitable sources of sediment, and a sufficiently broad river corridor to allow for stream meandering.
(2) To improve and increase the quantity, diversity, quality, and connectivity of riverine and floodplain habitats, including aquatic, riparian, wetland, shaded riverine aquatic (SRA) cover, and other floodplain habitats, as well as agricultural lands that can provide wildlife values.
(3) To contribute to the recovery and sustainability of native species populations and overall biotic community diversity. Particular attention is given to native species associated with riverine habitats at risk of extinction. This goal also emphasizes the need to avoid and minimize adverse effects on sensitive species, to develop compensatory habitat for adversely affected sites, and to contribute to species recovery in addition to mitigating for impacts.
(4) To reduce the stressors related to the development and operation of the SPFC that negatively affect at-risk species. These stressors include invasive plant species, constraints on sediment sources and channel meander migration, isolation of floodplains from rivers by levees, and fish passage barriers, all of which contribute to loss and degradation of ecosystem functions and habitats.
(5) To increase support and collaboration among regulatory agencies, flood managers, local planners, environmental nongovernmental organizations (NGOs) and agricultural interests for multi-benefit flood projects.
(6) To increase the quality of environmental information and tools for informing flood management and conservation activities.[712]

Overall, the CF and its articulated goals provided direction for flood risk management conservation planning. The CF was included as the "first phase" of a more comprehensive and integrated Central Valley Flood System

[711] *Id.* at 1-30.

[712] CAL. DEP'T OF WATER RES., 2012 CENTRAL VALLEY FLOOD PROTECTION PLAN, ATTACHMENT 2: CONSERVATION FRAMEWORK 3-1–3-2 (2012), https://www.water.ca.gov/LegacyFiles/floodsafe/leveeveg/levee_documents/DPEIR-Appendix-E-2012.pdf.

Conservation Strategy (Conservation Strategy, or CS).[713] In a sense, the CF was a first draft of the CS.

3. Conservation Strategy

The CF goals listed above are also the same basic goals for the Draft Central Valley Flood System Conservation Strategy (CS). The overall goals of the CS are to promote natural dynamic hydrologic and geomorphic processes; increase and improve the quantity, diversity and connectivity of habitats; and to promote the recovery and stability of native species populations and the overall biotic community diversity.[714]

The CS was developed to provide a comprehensive approach for the State, consistent with the CF, to achieve the environmental goals and objectives set forth in the Central Valley Flood Protection Act, FloodSAFE, and 2012 CVFPP. The CS was also developed to implement the DWR environmental stewardship policy within the flood management system.[715]

The CS seeks to provide a comprehensive, long-term approach for improving riverine and floodplain ecosystems through multi-benefit projects that provide ecological benefits while protecting public safety. The CS utilizes a regional, programmatic framework to increase the predictability and cost-effectiveness of permitting.[716]

The development of the CS was first proposed in the 2009 California Levees Roundtable framework document, "California Central Valley Flood System Improvement Framework" (2009).[717] The framework addressed levee vegetation issues and advocated for the development of a Conservation Strategy for the Central Valley flood system.

The CS describes how to achieve the environmental goals and objectives set forth in the 2012 CVFPP. It promotes actions that support multiple goals and objectives, referred to as "multi-benefit" projects. For example, to support both improved flood risk management and habitat restoration, the CS promotes structural improvements that increase the size of the floodway (including bypass expansions, new transient storage areas, and setback levees, which would improve flood risk management by increasing system flexibility and reliability).[718] The CS supports the CVFPP's promotion of multi-benefit projects that reduce vegetation and sediment to be removed from channels and more generally locate habitat where conflicts are minimized. The CS also supports the

713 *Id.* at 1-1.

714 CAL. DEPT. OF WATER RES., *supra* note 135, at 3-2–3-4.

715 *Id.*

716 *Id.*

717 CAL. LEVEES ROUNDTABLE, *supra* note 7, at 24.

718 CAL. DEP'T. OF WATER RES., *supra* note 135.

CVFPP O&M goal by promoting relocation of certain facilities to reduce the physical forces acting on them, thus reducing maintenance needs.[719] The CS promotes regional and programmatic permits, advance mitigation, long-term maintenance, and incorporation of multi-benefit features, all of which could increase the reliability and cost-efficiency of the permitting process and result in more efficient O&M.[720]

To support the improvement of institutional support, the CS recommends that projects which advance conservation goals attract funding from outside sources interested in promoting conservation.[721] The CS also predicts that flood risk reduction projects which improve environmental quality will build public support for funding and implementing such projects.[722] Finally, the CS directly supports the 2012 CVFPP goals of promoting ecosystem functions in every almost aspect of the strategy.[723]

Given the programmatic nature of the CS goals, the strategy was developed in close coordination with two Basinwide Feasibility Studies (BWFS) for the Sacramento and San Joaquin River, [724] and six Regional Flood Management Plans (RFMPs) for subdivisions of those basins.[725] These programmatic planning documents will likely be included in the 2017 CVFPP.

The CS addresses the importance of incorporating environmental improvements directly into flood risk management activities, rather than project proponents paying for conservation in a physically remote location to try to mitigate impacts.[726] It provides approaches for integrating ecosystem restoration into multi-benefit flood risk management projects.

To achieve its goals, the CS takes a targeted approach to habitats, processes, species and stressors. It "targets," or focuses, on habitats and species with the most potential to benefit from conservation integrated with flood management.[727] Then, the CS sets "measurable objectives" for these targets, which include floodplain inundation, riparian habitat and fish passage barriers.[728]

The inclusion of measurable objectives may be the most noteworthy aspect of the CS. The measurable objectives provide a framework for measuring,

719 *Id.* at 3-4.

720 *Id.*

721 *Id.*

722 *Id.*

723 *Id.*

724 CAL. DEP'T. OF WATER RES., *Basin-Wide Feasibility Studies*, https://www.water.ca.gov/Programs/Flood-Management/Flood-Planning-and-Studies/Basin-wide-feasibility-studies (last visited Feb. 15, 2018).

725 *See* CAL. DEPT. OF WATER RES., *supra* note 135, at 8-18–8-19.

726 CAL. DEP'T. OF WATER RES., *supra* note 135.

727 *Id.* at 4-1.

728 *Id.*

monitoring and evaluating progress in implementing conservation measures. This in turn informs the CVFPB and DWR funding program, which can look to current and projected levels of compliance with the objectives. The objectives are intended to be attainable, relevant to the SPFC, and include a time frame for achievement.[729] The CS also recognizes the uncertainty associated at the intersection of flood management and ecosystem restoration, and establishes reevaluation criteria to revise and review the objectives during early implementation.[730]

The objectives themselves are not obligatory, and the CS does not establish any performance obligations on DWR or other LMAs with respect to the conservation objectives. Rather, the measurable objectives are intended to "begin the process of developing a scientifically supportable and stable framework for evaluating progress over time rather than setting absolute performance criteria for DWR to meet."[731] The objectives look at realistic opportunities to contribute to conservation based on flood system management and attempt to set realistic measurable objectives based on existing opportunities.[732]

The measures themselves are articulated in Section 5.0 of the CS discussing areas in the Systemwide Planning Area (SPA). [733] Those areas are divided into five Conservation Planning Areas (CPAs). These CPAs include: (1) The Sacramento River CPA, which includes the Sacramento River and tributaries from Red Bluff to the Fremont Weir (Upper and Mid-Sacramento River CVFPP RFMP regions); (2) The Feather River CPA, which includes the Feather River, as well as the Yuba and Bear Rivers and other tributaries (Feather River CVFPP RFMP region); (3) The Lower Sacramento River CPA, which includes the Sacramento River and tributaries from the Fremont Weir to Isleton (Lower Sacramento River and Delta-North CVFPP RFMP regions); (4) The Upper San Joaquin River CPA, which includes the San Joaquin River and tributaries from Friant Dam to the Merced River (Upper San Joaquin River CVFPP RFMP region); and (5) The Lower San Joaquin River CPA, which includes the San Joaquin River and tributaries from the Merced River to Stockton (Lower and Mid-San Joaquin River and Delta-South CVFPP RFMP regions).[734]

Within each CPA, each measurable objective addresses a targeted ecosystem process, habitat, or stressor. The objectives themselves consist of one or more

729 *Id.* at 5-1.

730 *Id.*

731 *Id.* at 1-3.

732 *Id.* at 5-7.

733 *Id*. at 1-3 ("The Systemwide Planning Area (SPA). . . .consists of lands currently receiving protection from the SPFC and additional areas where management actions may be implemented as part of the CVFPP…").

734 *Id.* at 1-4–1-6.

specific metrics (for example, the acreage of riparian vegetation).

The CS itself will likely be included as part of the 2017 CVFPP, just as the CF was included as an Attachment 2 in the 2012 CVFPP. As of the time of the writing of this paper, discussions continue as to the utilization of the CS in the 2017 CVFPP, and possible incorporation elsewhere.[735]

Appendix D of the CS includes details on the State's Levee Vegetation Management Strategy (LVMS), an integral part of the CS. This strategy differs from the federal vegetation management strategy in many ways, including the presumption that levee vegetation necessarily poses a threat to levee integrity. Rather, vegetation management is considered important to maintain visibility and accessibility for inspections and flood fighting, and "in some limited cases," may pose an unacceptable threat to levee integrity.[736] The LVMS also seeks to eliminate invasive plants, which can be harmful to endangered species and flood system capabilities. As part of the LVMS, newly constructed levees are to be free of vegetation (except for native grasses and waterside planting berm), which complies with USACE requirements.[737] But, in order to minimize impacts on SRA, the LVMS promotes designing new levees with a waterside planting berm "that accommodates trees and other woody vegetation to sustain continuous SRA habitat."[738] The planting berm is included not only for improving habitat, but also to minimize erosion on the waterside. DWR also requires that the planting berm on newly constructed levees conform to USACE engineering standards.[739] The LVMS also supports the implementation of setback levees, where practical.[740]

The State's LVMS further clarifies the definition of "legacy vegetation," to include,

> trees and other woody vegetation that was inspected by USACE and for which there is no documentation stating that the nonfederal sponsor was notified before 2007 that the vegetation needed to be removed. This includes vegetation present on State/federal project levees at the time the project was turned over by USACE in the 1950s, vegetation that was planted for mitigation as part of a cost-shared USACE project, and vegetation that has been allowed by USACE to remain to meet federal [ESA] or other requirements.[741]

The LVMS discusses this legacy vegetation as a "potential risk," rather

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735 Interviews with Nat'l Marine Fisheries Serv. and Cal. Dep't Water Res. officials (June 2016-July 2017).

736 CAL. DEP'T. OF WATER RES., *supra* note 135.

737 *Id.* at D-3.

738 *Id.*

739 *Id.*

740 *Id.*

741 *Id.* at D-4.

assuming all existing woody vegetation necessarily poses a risk. Recent studies, including USACE's ERDC report, support this by showing that woody vegetation can increase or decrease levee safety depending on a variety of factors[742] Management of legacy vegetation includes a Vegetation Management Zone (VMZ) in which vegetation is managed (trimmed and thinned) for visibility and accessibility and new vegetation growth is removed. Vegetation outside of this zone, in the lower waterside slope of the levee would largely remain unmanaged and in place, given its low threat to levee safety and high ecosystem value, especially for endangered fish. As part of the State's vegetation management strategy, trees that have been identified to pose an unacceptable threat to levee integrity shall be identified and removed, or managed to reduce their threat to an acceptable level.[743]

The CS also references assessment tools currently under development, which could help identify which trees pose such a threat. These tools will be discussed in greater detail in *Appendix 4: Science and Research*. The State approach encourages the establishment of riparian forest corridors in the vicinity of existing levees, on the waterside if feasible.[744] Finally, the LVMS establishes protocols for vegetation management as part of levee repair or improvement projects. This includes directives to replant vegetation where appropriate and include root or seepage barriers in the levee crown.[745]

In addition to clarifications made to previous DWR strategy, the State's LVMS also offers new strategies to manage channel vegetation and invasive plants. This includes utilization of new models to determine channel conveyance along with habitat needs.[746] The LVMS also emphasizes the DWR goal of removing invasive plant species along levees through increased institutional support, development of coordinated approaches within Channel Maintenance Areas, and development of partnerships to optimize limited resource use.[747] The State also plans on continuing implementation of ongoing strategies to combat invasive species, including prioritizing species for control, implementing best management practices (BMPs) and continuing to use models to track and prioritize treatment of invasive plants.[748]

In summation, the State's approach differs from that of the federal approach. The State's vegetation management approach, embodied in the LVMS,

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[742] MAUREEN K. CORCORAN ET AL., *Volume IV: Summary of Results and Conclusions*, *in* INITIAL RESEARCH INTO THE EFFECTS OF WOODY VEGETATION ON LEVEES 29-30 (2011), http://wri.usace.army.mil/documents/woody_vegetation_report/Vol_IV-Summary_of_Results_and_Conclusions.pdf.

[743] CAL. DEP'T. OF WATER RES., *supra* note 135.

[744] *Id.* at D-9.

[745] *Id.* at D-11.

[746] *Id.* at D-13.

[747] *Id.* at D-13–14.

[748] *Id.* at D-14.

presumes vegetation retention in most cases, and addresses site-specific characteristics.

APPENDIX 3: CASE LAW

Two prominent lawsuits quickly followed the release of the USACE vegetation-free policy. One was brought by a group of environmental non-governmental organizations (NGOs), and another by the CDFW.[749] Both alleged that in promulgating their new rule, USACE violated the Endangered Species Act (ESA), National Environmental Policy Act (NEPA) and the Administrative Procedure Act (APA).[750] It is unclear whether either of these cases would have won on the merits. While the lawsuits were in litigation, WRRDA 2014 was released. WRRDA 2014, Section 3013 directed USACE to revisit and reissue the vegetation-free policy.[751] In each case, the court abstained from issuing a ruling because USACE was already compelled by the legislature to re-write the vegetation policies at issue. However, in both cases the court maintained the authority to hear the case again if USACE failed to comply with the directives of WRRDA 2014, Section 3013.[752]

The case details of the cases are summarized below with additional background on claims brought by the plaintiffs. The specific allegations remain significant today because these cases could potentially be brought against USACE again in the future.

A. Friends of the River v. United States Army Corps of Engineers

1. Complaint

In *Friends of the River v. United States Army Corps of Engineers*, the plaintiffs filed suit in the United States District Court, Eastern District of California in June 2011. The plaintiffs, including Friends of the River (FOR), Center for Biological Diversity, and Defenders of Wildlife, filed for Declaratory and Injunctive Relief.[753] The claims were: First Amendment and Administrative

[749] *See* First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 2-6; Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 4.

[750] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 19, 22, 23; Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 16, 18, 20.

[751] Water Resources Reform and Development Act of 2014 § 3013(b).

[752] Stipulation and Order of Voluntary Dismissal Without Prejudice at 4, Friends of the River v. U. S. Army Corps of Eng'rs, 870 F. Supp. 2d 966 (E.D. Cal. 2012) (No. 2:11–CV–01650 JAM–JFM).

[753] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 25–26. Declaratory relief refers to a judge's determination of the parties' rights under contract or statute. In this case, the plaintiffs sought a court declaration of the meaning of the statute. Injunctive relief refers to any court order for an action, rather than money damages. In this case, the plaintiffs sought an injunction that would compel the defendants to follow certain statutory mandates.

Procedure Act (APA) claims for violation of the National Environmental Protection Act (NEPA); an APA claim for violation of ESA; and an APA claim for failure to follow rulemaking procedures.[754]

The above issues alleged by FOR arose from USACE issuance of levee vegetation policies. More specifically, the claims are related to ETL 1110-2-571 (2009), the PGL variance policy, and USACE reliance on "Final Draft White Paper: Treatment of Vegetation within Local Flood-Damage-Reduction Systems" (2007).[755] FOR alleged that USACE violated NEPA by failing to prepare an Environmental Impact Statement (EIS), violated ESA by failing to consult with NMFS and FWS in issuing the aforementioned policies, and violated APA rulemaking in adopting policies that prohibit vegetation on levees.[756]

The Plaintiffs' complaint begins by reporting that the vegetation on and near California levees contain virtually all that remains of the riparian forests in the Central Valley and certain other parts of the State of California.[757] The plaintiffs allege that, if USACE policies were to stay in place,

> it would require the destruction of much of the last 5% of once thriving riparian forests in California's Central Valley that provides essential habitat for the survival of several endangered species, scenic beauty and shade for aesthetic and recreational enjoyment of the rivers by people.[758]

They claim that the USACE policies require removal of all vegetation from levees without environmental review, consideration of regional differences, and without scientific support.[759] FOR argues that this in essence requires the clear-cutting of the surviving remnant of riparian forests in the Central Valley, violating NEPA, ESA and APA.[760]

The FOR complaint also discusses the history of levee vegetation maintenance in California, and how USACE historically allowed, encouraged, and even required the maintenance and planting of trees and shrubs on California levees.[761] FOR describes how USACE reversed course in 2007 when they issued the Final Draft White Paper, "Treatment of Vegetation within Local Flood-Damage-Reduction Systems." This paper established new policy guidance for a vegetation-free-zone for all levees for which USACE has responsibility for design, operation, maintenance, inspection or certification.[762]

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754 *Id.* at 19, 22, 23.

755 *Id.* at 19–25.

756 *Id.*

757 *Id.* at ¶ 1.

758 *Id.*

759 *Id.* at 20.

760 *See Id.* at 19–24.

761 *Id.* at 7.

762 *Id.* at 8.

FOR describes the pushback that USACE received upon the release of the 2007 White Paper from other state and local agencies, as well as from NGOs and individuals.[763] This includes a DWR letter which described the long-standing agreement amongst regulatory agencies that trees and other vegetation on levees in the Central Valley can co-exist with their public safety function.[764] That this agreement was set aside by USACE when it created a new, nationwide policy.

The FOR complaint continues on to describe USACE's issuance of ETL 1110-2-571 in 2009 despite multiple objections.[765] The ETL requires a vegetation-free zone, or corridor, along levees, including the span of the actual levee and 15 feet on each side and the removal of all vegetation except for grass.[766] This encompasses existing riparian forest on and alongside California levees. The ETL further places the burden of seeking a variance from the vegetation-free zone requirements on the levee operators.[767] The ETL applies broadly to all USACE Commands having Civil Works responsibilities and to all flood damage reduction projects for which USACE has responsibility for design, operation, maintenance, inspection, or certification.[768] For nonfederal projects, the ETL is applicable under the Rehabilitation and Inspection Program (RIP), where USACE performs inspections of nonfederal projects under ER 500-1-1 and PL 84-99.[769]

The complaint further discusses the USACE issuance of the PGL in February 2010, which adopted a new request policy for variances from USACE vegetation requirements. USACE issued a public notice for the new PGL in 2010.[770] The notice acknowledged the mandatory vegetation-management standards for levees established in ETL 1110-2-571.[771] The notice also stated that the PGL would "serve as an interim guidance until the process is incorporated into a USACE engineer publication," and provided a deadline of September 30, 2010 for all variance applications (including new and existing variances).[772] Thus, on its face, the PGL and notice appeared to invalidate any existing variances prior to September 30, 2010, unless a new application was filed.

FOR further disputed USACE claims that the ETL did not establish new

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763 *Id.*

764 *Id.*

765 *Id.*

766 *Id.* at 8–9.

767 *Id.*

768 *Id.* at 9.

769 *Id.*; *See generally* U.S. ARMY CORPS OF ENG'RS, *supra* note 49 (prescribing policies for the Civil Emergency Management (CEM) Program of USACE).

770 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 9.

771 *Id.*

772 *Id.*

standards, but instead clarified standards presented in EM 1110-2-301.[773] FOR argued that the ETL established new standards for the following reasons: (i) the ETL declares "on its face" that it supersedes EM 1110-2-301,[774] (ii) EM 1110-2-301 defines a limited vegetation-free zone, different from the larger one described in the ETL,[775] (iii) EM 1110-2-301 provided for plantings on urban levees for aesthetic reasons, and rural levees to restore environmental values, while the ETL specifies that the vegetation-free zone must be maintained in all areas except those with a formal variance,[776] (iv) FOR also argued that the ETL standard is in direct conflict with 33 C.F.R. § 208.10, which encourages certain types of tree growth on levees,[777] (v) FOR argued that in even if the ETL had not substantially changed USACE policy regarding vegetation on levees, the PGL did because the PGL states that existing variances are no longer valid.[778] In issuing the PGL and effectively invalidating existing variances, FOR argued that USACE took an agency action that had direct, indirect and cumulative impacts on the environment, including listed species and critical habitats.[779]

FOR continued by enumerating the many objections from federal, state, and local agencies, as well as NGOs and individuals regarding the issuance of the USACE vegetation removal policy.[780]

For example, the FWS voiced the following complaints in comments regarding the USACE policy:

> The woody vegetation found on Central Valley Levees is a significant portion of the remaining riparian habitat that provides nesting, foraging and cover habitat for migratory birds (including neo-tropical migrants, raptors, and others), overhead cover and shade that moderates water temperatures and energy input to river productivity at all trophic levels. This residual vegetation serves an important ecological role essential to the survival of numerous terrestrial and aquatic animals, and plant species throughout the Central Valley, including those in the Sacramento-San Joaquin Bay-Delta region significant to the economy of the State of California. Included are federally listed threatened and endangered species whose survival as well as recovery is directly or indirectly dependent on riparian habitat. Only about 5 percent of historic riparian habitat remains in the Central Valley, much of which exists on man-made levees.[781]

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773 *Id.* at 17–18.
774 *Id.* at 9.
775 *Id.* at 8.
776 *Id.*
777 *Id.*
778 *Id.* at 9.
779 *Id.* at15.
780 *Id.* at 12.
781 *Id*.

CDFW and DWR voiced similar complaints in comments submitted to USACE:

> Federal or state-listed endangered or threatened species that could be affected by removal of the levee vegetation include salmonids such as winter-run and spring-run Chinook and Central Valley steelhead, delta smelt, Valley elderberry longhorn beetle, late fall-run Chinook salmon, southern [distinct] population segment of the North American green sturgeon, long-fin smelt, giant garter snake, riparian brush rabbit, Swainson's hawk, and burrowing owl.[782]

The State Water Resources Control Board (SWRCB) issued the following comments in response to the USACE vegetation-removal policy:

> The ecological benefits of riparian vegetation are well documented. Riparian vegetation slows surface velocities and increases infiltration. Riparian vegetation filters pollutants and reduces bank erosion and sedimentation. Sediment-laden waters impact municipal water supplies, recreational uses, and conditions for anadromous fish and other aquatic organisms. Riparian vegetation provides cover and shade for aquatic species. Shade reduces water temperatures which is critical for many aquatic species including salmonids.[783]

The complaint further describes the ongoing substantial public controversy over the issue of whether vegetation has an adverse, beneficial, or no effect on levee performance. FOR explained that, despite this controversy, most of the studies surrounding this issue have concluded that vegetation on levees is compatible with the flood function of levees, or that vegetation actually improves levee safety by reducing the potential for levee erosion.[784] Concluding this discussion, FOR references USACE's own two studies. One study, "The Effects of Vegetation on the Structural Integrity of Sandy Levees" (1991), concluded that trees generally improve, rather than degrade levee safety.[785] The other, conducted by ERDC and issued in 2007 after the White Paper concluded that "no documented evidence exists to prove trees negatively influence levee integrity; however, research is very limited that specifically addresses woody vegetation on levees."[786]

In summarizing the ongoing controversy, FOR also describes USACE's admission of the issues associated with vast requirements for vegetation removal. FOR cites the July 26, 2011 USACE Literature Review, prepared by

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782 *Id.* at 12.

783 *Id. at* 13.

784 *Id.* at 13–14.

785 *Id.* at 13.

786 *Id.*

ERDC, which found that "clear-cutting on natural slopes and stream banks generally leads to an increase in slope failures."[787] The Literature Review further concedes that the benefits and risks of converting wooded levees to grass-covered levees, as well as the engineering feasibility and economic costs, have yet to be fully investigated.[788] The Literature Review made such recommendations as addressing levees in terms of ecosystem habitat diversity, and establishing specific guidance for each individual ecosystem as a separate environmental community.[789]

FOR continued their description of the public controversy over woody vegetation on levees by describing the paper released by USACE on September 8, 2011. The paper was entitled, "Initial Research into the Effects of Woody Vegetation on Levees" and was prepared by ERDC.[790] ERDC conducted site visits, field studies, laboratory testing, modeling and simulations, and conducted analyses for eight locations around the Central Valley as well as other parts of the county.[791] FOR pointed to specific conclusions found in the report, including, "Trees near the toe increased the factor of safety because of the reinforcing effects of the roots and the increased counterweight effect of the tree to slope movement."[792] The report further found that tree presence on levees "can increase or decrease the factor of safety with respect to slope stability depending on the location of the tree on the levee" and that, "because of the extreme variability in geology, tree species, climate, and soils, the impact of trees on levees must be analyzed on a case-by-case basis."[793]

FOR concluded describing development of the levee vegetation policy by introducing USACE press releases made in September 2011 that seemingly disregarded the results of the aforementioned studies. The Press Releases stated that the initial research did not warrant a change to the USACE national vegetation management standard.[794] Rather, the results would be used to inform USACE decisions for trees on levees in the USACE levee safety program, including programs such as prioritizing deficiencies.[795]

FOR's complaint points out the economic cost of complying with USACE

[787] *Id.* at 13; *see also* CORCORAN ET AL., *supra* note 73 (supporting FOR's statement).

[788] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 13.; CORCORAN ET AL., *supra* note 73, at 16.

[789] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 13; CORCORAN ET AL., *supra* note 73, at 16.

[790] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 13–14.

[791] *Id.* at 14.

[792] *Id.*; MAUREEN K. CORCORAN ET AL., INITIAL RESEARCH INTO THE EFFECTS OF WOODY VEGETATION ON LEVEES (2011) (quoted by FOR in the complaint).

[793] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 14; CORCORAN ET AL., *supra* note 742, at vi, 29 (2011) (quoted by FOR in the complaint).

[794] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 14.

[795] *Id.*

vegetation removal policies. The complaint references CDFW and DWR comments, where the agencies estimated that the cost of complying with the ETL for the 1600 miles of non-compliant project levees would be $7.5 billion.[796] CDFW and DWR noted that if all of the entire remaining levee bond funds were redirected to address vegetation management, this cost could potentially be paid.[797] However, that would be at the risk of redirecting funds from far more significant levee deficiency repairs, such as deficiencies from seepage and erosion.

FOR's complaint also discussed the burdensome nature of the PGL's variance requirements, and that an approved variance will "likely prove unattainable for many agencies."[798] Because of the expensive and burdensome process, they predict that at least some of the levee maintaining agencies will choose to remove vegetation rather than seeking a variance from USACE.[799] Therefore, even though USACE underwent limited environmental review for the PGL, the full environmental effects of USACE vegetation removal policies will never be evaluated under NEPA.[800]

The FOR complaint also discussed the Sacramento Area Flood Control Agency (SAFCA)'s application for a variance for the Natomas Levee Improvement project.[801] In 2006, SAFCA proposed a "fix in place" alternative for the 42-mile levee system, where little vegetation would have been removed. Upon the release of the new USACE vegetation standard, SAFCA instead proposed an Adjacent Set-back levee alternative in 2007.[802] This would have reduced the need to remove waterside vegetation while complying with the USACE guidance.[803] However, this did result in the removal of several landside woodland groves and individual trees on the landside of the levee. The Natomas Levee Improvement project ultimately cost SAFCA about $180 million more than originally projected.[804]

Plaintiffs additionally argued that USACE violated NEPA procedures. NEPA, 42 U.S.C. 4321-4370, directs federal agencies to address the environmental consequences of proposed actions. Prior to undertaking any major federal action significantly affecting the environment, the federal agency taking the action must prepare and circulate for public review and comment a detailed Environmental Impact Statement (EIS).[805] Further, if, after preparing an EIS, the

796 *Id.* at 14–15.
797 *Id.*
798 *Id.* at 15.
799 *Id.*
800 *Id.*
801 *Id.* at 15–16.
802 *Id.*
803 *Id.*
804 *Id.*
805 42 U.S.C. § 4332(2)(C) (2012).

agency makes substantial changes to the proposed action, the agency must prepare a supplemental EIS analyzing the environmental implications of the changes.[806]

To consider whether a proposed action will have significant environmental impacts (and thus necessitating the development of an EIS), the agency may prepare an Environmental Assessment (EA). However, the agency may also skip this step and prepare a full EIS from the outset.[807] If the agency concludes that the action will not have significant impacts on the environment based on the EA, the agency must document its decision and explain the reasons why the project's impacts are insignificant in a "finding of no significant impact" (FONSI).[808] Unless the environmental consequences of a proposed action are so minor that the action can be categorically excluded from consideration in an EIS,[809] the agency must at least prepare an EA, which provides evidence and analysis for determining whether to prepare an EIS or a FONSI.[810]

The complaint describes how USACE did not prepare an EIS or EA under NEPA before issuing the 2007 White Paper, the 2009 ETL, the 2010 PGL, or the notice for the PGL in the Federal Register. [811] FOR alleged that the USACE vegetation removal policies, as set forth in the ETL and PGL, were major federal actions "significantly affecting the environment," thus, USACE violated NEPA when it failed to prepare an EIS, or at the very least an EA.[812] FOR described the environmental impacts of the ETL and PGL in terms of context and intensity, including direct, indirect, and cumulative ecological, aesthetic, historic and cultural effects in concluding that USACE policy significantly affects the environment.[813] FOR specifically points to examples of the policy's environmental effects. These include: the nationwide context of the ETL and PGL and the long term effects on riparian areas; the intensity of the scientific controversy over removing trees from levees; the cumulative nature of the impacts of removing trees from 1600 miles of levees in California; the destruction of the last remaining significant scientific, cultural, and historical resources made up by the surviving remnant of riparian habitat; removal of riparian habitat adversely affecting endangered and threatened species; and violation of environmental laws.[814]

Further, FOR alleged that USACE vegetation removal policies as set forth in

806 40 C.F.R. § 1502.9(c) (2017).

807 *Id.* § 1502.4.

808 *Id.* § 1508.13.

809 *Id.* § 1508.4.

810 *Id.* § 1508.9.

811 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 19–22.

812 *Id.* at 20.

813 *Id.* at 19–20.

814 *Id.*

the ETL and PGL were "major federal actions," and thus subject to NEPA's EIS requirement. NEPA regulations require EIS preparation at the earliest possible time, so that planning decisions reflect environmental values.[815] FOR alleged that USACE violated NEPA by failing to prepare an EIS, or even an EA, on the ETL, PGL and vegetation removal program. FOR maintained that the USACE vegetation removal program was a final agency action and decision, and was arbitrary and capricious because it was not based upon, guided by, or even accompanied by adequate environmental review in an EA or EIS.[816]

Although USACE did release a draft EA/FONSI for the PGL, FOR contends that the EA/FONSI is wholly inadequate, containing no environmental analysis whatsoever.[817] Further, FOR alleged that USACE "belatedly and tacitly conceded that applicability of NEPA" in issuing the EA/FONSI about 10 months after issuing the ETL. FOR argues that in doing so, USACE was essentially admitting that they were taking an action that requires USACE to comply with NEPA, but did so in a post hoc way that still violated the full NEPA requirements.[818]

Finally, FOR alleges that USACE violated NEPA by improperly segmenting or truncating the project description, avoiding the preparation of a programmatic EIS. In doing so, FOR argues that USACE failed to consider basic environmental issues, such as the effect of vast vegetation removal from levees on flood control effectiveness, whether a "no action" alternative could accomplish the same goals, the environmental impact of vast vegetation removal, program alternatives, cumulative impacts of levee vegetation removal, and the cost of vegetation removal.[819]

Plaintiffs also argued that USACE violated ESA procedures. The ESA provides that,

> each Federal agency shall, in consultation with and with the assistance of the Secretary [of Commerce or the Interior], insure that any action authorized, funded, or carried out by such agency. . . is not likely to jeopardize the continued existence of an endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected states, to be critical. . .[820]

To fulfill this mandate, the federal agency taking the action ("action agency") must consult with the appropriate wildlife agency ("consultation agency")

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815 *Id.* at 20; 40 C.F.R. §§ 1501.2, 1502.5 (2017).

816 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 20.

817 *Id.* at 21–22.

818 *Id.* at 11–12.

819 *Id.* at 20–21.

820 *Id.* at 22–23; 16 U.S.C. § 1536(a)(2) (2012).

whenever an action may affect a listed species.

Under the ESA Section 7 requirements, the action agency (federal agency taking the action) must decide whether or not that action may impact a listed species or its critical habitat.[821] The action agency then determines the effect the action may have on the species or its critical habitat.[822] If the action will have no effect on the species or its critical habitat, the agency makes a "no effect" determination, and no consultation is needed.[823] If the action may affect, but is not likely to adversely affect the species or its critical habitat, the action agency may submit a Biological Assessment (BA) assessing the effects of the project, to the consultation agency, but is not required to do so.[824]

This is the process of informal consultation, and if the consultation agency agrees that the action is not likely to adversely affect the species and critical habitat, the consultation agency concurs with the action agency.[825] If the consultation agency disagrees, and finds that the action will adversely affect the species or its habitat, the action agency must initiate formal consultation.[826] If the action is likely to adversely affect a listed species or its critical habitat, the action agency is required to prepare and submit a BA to the appropriate consultation agency.[827] This is the process of formal consultation.

"Action" under the ESA refers to any and all activity or program of any kind authorized, funded, or carried out fully or partially by federal agencies in the United States. Examples of "actions" include the promulgation of regulations and actions that directly or indirectly modify the land, water, or air.[828]

As mentioned previously, the appropriate consultation agency is either the U.S. Fish and Wildlife Service (FWS) or NOAA Fisheries/National Marine Fisheries Service (NMFS), depending on the affected species. To summarize, whenever an action may affect a listed species or critical habitat, the action agency must undergo informal or formal consultation with the appropriate consultation agency. The action agency must undergo *formal* consultation with the consultation agency when the action agency determines that the action may adversely affect a listed species or critical habitat. In undergoing a formal consultation, the action agency must provide the best scientific and commercial data that is available or which can be obtained.[829]

FOR alleged that USACE violated the ESA by failing to consult with either

821 50 C.F.R. § 402.12 (2017).

822 *Id.*

823 *Id.*

824 16 U.S.C. § 1536(c)(1) (2012).

825 50 C.F.R. § 402.13 (2017).

826 16 U.S.C. § 1536(a)(3)–(4) (2012).

827 50 C.F.R. § 402.14 (2017).

828 *Id.* § 402.02(b), (d).

829 *Id.* § 402.14(a)–(d).

consultation agency prior to releasing the vegetation removal policy, as set forth in the ETL, White Paper and PGL.[830] FOR contends that the release of this policy is subject to the ESA Section 7 requirements, because it is an activity or program, carried out in whole or in part by USACE that directly or indirectly causes modification to land, water, or air, and thus is an agency action that may affect ESA-listed species and/or their critical habitat within the meaning of the statute and implementing regulations.[831] USACE did not initiate and complete consultation with FWS or NMFS in order to ensure against jeopardy or adverse modification to listed species and/or their critical habitat.[832] FOR further argued that USACE violated ESA by making an "irretrievable commitment of resources" in promulgating and enforcing the vegetation-removal policies prior to consultation with FWS or NMFS to address impacts to listed species and critical habitat.[833]

FOR's third and final claim centers on APA violations for failure to complete a formal rulemaking before the USACE adoption of new rules.[834] Pursuant to the APA, a reviewing court may hold unlawful and set aside an agency action, findings, or conclusions found to be, "(A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law; . . . (C) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right; . . . (D) without observance of procedure required by law."[835]

FOR contended that USACE promulgated new mandatory vegetation "rules," in releasing the ETL and PGL, subjecting USACE to the notice-and-comment requirements of the APA. A "rule" is defined as "the whole or a part of an agency statement of general or particular applicability and future effect designated to implement, interpret, or prescribe law or policy or describing the organization, procedure, or practice requirements of an agency."[836] FOR argues that the ETL and PGL fall under this definition of a rule, and therefore USACE violated the APA in failing to offer adequate public notice and opportunity for comment, prior to releasing these policies.

Further, FOR alleged that USACE violated APA because adopting the new vegetation policies without proper analysis under NEPA and without consultation under ESA was not in accordance with the law and must be set aside pursuant to APA Section 706(2).[837]

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830 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 23.

831 *Id*. at 22.

832 *Id.* at 23.

833 *Id.*

834 *Id.* at 24.

835 5 U.S.C. § 706(2) (2012).

836 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 24; 5 U.S.C. § 551(4) (2012).

837 First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 24.

2. Dismissal

The parties ultimately agreed to dismiss the case in September 2014 due to the passage of WRRDA 2014.[838] Specifically, Section 3013 of WRRDA 2014 resolved the Plaintiff's claims because it requires the USACE to comprehensively review their vegetative management guidelines for levees, and to determine whether their current policy regarding levee vegetation is appropriate for all regions of the United States.[839] The court further emphasizes 3013(g), prohibiting the USACE from requiring any vegetation removal "as a condition or requirement for any approval or funding of a project, or any other action, unless the specific vegetation has been demonstrated to present an unacceptable safety risk."[840]

In addition to the legislative mandate of WRRDA 2014, Section 3013, the Court itself stressed the importance that USACE not require vegetation removal until they have revisited their vegetation removal guidelines. The Court held that the Corps would not require the removal of existing vegetation as a condition or requirement for any approval or funding for a project unless the specific vegetation had demonstrated an unacceptable safety risk.[841]

In conclusion, FOR alleged numerous and detailed violations of environmental and administrative laws by USACE. However, both parties recognized that the case should be put on hold as USACE undergoes the requirements set forth in WRRDA 2014, Section 3013. To date USACE has failed to comply with WRRDA 2014, Section 3013. Therefore, FOR's allegations remain relevant as the plaintiffs may choose to reinitiate the lawsuit in the future.

B. California Department of Fish and Game v. United States Army Corps of Engineers

Shortly after FOR filed their lawsuit against USACE, California Department of Fish and Game (now the California Department of Fish and Wildlife, or "CDFW") filed a similar suit in the Eastern District of California.

1. Complaint

CDFW's complaint gives an overview of USACE levee vegetation policies, including ETL 1110-2-571 (2009), the SWIF policy, PGL (2010), and the "Revised" PGL (2012).[842] The complaint continues to describe the state-federal

[838] Stipulation and Order of Voluntary Dismissal Without Prejudice, *supra* note 752, at 3.

[839] First Amended Complaint for Declaratory and Injunctive Relief, *supra* note 247, at 22; Water Resources Reform and Development Act of 2014 § 3013.

[840] Water Resources Reform and Development Act of 2014 § 3013(g).

[841] Stipulation and Order of Voluntary Dismissal Without Prejudice, *supra* note 752, at 3.

[842] Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 1–2.

flood protection system in California's Central Valley.[843]The system consists of 1,600 miles of federal project levees, 1,200 miles of 148,000 acres of designated floodways, 26 project channels covering several thousand acres, and 56 other major flood protection works along the Sacramento and San Joaquin rivers and tributaries.[844] CDFW also describes the system of "levee sponsors" in California and the manner in which state or local entities work with the federal or state government on funding of flood control projects.[845]

In the complaint, CDFW describes USACE's partnership with the State of California for flood control since 1917, including previous policies encouraging vegetation growth and retention on levees.[846] CDFW also pointed to studies conducted by DWR from 1967, 1999 and 2008 pointing to the benefits of woody vegetation for levees.[847] Such benefits are: stability and erosion prevention provided by riparian vegetation on the levees, compatibility with flood control,[848] (a lack of documented levee failures caused by woody vegetation in California,[849] and avoidance of costs and dangers from the removal of vast amounts of woody vegetation on levees would.[850]

The complaint further describes the importance of woody vegetation on levees to the ecological system in California. California's Central Valley levee system has approximately only five percent of riparian forest it once had.[851] The remaining riparian habitat contains habitat for non-listed species including Swainson's hawk, the Giant garter snake, Riparian brush rabbit and burrowing owl. It also contains critical habitat for the following listed species: Valley elderberry long-horn beetle, Green Sturgeon, Winter-run Chinook salmon, Spring-run Chinook Salmon and Central Valley Steelhead.[852]

The CDFW complaint further described the USACE levee vegetation policy at the time the complaint was filed.[853] This includes the 2007 USACE White Paper, which first proposed the USACE levee vegetation removal policy DWR objected.[854] The complaint also describes the California Levees Roundtable with various stakeholders including DFG, DWR, the CVFPB and federal and local agencies, to address vegetation and other issues affecting levees in California's

843 *Id.* at 2.
844 *Id.* at 4.
845 *See id.* at 4–6.
846 *Id.* at 4–5.
847 *Id.* at 5.
848 *Id.*
849 *See id.*
850 *Id.*
851 *Id.*
852 *Id.*
853 *Id.* at 6.
854 *Id.*

Central Valley.[855] As a result of the Roundtable process, USACE signed the Roundtable Framework, released in April 2008. The Roundtable Framework memorialized the group intent to work collaboratively to develop a plan to address levee integrity, public safety, flood control and vegetation issues in the Central Valley. The Roundtable Framework called for a measured approach to vegetation management so that potential damage to levees from wholesale vegetation removal could be avoided, and that all levee risk factors be considered together, along with good science.[856] However, in 2009, USACE instituted a policy that largely diverted from the temporary policy set forth in the Roundtable Framework.

The complaint describes the details of ETL 1110-2-571, issued in April 2009, which established the current USACE vegetation removal policy.[857] ETL 1110-2-571 marked a change in USACE policy. It superseded the previous policy set forth in EM 1110-2-301which promoted vegetation-free zones on levees where woody vegetation posed a threat to levee safety and encouraged levee vegetation on levees where the levee structure would not be compromised.[858] EM 1110-2-301 allowed for regional flexibility where ETL 1110-2-571 established a strict national policy.[859] ETL 1110-2-571 essentially mandated that all flood reduction systems, including levees, have a vegetation-free corridor the width of the levee, plus fifteen feet on each side, and a height of eight feet.[860] All vegetation that does not conform to the policy must be removed. CDFW stresses that USACE did not prepare an Environmental Assessment (EA), an Environmental Impact Statement (EIS), nor consult with wildlife agencies prior to issuing the ETL.[861]

CDFW also describes the "PGL" and "Revised PGL" in the complaint. The PGL is USACE policy that sets forth procedures to obtain a variance from vegetation standards.[862] In 2010, USACE released the draft PGL and took public comments.[863] At that time USACE also announced that all previously-granted variances were revoked and if the applicant required a variance from the new ETL, the applicant would need to submit a variance application with the PGL.[864] The PGL guidelines require the submitting agency to comply with all applicable environmental laws, including the National Environmental Policy Act (NEPA) and the ESA before submitting a variance request.[865]

855 *Id.*
856 *Id.* at 6-7.
857 *Id.* at 7.
858 *Id.*
859 *Id.*
860 *Id.*
861 *Id.* at 8.
862 *Id.* at 10–11.
863 *Id.* at 10.
864 *Id.*
865 *Id.*

Further, as per the terms of the PGL, USACE will only grant a variance to sections of levee systems, not levee systems on a watershed scale.[866] This differed from the previous policy, which allowed variances on a watershed scale.[867] The PGL also differed from previous USACE policy in that waterside planting berms will now only be allowed after a variance is granted.[868] Additionally, previous USACE policy had allowed for variances on a case-by-case basis for any portion of the levee.[869] With the issuance of the PGL, that policy changed, and now certain portions of levees never qualify for a variance. This includes the upper third of the riverside slope, crown, landside, and the area within fifteen feet of the landside levee toe. [870] The PGL also diverges from previous USACE policy in that it no longer allows for trees less than five inches in diameter to be placed on the levee.[871]

CDFW further notes that in issuing the PGL, USACE published an EA and a Finding of No Significant Impact (FONSI), pursuant to NEPA.[872] These environmental review documents found that changing the variance process did not affect the environment, and that the PGL would not have a significant effect on the quality of the human environment.[873] Thus, USACE did not conduct a more extensive review under NEPA, which would have consisted of an EIS.

The CDFW complaint also describes the "Revised PGL," which is a subsequent variance policy issued by USACE of the same name as the PGL, published as a final rule in February 2012 (33 Fed. Reg. 9637). The complaint describes the Revised PGL as a final rule of general application.[874] It establishes the current process for applying for and receiving a variance from the ETL. This policy gives levee sponsors one year from the date of its issuance to develop a letter indicating intent to apply for a variance from the ETL, or to develop a SWIF.[875] The Revised PGL is very similar to the 2010 draft PGL, in that the sponsor must still comply with the ETL, it is still the sponsor's duty to comply with ESA and NEPA mandates, and there is no administrative means to contest an adverse decision.[876] It differs from the draft PGL in that it requires any scientific information regarding levee vegetation be peer-reviewed and submitted to the ERDC for first level of evaluation.[877] In other words, if a levee

866 *Id.* at 11.
867 *Id.*
868 *Id.*
869 *Id.*
870 *Id.*
871 *Id.*
872 *Id.* at 2.
873 *Id.* at 12.
874 *Id.* at 13–14.
875 *Id.* at 14.
876 *Id.*
877 *Id.*

sponsor wishes to submit new science or technology to justify keeping vegetation on levees, the submitter must first submit new science to USACE's ERDC for review, before including the science or technology in the variance request. In issuing the Revised PGL, USACE similarly issued an EA and FONSI under NEPA. There was no environmental review or consultation conducted under the ESA.[878]

The complaint also describes the USACE Policy for System-Wide Improvement Frameworks (SWIF), issued November 29, 2011.[879] The SWIF promotes a "fix-the-worst-first-policy" and describes a process for levee sponsors to bring levees into compliance with USACE requirements in a prioritized way while maintaining eligibility for assistance under PL 84-99.[880] Under the SWIF, levee sponsors must still comply with the ETL, and remove vegetation. However, the SWIF allows sponsors to delay removal and use limited funds to first address higher priority safety issues to levee integrity, rather than focusing on vegetation on levees, which is less of a threat to levee integrity.[881]

CDFW alleges that the above policies violate NEPA, ESA and APA. NEPA applies to all federal actions that significantly affect the human environment.[882] The federal actor must prepare an Environmental Assessment (EA), to determine whether an action might have any significant environmental effects, and if the EA raises substantial questions that the action may have a significant effect upon the human environment, an EIS is required.[883] Alternatively, if the federal acting agency suspects or knows that the action may have significant environmental effects, they can jump straight to preparing an EIS and skip the development of an EA.[884] If the agency determines, through the EA, that the proposed action will not have a significant effect on the environment, the agency must document and explain its decision and prepare a FONSI.[885]

An EIS is a lengthy and substantial environmental review document, intended to guide federal agency actions and encourage the acting agency to take into account the environmental effects of their actions.[886] An EIS must include (i) environmental impacts of a proposed action, (ii) any adverse environmental effects that cannot be avoided, and (iii) alternatives to the proposed action and mitigation measures to lessen any adverse impacts.[887] This is a public process

878 *Id.* at 2.
879 *Id.* at 15–16.
880 *Id.* at 15.
881 *Id.*
882 42 U.S.C. § 4332(C) (2012).
883 *See* 40 C.F.R. § 1501.4 (2017).
884 *Id.* §1502.4.
885 *See id.* §1508.13.
886 *Id.* § 1502.1.
887 Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 16–17.

where the acting agency solicits public comments.[888] In determining the "significance" of environmental effects, the agency must take into account listed species and critical habitat that may be affected.[889]

CDFW alleges that the ETL, SWIF and PGLs violate NEPA, because the release of these policies are final agency actions that would otherwise necessitate full NEPA review.[890] Further, they allege that the ETL, SWIF and PGLs are all likely to affect the quality of the human environment, and as such, USACE should have at the very least prepared an EA for each policy.[891] USACE prepared an EA for the PGL, followed by a FONSI, however, they did not prepare an EA for the ETL or SWIF policies.[892]

Additionally, CDFW alleges that the above actions have unambiguous significant environmental effects, and as such, USACE should have prepared an EIS (as opposed to a FONSI) for each policy.[893] To determine whether something has a "significant effect," the acting agency must consider any take or harm of any listed species, destruction of habitat for any listed species, and harm to fish and wildlife resources from unstable levees that fail and could cause flooding.[894] CDFW alleges that the ETL specifically causes direct, indirect, and cumulative adverse effects on California fish and wildlife resources through habitat destruction.[895] Similarly, CDFW alleges that the SWIF and PGLs have direct, indirect and cumulative adverse effects on California fish and wildlife resources.[896] Ultimately, CDFW argues that USACE should have prepared an EIS for the new levee vegetation management policies, and violated NEPA by failing to do so.[897]

Under the ESA, CDFW alleged that USACE violated the ESA for failing to consult with applicable wildlife agencies. Under ESA section seven, any federal agency carrying out an "agency action" (any action authorized, funded, or carried out by a federal agency), must ensure it is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the habitat of any listed species.[898]

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888 40 C.F.R. § 1503.1 (2017).

889 *Id.* § 1508.27(b)(9).

890 Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 17–18.

891 *See id.* at 16–18.

892 *Id.* at 1.

893 *See id.* at 17.

894 *Id.*

895 *Id.*

896 *Id.*

897 *Id.* at 18.

898 16 U.S.C. § 1536(a)(2) (2018); *see generally* 50 C.F.R. § 402.10 (2018) ("Each Federal agency shall confer with the Service on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat.").

CDFW alleged that the USACE levee vegetation removal policies, codified in the ETL, SWIF and PGLs, constituted agency actions within the meaning of the ESA. This is because the listed policies are all agency actions, directly and indirectly modifying the land and water. Thus, CDFW alleges that USACE clearly violated ESA policy in failing to prepare a BA or consult with USFWS and NMFS in promulgating the ETL, PGL and SWIF vegetation policies. [899]

The APA imposes regulations on federal agencies when they enact and enforce agency policies when they include substantive rules of general applicability.[900] CDFW alleges that the USACE violated the APA in issuing its vegetation removal policies. They argue that because the ETL, SWIF and PGLs all constitute new rules of general application, adopted without adequate public notice and opportunity to comment required by NEPA and ESA.[901] CDFW alleges that the USACE vegetation removal policy is arbitrary, capricious, and an abuse of discretion not in accordance with the law.[902]

Finally, for the purposes of NEPA and the ESA, CDFW described how the USACE vegetation removal policies are "final agency actions."[903] The definition and legal implication of the term determines whether or not the ETL, SWIF and PGL constitute "final agency actions." If considered "final agency actions," the policies would be subject to the requirements of the aforementioned federal laws, including NEPA.[904] For example, USACE would have violated NEPA and the APA because it failed to prepare an EIS prior to releasing the policies. CDFW alleges that the ETL is a final agency action for a few reasons. They provide numerous examples when LMA submitted requests for variances from the ETL, notifications to local maintainers that the projects do not conform to ETL requirements, the USACE's own statement that the ETL takes precedence over the guidelines of its O&M manual, and numerous local maintainers admissions that they are required to comply with the ETL policy.[905]

CDFW also points to policy arguments. One argues that the ETL changes the financial rights and obligations of levee sponsors.[906] Levee sponsors must now remove vegetation from levees in order to remain eligible for PL 84-99 funding. In order to remove vegetation, levee sponsors must spend large amounts of money and time on environmental review and authorizations under ESA. Another expresses that, as a direct result of the ETL vegetation removal policy,

899 Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 19.

900 5 U.S.C. §§ 552–559 (2012).

901 Cal. Dep't of Fish & Game's Complaint, *supra* note 181, at 20–21.

902 *Id.* at 18.

903 *Id.* at 21.

904 *Id.* at 17.

905 *See id.* at 8–10.

906 *Id.* at 10.

levee sponsors' legal rights and obligations have changed.[907] Levee sponsors are now either in noncompliance with the ETL and must forfeit assistance under PL 84-99, or remove riparian habitat and likely violate terms of the ESA. Or the levee sponsor could pay approximately $300,000 per levee mile to obtain a variance without any assurance that they would successfully obtain the actual variance requested.[908] Further, CDFW alleges that implementing the variance policy to comply with PGL standards would cost $1,100,000 per levee mile.[909]

CDFW requested declaratory relief in the form of a court order stating that the ETL, SWIF and Revised PGL violate NEPA, ESA and APA.[910] They also sought declaratory relief in the form of a court order requiring the USACE to comply with NEPA, ESA, APA and vacating (setting aside) the ETL, SWIF and PGL polices until such time as the USACE comes into compliance with NEPA and ESA.[911] Finally, CDFW sought an injunction, preventing the USACE from any further implementation of levee vegetation removal policies until the ETL, SWIF and PGLs comply with NEPA, ESA and APA.[912]

2. Dismissal

The CDFW case was ultimately dismissed on similar grounds to the FOR case. The development of WRRDA 2014, of which Section 3013 required USACE to revisit and reissue the ETL, PGL and SWIF policies, essentially targeted the exact arguments set forth by CDFW.[913] Thus, the case was dismissed without prejudice, which in a sense placed the case on hold until such time as the USACE complies with WRRDA 2014, section 3013 requirements. It should be noted once more that at the time of this paper, USACE has failed to comply with section 3013, and has not revisited or reissued its vegetation guidelines, nor has it reached out to the applicable resource agencies for input in any part of this process. It is therefore unclear if FOR or CDFW will reinitiate their lawsuits with USACE.

APPENDIX 4: SCIENCE AND RESEARCH

The issuance of USACE vegetation removal policies prompted efforts to justify both the presence and removal of vegetation on levees from various

907 *Id.*

908 *Id.* at 10.

909 *Id.*

910 *Id.* at 22.

911 *Id.*

912 *Id.*

913 Section 3013 of WRRDA 2014 is legislation that requires USACE to revisit and reissue the ETL, PGL and SWIF policies, taking local and environmental considerations into account. *See supra* APPENDIX I: Federal Laws and Policies for more details on WRRDA 2014.

stakeholders. Proponents from each side of the debate attempted to leverage scientific studies to reinforce their arguments. Initially, this led to the realization on both sides that more research needed to be done. Eventually this prompted the development of innovative and cutting-edge levee vegetation research.

A. 2007 Research symposium

In 2007, stakeholders met in Sacramento, California at the Levee Vegetation Research Symposium to address "The Vegetation Challenge."[914] In order to do so, the Symposium's description and purpose included "[a] scientific and engineering examination of managing vegetation along California's Central Valley Levees that protect urban and rural areas from devastating floods."[915]

The symposium was sponsored by USACE, the CVFPB, DWR and SAFCA.[916] These sponsors came together to explore science, real-world experience, challenges, and policy solutions related to levee vegetation. Registration numbers revealed over 511 people from 21 states nationwide registered for the symposium, representing over 151 agencies from federal, state and local flood management, resource agencies, academic institutions and consulting engineering and environmental firms.[917] Speakers at the Symposium presented information regarding the following topics:

- Differing perspectives on levee vegetation issues from Federal, State, and local flood managers;
- USACE levee vegetation guidelines;
- Greatest challenges State and Local levee managers face from USACE levee vegetation policies;
- USACE's technical manual for earthen dams; Root architecture, root response to soil conditions, levees and river hydrology;
- Geotechnical stability, levee seepage & piping and the effects of woody vegetation;
- Literature review of vegetation in flood control;
- Ground squirrel and other mammal relationship/interactions with vegetation on levees;

[914] The "Vegetation Challenge" refers to the title of the symposium. *See 2007 Levee Vegetation Research Symposium: Overview*, SACRAMENTO AREA FLOOD CONTROL AGENCY, http://www.safca.org/protection/Environmental_2007_Symposium.html (last visited August 18, 2016) ("This symposium was held in response to the release of US Army Corps of Engineers (Corps) draft white paper regarding maintenance standards for vegetation on levees. The requirements contained in the draft white paper called for the removal of trees and shrubs along the waterside and landside of Corps program levees nationwide, including 1600 miles of Central Valley levees, to be in compliance with existing standards.").

[915] *Id.*

[916] *Id.* (select "Day 1 Proceedings" tab).

[917] U.S. Army Corps of Eng'rs, *California Vegetation Levees Symposium, August* 2007, 1 FLOOD RISK MGMT. NEWSL., no. 2, 2007, at 7.

- Role of vegetation bank stability and revetments;
- Tree windthrow and contributing factors;
- Vegetation effects on river hydraulics, floodway conveyance and velocity response;
- Delta levee bank erosion, seasonal levee/bank changes, effects of wind waves and boat wakes;
- Lessons learned from elsewhere, including New Orleans vegetation removal activities, the Dutch experience and the role of woody vegetation on dykes in Bavaria, and the Missouri River;
- Origins of the Central Valley Flood Control Project;
- Overview of CA natural history, state of Central Valley river systems, and the California experience of flood fighting and levee inspection and repair activities;
- USACE levee repair pilot study;
- Overview of study of Sacramento region levee conditions;
- Engineer and science solutions and alternative levee designs;
- Risk and uncertainty/factors of safety/costs and benefits of implementing USACE's vegetation free zone policy;
- And a look to the future, including critical research needs and policies.[918]

The following is a brief description of each talk given at the Symposium. They highlight the state of the science when the Symposium took place in 2007.The Symposium began with a keynote speech given by the Mayor of Sacramento, Heather Fargo.[919] In that speech, she called for greater collaboration between all agencies, scientists and stakeholders, and expressed the importance of vegetation, especially in places like Sacramento, the "City of Trees."[920] The Symposium continued by introducing the levee vegetation conflict, and its timeliness and importance to the Central Valley.[921]

Proceedings began with perspectives from USACE, state and local agencies, researchers and engineers, and biologists. The speaker from USACE gave a presentation entitled, "Corps Perspective," followed by a speaker from DWR who gave a presentation entitled, "California Perspective," and finally the speaker from SAFCA presented on, "Local Perspective."[922] Each of these presenters outlined the basic policies of USACE, DWR and local agencies, respectively, noting the importance of balancing safety and environmental

[918] *2007 Levee Vegetation Research Symposium: Overview*, *supra* note 914.

[919] *Id.*

[920] *See* Heather Fargo, *Welcome*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Fargo_Transcript.pdf.

[921] *Id.*

[922] *2007 Levee Vegetation Research Symposium: Overview*, *supra* note 914.

concerns, and doing so in the face of limited resources.[923]

Next, USACE presented on the April 20, 2007 "Draft Final White Paper, Treatment of Vegetation within Local Flood-Damage-Reduction Systems".[924] The paper is described as a 34-page "thinking paper" that examines the levee vegetation issue at a policy level.[925] Subsequently, a presenter from DWR gave a talk that stressed issues the State and LMAs face when attempting to comply with the compliance issues with the USACE White Paper.[926] In addition to the shortcomings of the USACE policy, the DWR presenter also discussed DWR's view that fixating on vegetation issues would divert attention from more important levee safety issues.[927] The presenter called for collaborative discussions and greater scientific input in moving forward with levee vegetation policies.[928]

Presentations also included an overview of a report from a UC Davis plant scientist, Dr. Alison Berry, who focused on issues that tree roots pose as potential risk factors to levees.[929] Dr. Berry gave an overview of studies conducted on tree roots in levees, focusing on the potential for roots to cause increased seepage, or surface erosion from windthrow.[930] Results indicated that tree roots generally avoided "well-compacted fill," and the toe region of the levee, suggesting that mitigation measures such as keyhole trenches or slurry walls may be effective with coping with potential tree root concerns.[931] Dr. Berry also suggested numerous areas where more research was needed to better explore the issue, including more information combining trench excavation and other methods to determine "the real picture of roots and levees."[932]

Dr. Donald Gray, a Professor of Civil and Environmental Engineering from the University of Michigan also spoke to the general factors, including vegetation, which affect the structural stability and integrity of earthen levees.[933] The three major failure mechanisms affecting earthen levees include: mass stability failures, superficial erosion, and hydraulic forces.[934] Dr. Gray noted that

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923 *Id.*

924 *Id.*

925 *Id.* This paper is described in more detail in, *supra*, *Appendix 1: Federal Laws and Policies*.

926 *Id.*

927 *Id.*

928 *Id.*

929 *See* Alison Berry, *Root Architecture, Root Response to Soil Conditions, Levees & River Hydrology*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Berry_Transcript.pdf.

930 *Id.*

931 *Id.*

932 *Id.*

933 Donald Gray, *Geotechnical Stability, Levee Seepage & Piping and the Effects of Woody Vegetation*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Gray_Transcript.pdf.

934 *Id.*

most woody vegetation appears to have a beneficial influence on the structural integrity and stability of levees, because roots can reinforce soil and increase the resistance to shallow sloughing failures.[935] Vegetation can also improve resistance to scour and erosion that can occur during overtopping.[936] However, Dr. Gray also mentioned potential adverse effects vegetation on levees can pose, the foremost of which included instances of isolated, tall trees growing on levees prone to windthrow or that promote turbulence and erosion around their base.[937] Lastly, Dr. Gray argued that seepage erosion and piping problems attributed to tree root presence are not as great as have been suggested, and that seepage occurs in many ways irrespective of tree roots.[938]

A UC Davis Professor of Wildlife Biology, Dr. Dirk Van Vuren, gave a presentation on mammals on Sacramento levees, focusing on those with a potential for significant soil displacement through digging and burrowing.[939] Dr. Van Vuren found that removing woody vegetation on levees would have differing effects on burrowing animals, depending on the animal.[940] For instance, converting woody vegetation to open grassland could increase the abundance of voles, gophers, ground squirrels, and possibly badgers, likely have no effect on muskrats, and have uncertain effects on beavers. Dr. Van Vuren concluded that removing woody vegetation from levees may increase burrowing potential of some soil-excavating mammals.[941]

Dr. Douglas Shields, a research hydraulic engineer at the National Sedimentation Laboratory of the USDA Agricultural Research Service, gave a presentation on the effects of vegetation on levee slope stability and revetment durability.[942] Dr. Shields summarized a study conducted in 1987, which looked at six sites on the riverside of the Sacramento River levee supporting various types of vegetation. Dr. Shields revisited that study recently, taking information found from the original study and incorporating it into a computer model for slope stability. The model analyzed vegetation correlations with surface permeability of the soil, as well as slope stability.[943] Results indicated that roots generally reinforced the levee soil and increased factors of safety, and roots

935 *Id.*

936 *Id.*

937 *Id.*

938 *Id.*

939 Dirk Van Vuren, *Ground Squirrel & Other Mammal Relationships/Interactions with Vegetation on Levees*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_VanVuren_Transcript.pdf.

940 *Id.*

941 *Id.*

942 Douglas Shields, *Role of Vegetation in Bank Stability & Revetments*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Shields_Transcript.pdf.

943 *Id.*

generally posed no seepage problems, except in extreme and unlikely conditions.[944] Results further indicated that roots generally did not create any void in the soil, although voids were associated with animal activity. Dr. Shields concluded by describing areas not covered in the study, including woody vegetation impacts on maintenance and inspection activities.[945] These areas are still in need of study.

A forest ecologist in the Department of Plant Biology at the University of Georgia, Dr. Chris Peterson, presented on risks of uprooting that high winds pose to trees.[946] Dr. Peterson noted that at the time of the symposium, there had been no published studies documenting the effects of high winds leading to tree uprootings on levees. Therefore, he spoke to the research that had been conducted for tree uprootings in forest settings. [947] Major factors in uprootings include high winds, which are generally not an issue in California's Central Valley.[948] A higher rate of windthrow is correlated with larger, taller trees, and windthrow properties differ by species.[949] Larger trees are also more likely to create large "root pits" or holes in the ground as the tree uproots, but this is also influenced by tree species.[950] Additionally, lower-density (or trees spaced further apart from each other) are more vulnerable to windthrow than higher-density trees.[951] Shallow roots in saturated soils are also more likely to uproot due to windthrow than deeper roots in less saturated soils.[952] Dr. Peterson concluded by suggesting additional research is needed, most likely in the Central Valley, including merging models with site-specific features like soil conditions and topography to get predictions for particular stretches of levee in the Central Valley.[953]

Dr. Johannes DeVries, an internationally recognized expert in hydrology and hydraulic engineering gave a presentation on vegetation effects on river hydraulics and floodway conveyance, or the capacity of the river to carry flow.[954] Dr. DeVries applied models for flow to the specific dimensions of the

944 *Id.*

945 *Id.*

946 *See* Chris J. Peterson, *Tree Windthrow & Contributing Factors*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Peterson_Transcript.pdf.

947 *Id.*

948 *Id.*

949 *Id.*

950 *Id.*

951 *Id.*

952 *Id.*

953 *Id.*

954 Johannes DeVries, *Vegetation Effects on River Hydraulics, Floodway Conveyance & Velocity Response*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_DeVries_Transcript.pdf.

Sacramento River, looking at areas with and without vegetation on levees.[955] He found that reducing vegetation or dense vegetation next to levees generally increased the velocity of water, which in turn increased the potential for scour.[956] Dr. DeVries also analyzed erosion from high wind waves and boat wakes on levees, and found that grass levees acted basically like smooth or concrete surfaces, and were the most resistant to erosion from high waves.[957] Shrubs and trees however, seemed to provide erosion protection from waves, and rock and riprap provided the greatest degree of protection.[958] The ability of woody vegetation to protect levees from erosion due to high waves also differed depending on branch location, with maximum protection provided by trees with stems and branches in the water.[959]

Dr. Douglas Sherman, a Professor and Department Head at Texas A&M University's Department of Geography gave an overview of a decadal research project designed to assess the impacts of boat wakes on delta levees, with an emphasis on the influence of vegetation.[960] Dr. Sherman had been monitoring forty-four sites, four times per year, and the sites represented a cross section of environments in the Sacramento-San Joaquin Delta. The study recorded horizontal and vertical erosion at all sites, and monitored boat traffic, including boat speed, length, wake characteristics, and cumulative bank effects.[961] The conclusion of the study indicated that levee erosion from boat wakes in the Delta is slowed by the presence of vegetation, particularly from tule stands and brush bundles.[962]

At the time of the symposium, little direct vegetation research had been conducted on California levees.[963] Thus presentations focused on levee vegetation research and policies in New Orleans, the Missouri River, the Netherlands, and Germany. The presentation from New Orleans, entitled "New Orleans; Current vegetation removal activities, driving factors & technical basis", discussed how, in the wake of Hurricane Katrina, the New Orleans District of USACE established a tree removal project team to remove trees and other woody vegetation on and near levees and floodwalls.[964] The presenter,

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[955] *Id.*

[956] *Id.*

[957] *Id.*

[958] *Id.*

[959] *Id.*

[960] Douglas J. Sherman, *Delta Levee Bank Erosion, Seasonal Levee/Bank Changes, Effects of Wind Waves & Boat Wakes*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Sherman_Transcript.pdf.

[961] *Id.*

[962] *Id.*

[963] See *2007 Levee Vegetation Research Symposium: Overview*, *supra* note 914 (select "Day 1 Proceedings" tab).

[964] Michael Stout, *New Orleans; Current Vegetation Removal Activities, Driving Factors & Technical Basis*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007),

Michael Stout, spoke to problems posed by trees to levee stability and seepage, as well as maintenance, inspection and flood-fighting, as well as the process of removing trees from the levee system, highlighting challenges and issues. Stout, a Project Manager for Tree Removal with USACE, worked to remove trees, fences and other encroachments within 15 feet of levees.[965] Stout described how, in the course of his work, he encountered tree roots posing problems to levee safety by providing pathways for seepage.[966] He also described how, during storms when trees blow over and root balls create voids, large trees can worsen seepage and weaken levee stability.[967] Further, he contended that the shading of trees could result in erosion of the levee embankment and poor grass turf establishment.[968] Finally, Stout argued that trees too close to levees impair maintenance, inspections and flood fighting activities on levees.[969]

The Dutch presentation, "The Dutch Experience: Scientific basis for Dutch levee vegetation policy", was given by a Dutch Geotechnical Specialist, Clara Spoorenberg.[970] She described how, in the Netherlands, national legislation states that no trees on levees are permitted, but that despite these regulations, trees occur on much of the Dutch levee system.[971] In practice, the Dutch approach to levee vegetation management is characterized by flexibility and site-specific needs.[972] Spoorenberg thus argued that the required safety level could be guaranteed without removing vast amounts of trees from levees.[973] Two-thirds of the Netherlands is below mean sea level, with some parts of the country as low as seven meters below sea level. The country is at risk of flooding due to high water levels from the North Sea, large rivers overflowing from Germany and Belgium, and several large lakes within the country's borders.[974] It is secured against flooding by more than 3,500 kilometers of levees, dikes and dams, some of which are over 1,000 years old.[975] In addition to the primary levees, the Dutch maintain 14,000 kilometers of secondary levees along canals, small streams, brooks, creeks and smaller lakes.[976] Maintainers, consisting of Dutch water boards, are required to perform a safety review on the

http://www.safca.org/protection/NR_Documents/2007_Symposium_Stout_Transcript.pdf.

965 *Id.*

966 *Id.*

967 *Id.*

968 *Id.*

969 *Id.*

970 Spoorenberg, *supra* note 362.

971 *Id.*

972 *Id.*

973 *Id.*

974 *Id.*

975 *Id.*

976 *Id.*

primary levees every five years.[977] Dutch water boards have various approaches regarding policies towards trees on levees, generally grouped into "toleration policies" or "extinction policies," where toleration policies allow trees on levees and extinction policies require removal and replanting.[978] Spoorenberg pointed to levee stability problems that may have been related to the presence of trees.[979] Following those events, the Dutch Levee Advisory Board published new legislation in 2000 and 2001. This policy required the removal of many trees in the name of safety, but prompted public backlash.[980]

Spoorenberg continued by arguing that trees influence levee stability in either a positive or negative manner, depending on the location within the levee profile, the weight of the tree, and other factors.[981] In addition to causing dynamic tree motions during storm conditions, trees may cause damage during a storm by retaining the water source they are a part of.[982] Trees can also increase soil stability, depending on local conditions.[983] The largest threat that trees posed to levee stability, according to Spoorenberg, is uprooting.[984] However, she discussed possible solutions to this problem, including planting new trees near old, decaying trees, so that the new roots would replace the hollow spaces left from decaying roots and reduce the chance of uprooting.[985] Spoorenberg also presented the demonstrated public support for maintaining trees in the Netherlands, and pointed to situations where action groups successfully blocked planned tree removals via litigation.[986] In these situations, the court ordered that only necessary trees be taken down.[987] Overall, despite strict anti-vegetation policies, the Dutch experience is practically characterized by a flexible system that takes into account the possible negative and positive effects woody vegetation on levees provides.[988]

The German presentation, "German experience: Role of woody vegetation on dikes in Bavaria," was given by a German Project Engineer for the State Department of Water Resources and Institute of Hydraulic and Water Resources Engineering of the University of Technology in Munich, Dr. Ronald Haselsteiner.[989] He spoke to safety issues facing levees and dikes in Bavaria,

977 *Id.*
978 *Id.*
979 *Id.*
980 *Id.*
981 *Id.*
982 *Id.*
983 *Id.*
984 *Id.*
985 *Id.*
986 *Id.*
987 *Id.*
988 *Id.*
989 Ronald Haselsteiner, *German Experience: Role of Woody Vegetation on Dykes in Bavaria*,

Germany, comparing German technical specifications with international standards.[990] Dr. Haselsteiner spoke to the positive and negative effects woody vegetation can have on dikes and levees. As for the positive effects, he spoke to the ability of woody vegetation to provide natural reinforcement and drainage, protecting against surface erosion and acting as shoreline protection.[991] The negative effects included the hindrance woody vegetation poses to properly conduct flood fighting and inspections.[992] Negative effects also included dike breaches, although it was not clear whether reported breaches were caused by trees, or other factors.[993] Negative effects also include windthrow, where trees fall over, which can damage levees and dikes as roots are ripped from the earth.[994] Dr. Haselsteiner spoke to the issue of rotting roots causing erosion, but concluded that there is still an unanswered question as to whether rotting roots cause erosion or not, and mentioned ongoing studies that sought to shed light on that issue.[995]

The presenter from the Missouri River, Dr. John Dwyer, an associate professor and forest management specialist with the Department of Forestry at the University of Missouri, gave a presentation entitled, "Missouri River 1993 - Woody vegetation on levees & woody corridors."[996] Dr. Dwyer described results from a 2003 study, in which a 353-segment along the Missouri River was investigated to determine the relationship between woody vegetation corridors and levee damage during the flood of 1993.[997] The study demonstrated the protective values of woody corridors in the floodplains of the Missouri River. The study showed that, with a woody corridor width of 300 feet or more, the chance of levee failure was reduced by 75% or more.[998] Further, the median failure length for levees that did not have a woody corridor was significantly longer than failure lengths for levees where a woody corridor was present.[999] The study also demonstrated that there was an inverse relationship between the width of the woody corridor and length of levee failure.[1000] In other words, as the width of the woody corridor increased, the length of the levee failure

SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Haselsteiner_Transcript.pdf.

990 *Id.*

991 *Id.*

992 *Id.*

993 *Id.*

994 *Id.*

995 *Id.*

996 John Dwyer, *Missouri River 1993—Woody Vegetation on Levees & Woody Corridors*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Dwyer_Transcript.pdf.

997 *Id.*

998 *Id.*

999 *Id.*

1000 *Id.*

generally decreased.

The study also evaluated whether eligibility under USACE PL 84-99 program correlated with levees that were less likely to fail.[1001] The PL 84-99 program is one of federal rehabilitation relief after an emergency flood event, and is described in greater detail in *Appendix 1: Federal Laws and Policies*. In order to maintain eligibility in the PL 84-99 program, levee maintainers must meet USACE structural and engineering requirements.[1002] Dr. Dwyer found that levees were equally likely to fail regardless of their status in the PL 84-99 program.[1003] He also found a highly significant difference in length of levee failure depending on whether or not a woody corridor was present upstream of the levee.[1004] When a woody corridor was present upstream of a levee, the median levee failure length was about 341 feet. Absent the presence of a woody corridor upstream of a levee, median failure length was about 787 feet.[1005] For levees that did not fail, the median woody corridor length was 4,882 feet, but for levees that did fail, the median woody corridor length was 2,946 feet.[1006] Having a long woody corridor upstream from a levee was highly significant in whether or not the levee failed.

Dr. Dwyer also pointed out that the study did not look at bank stability but mentioned other studies that found that vegetation played a more significant role than soil type in reducing bank stability.[1007] Dr. Dwyer spoke to complex issues posed by roots in levees. On one hand, roots that die off create channels in the soil, which can negatively affect levee stability.[1008] On the other hand, he pointed to examples of tree roots in levees that kept the levees functioning and stable during flood events.[1009] He finished by offering numerous ideas for future research, stressing the importance of studying effects of woody vegetation on levees as a comprehensive, integrative practice, looking at as many risk factors as possible together, rather than studying the effects woody vegetation to levees in a vacuum.[1010]

The second day of the Symposium began with presentations from local maintainers who provided, "Regional perspective on levee conditions, risk factors, & consequences of implementing Corps' vegetation guidance & levee certification standards."[1011] The president of MBK Engineers provided the

1001 *Id.*
1002 *Id.*
1003 *Id.*
1004 *Id.*
1005 *Id.*
1006 *Id.*
1007 *Id.*
1008 *Id.*
1009 *Id.*
1010 *Id.*
1011 *2007 Levee Vegetation Research Symposium: Overview*, *supra* note 914 (select "Day 2

history and description of the Sacramento River Flood Control Project (SRFCP).[1012] Steve Chainey, a senior ecologist and watershed restoration expert also provided an overview of the natural history and current state of Central Valley river systems.[1013] This included an overview of the functions of river vegetation, which includes: shading and cooling the aquatic zone; providing nutrients and food exchange between terrestrial and aquatic habitats; proving a migration corridor for bird populations; providing cover and rearing habitat for fish, including juvenile salmon and steelhead; a source of instream woody material vital for juvenile fish survival; and as energy dissipation for waves, flows and sediment.[1014]

Chainey also spoke to the importance of floodplains with frequent (two to five year) flooding events.[1015] California has a few remnant floodplains left, but, for the majority of the state, natural floodplains remain cutoff from the river by levee systems.[1016] Today, the Sacramento and San Joaquin rivers are contained narrowly on each side by levee walls that are higher than the natural floodplain surface.[1017] Some riparian habitat remains at the waterside toe of levees, which Chainey described as "substitute floodplain habitat."[1018] The remaining forest, even that on the landside of levees, is not regenerating because the floodplains are isolated, so seed is not delivered in the spring as it naturally would.[1019] This riparian habitat is especially important to the survival of salmonids, particularly steelhead, which depend on the riparian system for spawning, migration and rearing habitat.[1020] In the case of steelhead, dams now block eighty percent of their historic reproductive habitat, and thirty-seven of the fifty tributaries of the Sacramento River are now completely blocked.[1021] Today, out-migrating juvenile salmon are predominantly forced to use the remaining shoreline, shallow vegetation and woody debris as cover from predators and heat, and to feed.[1022] However, much of the remaining vegetation on the waterside of levees

Proceedings" tab).

1012 Joseph D. Countryman, *Origins and State of Central Valley Flood Control Project*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 29, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Countryman_Transcript.pdf.

1013 *2007 Levee Vegetation Research Symposium: Overview, supra* note 816 (select "Day 2 Proceedings" tab); Steve Chainey, *Natural History and State of Central Valley River Systems*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 29, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Chainey_Transcript.pdf.

1014 *Id.*

1015 *Id.*

1016 *Id.*

1017 *Id.*

1018 *Id.*

1019 *Id.*

1020 *Id.*

1021 *Id.*

1022 *Id.*

has also been removed in favor of "rip-rap" or rocks covering the entire waterside of the levee, devoid of any vegetation. In the upper Sacramento River, three quarters has been armored with rip-rap, and out of the entire Sacramento River system, 200 miles, or nearly half, is covered with rip-rap.[1023] Finally, Chainey offered innovative engineer design solutions for safe levees designed by engineers and informed by biologists.[1024]

A water Resources Engineering Associate and Flood Fight Specialist with DWR, Rick Burnett, spoke to the experience of flood fighting and levee inspection in the Central Valley.[1025] Levee vegetation can pose issues for patrolling in advance of a flood event, and during the actual act of flood fighting. Vegetation presents a problem for regular patrollers, as it can hamper their view of any possible defects in the levee, and make patrolling much more difficult.[1026] Vegetation can also impede the ability of flood fighting by obstructing responders, and making it difficult for crews to deploy equipment.[1027] Burnett expressed the view that vegetation was more of an issue for regular maintenance and inspections, but for flood fighting, levee vegetation is "not so bad. If vegetation is in the way, it's usually cleared quickly by the same flood fighters that are responding."[1028]

The USACE Sacramento District also provided results from the Lower American River levee section pilot study.[1029] USACE and DWR conducted the study to test out USACE consistent national inspection ratings and standards checklists for both federal and nonfederal projects. USACE also wanted to be sure that local sponsors and state sponsors were applying the USACE inspection rating and checklists in a uniform manner.[1030] Inspection items were categorized into "acceptable," "minimally acceptable," and "unacceptable." Upon inspection, each district was expected to have a current O&M Manual and to be prepared with emergency supplies. Levees themselves were also examined for slope stability and slope cracking.[1031] There were some problems found with levee erosion and bank caving. There were three items on the checklist that were rated under the "unacceptable category," including: unwanted vegetation

[1023] *Id.*

[1024] *Id*. For more details on these innovative designs, see *supra*, *Part IV: Solutions*.

[1025] Rick Burnett, *California Experience—Flood Fighting, Levee Inspection & Repair*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 29, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Burnett_Transcript.pdf.

[1026] *Id.*

[1027] *See id.*

[1028] *Id.*

[1029] *Id.*

[1030] *See* Meegan G. Nagy, *US Army Corps Sacramento District - LAR Levee Section Pilot Study Results*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 29, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Nagy_Transcript.pdf.

[1031] *Id.*

growth, animal control, and encroachments.[1032] Unwanted vegetation included trees within the levee prism or within a 10-15 foot area from the landside or waterside toe.[1033] Corrective actions following the inspection included "about 1.5 miles of tree and wild growth removal."[1034] The biggest challenges in ensuring uniform inspections included the length of time to conduct thorough inspections, coordination with property owners, enforcement of encroachment permits (or lack thereof), and compliance with environmental laws.[1035] Since the study, inspection checklists were updated to be a bit more lenient in terms of not rating an area "unacceptable" based on one unacceptable item and revising the 15-foot vegetation free zone to an "easement area."[1036]

SAFCA gave an overview of a Sacramento-region levee vegetation and levee condition survey, as well as risk factors and issues encountered from attempting to implement the USACE vegetation guidance.[1037] Results indicated that there would likely be about 3,800 trees in the 20 miles surveyed that would need to be removed in order to comply with USACE guidelines.[1038] The average number of trees in the vegetation free zone is about 37 trees per 1,000 feet, and assuming about a 20-foot circle around those trees in order to remove them, there would be about 12,000 square feet of levee disturbance involved in tree removal.[1039] This presents problems in terms of significant levee reconstruction cost and labor in order to comply with the vegetation removal guidelines.[1040]

The symposium concluded with presentations on, "Policy solutions based on applied engineering and science – a practical vision for the future and those living behind the levee. Costs vs. benefits, multi-use values, & appropriate standards for vegetation removal along river levees."[1041] The first of these panels focused on applying engineering and science to solutions, with nine panelists representing a diverse set of disciplines.[1042] The second focused on risk and uncertainty, and costs and benefits of implementing USACE vegetation removal

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1032 *Id.*

1033 *Id.*

1034 *Id.*

1035 Ken Rood, *SAFCA's Study of Sacramento Region Levee Vegetation & Levee Conditions—Survey Results, Risk Factors & Issues for Corps' Vegetation Guidance*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 29, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Rood_Transcript.pdf; *See generally* Ed Wallace, *Overview of the Sacramento River & Levees in the Metropolitan Area*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 29, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Wallace_Transcript.pdf.

1036 *Id.*

1037 *Id.*

1038 *Id.*

1039 *Id.*

1040 *Id.*

1041 *2007 Levee Vegetation Research Symposium: Overview*, *supra* note 914 (select "Day 2 Proceedings" tab).

1042 *Id.*

policies.[1043] The final panel focused on critical needs for the future, and opportunities for flexibility in policy implementation.[1044] Themes from all panels included benefits versus risks of woody vegetation on levees; cost and labor required in vegetation removal; and full compliance with USACE guidelines versus regional flexibility.[1045]

The 2007 Levee Vegetation Research Symposium was groundbreaking in that it brought leading scientists and researchers together with policymakers to discuss contemporary levee vegetation research and policies. One key conclusion from the symposium was that there is a lack of scientific research on interactions of woody vegetation on California levees. Thus, the 2007 Levee Vegetation Research Symposium prompted tremendous strides in levee vegetation research over the next few years.[1046]

B. ERDC: 2010 Literature Review & 2011 White Paper

1. Literature Review

USACE's Engineer Research and Development Center (ERDC) conducted a literature review of topics related to vegetation on levees, to gain a better understanding of whether vegetation on levees compromises levee integrity.[1047] ERDC reviewed 200 documents in this process, including policy documents from state, federal, local, and international levels; journal articles; proceedings and transactions; newspaper articles; grey literature (including documents not published in an accessible format) and personal communications. Of the 200 reviewed, 140 documents were included in the literature review, and from that, 18 were considered "pertinent" literature documents that dealt with vegetation on levees. Of those 18 documents, multiple documents may have stemmed from the same initial research or data, so a central message of the effort was that, at the time, there was not considerable existing research on this subject.[1048]

The report highlighted many areas where additional research is needed, including: the influence of woody vegetation on burrowing animal habitat; the effect of woody vegetation on maintenance, inspection and flood fighting; a system-wide approach to future research to better understand the interaction of woody vegetation with different components of the levee system, environment, and river community; the effect of tree root decay and tree throw-down (the hole

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1043 *Id.*

1044 *Id.*

1045 *Id.*

1046 *Id.*

1047 CORCORAN ET AL., *supra* note 73, at 1.

1048 *See* Maureen K. Corcoran, *Literature Review of Vegetation in Flood Control*, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2007), http://www.safca.org/protection/NR_Documents/2007_Symposium_Corcoran_Transcript.pdf.

remaining after a tree has been uprooted) on seepage and levee stability; the effect of woody vegetation on slurry cutoff walls; and the benefits and risks of converting wooded levees to grass-covered levees, including the engineering feasibility and economic cost of such a conversion.[1049]

The review summarized the most prevalent issues found in existing literature. This includes the suggestion that levees be addressed in terms of ecosystem habitat diversity (as separate environmental communities), and that specific guidance be established for those ecosystems.[1050] The review recommended that "scientific and engineering principles should support guidance addressing woody vegetation on levees."[1051] Thus, based on a review of existing literature regarding levee vegetation, ERDC ultimately recommended that levee maintainers address levee vegetation on an ecosystem/regional scale and utilize the best available science in doing so.

2. 2011 Report

In September of 2011, ERDC conducted research on the impacts of trees on levees, releasing results of the research into a report, "Initial Research into the Effects of Woody Vegetation on Levees" (report).[1052] This was a "two-year, $1.34 million research effort. . . [that] included a global literature review, site characterizations and assessments, field data collection (root mapping, root strength, and soil properties) and numerical model development."[1053]

The report was unique in that no other program of this magnitude had ever been attempted on this topic. It involved a range of disciplines and employed several cutting-edge technologies. The report was presented in four volumes: (I) Project overview, (II) Field data, (III) Numerical modeling, and (IV) Summary of results and conclusions.

The report made clear that the research was not intended to weigh positive versus negative effects of woody vegetation on levees, but suggested that future efforts aim to do so. The analysis was limited to sandy or silty levees (those found in the Central Valley), and was further limited to living, isolated trees.

Volume I provided an explanation of the purpose of the report, which is to examine the positive and negative impacts of vegetation on the two primary levee failure mechanisms the USACE determined could be caused by levee vegetation: internal erosion or seepage, and slope stability.[1054] Volume II

1049 CORCORAN ET AL., *supra* note 73, at 16.

1050 *Id.*

1051 *Id.*

1052 *Fact Sheet: Initial Research into the Effects of Woody Vegetation on Levees*, U.S. ARMY CORPS ENGINEERS (Sept. 7, 2011), http://wri.usace.army.mil/documents/woody_vegetation_report/FactSheet-Woody_Vegetation_Report.pdf.

1053 *Id.*

1054 MAUREEN K. CORCORAN ET AL., *Volume I: Project Overview*, *in* INITIAL RESEARCH INTO

provided an overview of field tests conducted by ERDC, much of which was used in modeling efforts. [1055] Because of time constraints, much of the field data collected was not used in modeling, although models did include field data regarding root strength in slope stability. Other parameters, including levee geometry, soil characteristics, river hydrology and site geology were obtained from existing studies and reports.[1056]

Field tests included site assessments at six field sites east of, or within Dallas, Texas, as well as four western sites. These western sites include: Albuquerque, New Mexico; Burlington, Washington; Portland, Oregon; and Sacramento, California. The field studies included non-invasive and invasive techniques to collect root characterization data. The research team modified a root pull-out method, using an apparatus to measure root strength and applied non-intrusive methods to map tree roots.[1057] Data was also collected on soil properties around nine trees at eight locations. Findings from field studies indicate little to no evidence that tree roots influence the average hydraulic conductivity[1058] of soil.[1059] Field studies testing root strength indicated no difference in strength due to species, but location and root diameter were important determining factors for root strength.[1060]

Volume III summarized the numerical models and parameters used in simulating tree effects. Two-dimensional (2-D) models considered critical conditions for slope stability and seepage at the four western sites and within four levee cross sections (on both riverside and landside). These conditions were then used to assess levee performance at differing locations for single trees. Results showed that root zones generally affect the flow field (flow of groundwater through the soil) within their immediate vicinity but have no influence in the overall flow field.[1061] The models did not show any conclusive evidence that tree roots negatively influence seepage pathways in soil.[1062]

Three western sites were chosen to assess the affects of woody vegetation on erosion. The probability of woody vegetation causing internal erosion was

THE EFFECTS OF WOODY VEGETATION ON LEVEES (2011), http://wri.usace.army.mil/documents/woody_vegetation_report/Vol_I-Project_Overview.pdf.

[1055] MAUREEN K. CORCORAN ET AL., *Volume II: Field Collection (Text)*, *in* INITIAL RESEARCH INTO THE EFFECTS OF WOODY VEGETATION ON LEVEES (2011), http://wri.usace.army.mil/documents/woody_vegetation_report/Vol_II-Field_Data_Collection-Text.pdf.

[1056] Interview with Douglas Shields (June 2016).

[1057] CORCORAN ET AL., *supra* note 1055, at 244, 425.

[1058] *Id.* at 378 (defining hydraulic conductivity as "a measure of the ability of a soil to transmit water").

[1059] *Id.* at iii.

[1060] *Id.* at 442–43.

[1061] MAUREEN K. CORCORAN ET AL., *Volume III: Numerical Model Simulation*, *in* INITIAL RESEARCH INTO THE EFFECTS OF WOODY VEGETATION ON LEVEES (2011), http://wri.usace.army.mil/documents/woody_vegetation_report/Vol_III-Numerical_Model_Simulation.pdf.

[1062] *Id.* at iii.

concluded to be "negligible" at the toe of the levee for the Burlington and Portland sites.[1063] The probability of internal erosion occurring at the Albuquerque site was concluded to be, "negligible to 0.25."[1064]

Three-dimensional (3-D) models analyzed "worst case" scenarios for flow field around root zones, but found no apparent change to flow field or seepage associated with these zones.[1065] In general, the effect of a single tree on levee performance is smaller in the 3-D model than in the 2-D model.[1066]

2-D models were also used to determine the importance of tree location on slope stability. In general, the study found that trees on the upper part of the levee slope made levees less safe, because they add weight to the upper slope, but trees near the toe made levees safer by adding stability.[1067] Trees at midslope generally had a neutral effect on levee safety.[1068] Slope stability was also analyzed relative to wind loads. The models found that wind speeds are greater than 40 miles per hour, the factor of safety decreases for all tree locations evaluated.[1069]

Volume IV summarized the results and conclusions of the report. It stressed the many limitations of these models, and the need for additional research. It also discussed how tree roots can increase or decrease the factor of safety with respect to slope stability, depending on the location of the tree on the levee. When wind speeds greater than 40 miles per hour are considered, the factor of safety decreases for all locations evaluated.[1070] The research team further concluded that "because of the extreme variability in geology, tree species, climate, and soils, the impact of trees on levees must be analyzed on a case-by-case basis" that takes into account tree weight, tree location, root system and wind loads.[1071] The team also identified areas that required further study, including: impacts of dead or decaying root systems causing "piping," or seepage due to preferential flow paths; seepage generally and the progression of piping; general study on impacts from dead or decaying roots; windthrow and animal burrows in relation to seepage; the impact of woody vegetation on the hydraulic conveyance of a river; biological impacts; woody vegetation in relation to scour and erosion; and woody vegetation in relation to O&M activities.[1072]

USACE publicized the following results in a release through the public affairs

[1063] CORCORAN ET AL., *supra* note 1054, at v.

[1064] *Id.*

[1065] *Id.* at vi.

[1066] CORCORAN ET AL., *supra* note 742, at 22.

[1067] *Id.* at v.

[1068] *Id.*

[1069] *Id.* at vi.

[1070] *Id.*

[1071] CORCORAN ET AL., *supra* note 1054, at vi.

[1072] *Id.*

office:

> – Initial research has advanced our knowledge and understanding of some aspects of this complex issue.
>
> – The presence of trees on a levee increases the uncertainty associated with levee integrity and performance.
>
> – ERDC researches considered the effects of trees at various locations on levees and found that a tree may either increase or decrease the factor of safety; at some locations where a tree was found to increase the factor of safety under one set of conditions, that same tree was found to decrease the factor of safety when other likely conditions were considered.
>
> – ERDC researchers have determined that because of the many variables, including climate, moisture, soil types, three species and levee designs, the full impacts of trees on levees may never be fully quantifiable.[1073]

The public release concludes that the impacts of vegetation on levees remains "extremely complex, highly variable, and unquantifiable."[1074] USACE suggests that in the face of uncertainty, "USACE remains confident that a well-constructed levee with well-maintained grass cover represents the optimal goal for reducing the uncertainty of the performance of levee systems."[1075] It is likely that in the face of complex results, USACE chose what they viewed as the safest policy choice, which is to refrain from updating their vegetation removal policy until more conclusive science is presented.

C. 2011 DWR Memo

On March 23, 2011, the URS Corporation prepared for DWR's Division of Flood Management a Memorandum on, "The Influence of Vegetation on Levee Past Performance—a Review of Historic Data Based on the Levee Evaluation Program Database" (DWR Memo). This memo was developed as part of the Levee Evaluation Program (LEP), which evaluates the safety of both urban and non-urban levees in the Central Valley.[1076] At the time of the DWR Memo's release, DWR was beginning an effort to evaluate 470 miles of urban levees and 1,620 miles of non-urban levees in the LEP, determining where levees did not meet geotechnical criteria, and identifying remedial measures to bring levees

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[1073] *Fact Sheet: Initial Research into the Effects of Woody Vegetation on Levees*, *supra* note 1052.

[1074] *Id.*

[1075] *Id.*

[1076] Memorandum from Kabir & Bean, *supra* note 81, at 1.

into compliance.[1077]

The research team collected information on levees in the Central Valley from reports, interviews, historic data and field observations.[1078] The team cataloged the documents, reviewing each for points of interest (POIs) related to levee performance. POIs included: (1) locations with reported instances of past levee performance issues such as erosion, underseepage (boils), through-seepage, breaches, slides and overtopping; (2) locations with reported implemented mitigation measures, such as slurry cutoff walls or levee raises; and (3) locations with levee engineering structures such as pipe penetrations, pump stations, or weirs.[1079] Significant events related to levee performance were categorized by those related to seepage, stability, erosion, overtopping and levee breach. This included a database of more than 10,000 records and additional evaluation of over 350 miles of urban levees.[1080]

The review of performance data indicated that primary factors that play a key role in levee performance are: levee foundation characteristics, levee material, levee geometry, and hydraulic head.[1081] Secondary and external factors that may influence levee performance are animal burrows and the presence of utility penetrations.[1082]

Levee performance records were also evaluated to determine how vegetation affects levee performance. These records were categorized into the following: (1) performance records identifying vegetation as a factor that adversely or positively influenced levee performance; (2) performance records identifying vegetation as a factor that influenced levee operations and maintenance (O&M) activities; (3) performance records with an incidental description of vegetation, but no indication that vegetation influenced levee O&M or levee performance; and (4) performance records identifying the occurrence of vegetation in association with performance data but with no clear cause-effect relationship between levee performance and vegetation.[1083]

Of the over 10,000 records reviewed, 6,970 were identified in the four categories above. Of these categorized records, 348 described levee breaches that resulted in floodwater flowing to the landside of the levee. None of the records identified vegetation as an influence on the breach.[1084]

Of the remaining 6,622 performance records, 95 indicated the presence of

1077 *Id.* at 1.
1078 *Id.* at 2.
1079 *Id.* at 2.
1080 *Id.* at 3.
1081 *Id.*
1082 *Id.*
1083 *Id.* at 4.
1084 *Id.*

vegetation in the vicinity of an identified levee performance issue.[1085] These included: 11 records indicating that vegetation was a factor that influenced levee performance; 25 records indicating that vegetation had an influence on levee O&M; 39 records referencing vegetation in a way that was irrelevant to levee performance or O&M; and 20 records discussing the presences of vegetation in the vicinity of a levee performance issue, but with insufficient information about the role of vegetation on levee performance.[1086]

The memo concludes that records indicating vegetation had an influence on levee performance is very small, at 1.4% of total records, and of these, only 12% indicate that vegetation played a role in levee performance.

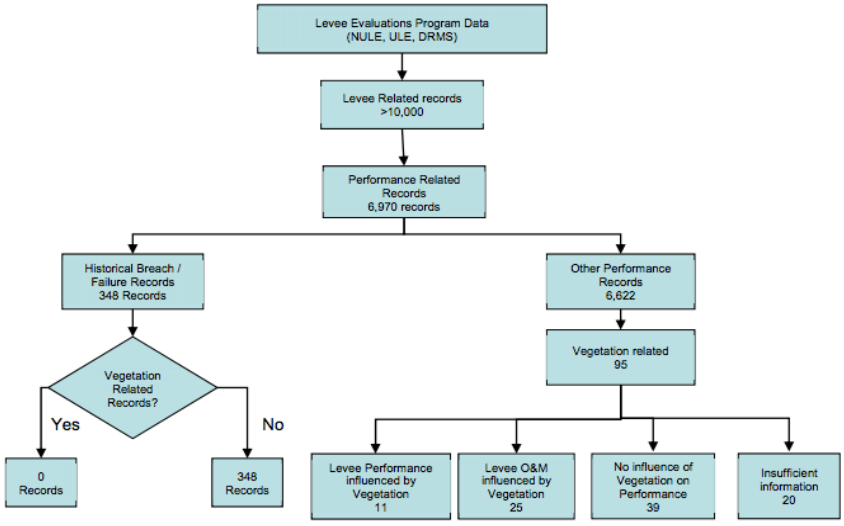

Figure 22: Levee Performance Records[1087]

[1085] *Id.*

[1086] *Id.* at 4–5.

[1087] *Id.* at 6.

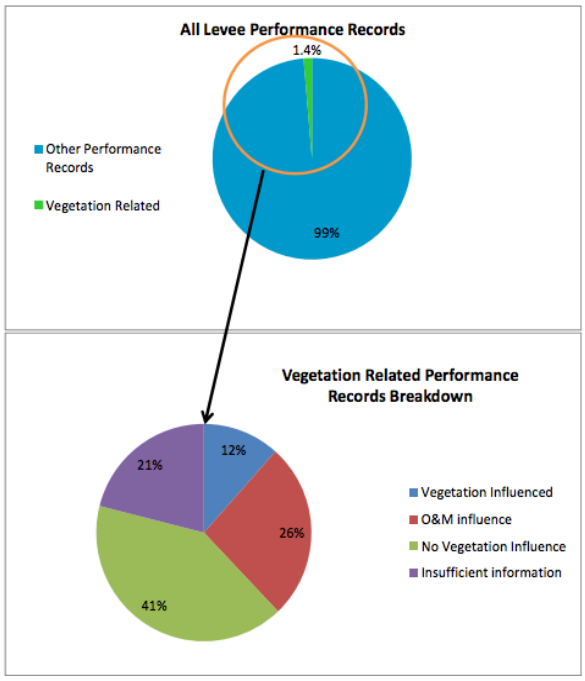

Figure 23: Distribution of Levee Performance[1088]

Of the records that did indicate vegetation played a role in levee performance, the majority related to O&M activities. Of these, records generally indicated the inability to visually determine levee performance during high water events due to the presence of vegetation on levees.

D. 2012 Symposium

The 2007 Levee Vegetation Research Symposium started an important discussion amongst stakeholders and prompted additional research from ERDC (discussed above) and the California Levee Vegetation Research Program (discussed below), and other relevant national and international studies regarding the effects of vegetation on levee integrity. The 2012 Symposium, "Levee Vegetation Research Symposium 2012, Scientific Progress Informing a Path Forward" was held in August in Sacramento, and built upon the 2007 Symposium and the research conducted in the interim.[1089] The symposium

[1088] *Id.* at 7.

[1089] *'Save the Date' Announcement. Levee Vegetation Research Symposium 2012 "Scientific Progress Informing a Path Forward" August 28-30, 2012—Sacramento, California*, DELTA

brought stakeholders and researchers together to discuss topics including:

- Tree root architecture in levees
- Slurry cut-off walls and roots
- Slope stability and tree roots
- Effects of roots on soil cohesion
- Tree windthrow and levees
- Effects of burrowing mammals
- International perspectives of vegetation and levees
- High-resolution 3D tree root and mammal burrow imaging
- Modeling/simulation for levee trees
- Levee seepage analysis
- Engineered or design solutions
- How science is incorporated into policy decision making
- Forensics of California levee failures[1090]

The symposium began with a welcome address by the past President of the CVFPB Benjamin Carter, followed by a welcome address from Congresswoman Doris O. Matsui.[1091] The Congresswoman voiced the need for secure levees, and raised her own concerns with the USACE approach to levee vegetation, and "their [USACE] so-called 'variance policy.'"[1092] The Congresswoman stated her concerns with the USACE vegetation removal policy as follows:

> [USACE's vegetation removal policy] could force thousands of trees to be pulled out and the levees to be rebuilt. This would result in the loss of shaded habitat for both aquatic and terrestrial species. But most importantly to me, in a time of shrinking federal, state, and local budgets, it could lead us down a path that makes levee improvements too costly to implement. It very likely could divert our attention away from necessary levee fixes to secondary issues that, while important, are not nearly as pressing.[1093]

Congresswoman Matsui was followed by William Stelle, Regional Administrator for the Northwest Region of NOAA Fisheries, who framed the issue of levee vegetation from a natural resource agency perspective.[1094] Mr. Stelle suggested that the issue not as one between public safety or aquatic

STEWARDSHIP COUNCIL (Dec. 16, 2011), http://deltacouncil.ca.gov/sites/default/files/documents/files/PB_16Dec2011_2012%20LeveeVeg%20Symposium%20-%20Save%20the%20Date.pdf.

[1090] *2012 Symposium Overview*, SACRAMENTO AREA FLOOD CONTROL AGENCY, http://www.safca.org/symposium2012.htm (last visited July 13, 2018).

[1091] *Tuesday, August 28, 2012*, SACRAMENTO AREA FLOOD CONTROL AGENCY, http://www.safca.org/2012_Symposium_Presentations_Day1.html (last visited July 13, 2018).

[1092] Doris O. Matsui, *Welcome Address* at 2, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2012), http://www.safca.org/symposium_2012_documents/2012_Symposium_Matsui_Transcript.pdf.

[1093] *Id.* at 3.

[1094] *Tuesday, August 28, 2012*, *supra* note 1091.

function, but "as an issue of both."[1095] He also expressed fundamental issues with USACE policy, including whether the ETL satisfies the "best available science" obligation under the federal Endangered Species Act, and whether the PGL and SWIF policy properly reflect USACE nondiscretionary obligations to conserve listed salmonids under the Endangered Species Act.[1096] These issues are explored in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements* and *Part IV: Solutions*.

The research and findings presented in the 2012 Levee Vegetation Research Symposium are included in the report, Synthesis of Levee Vegetation Research Results, which is discussed in detail below.

E. California Levee Vegetation Research Program

The California Levee Vegetation Research Program (CLVRP) was established following the 2007 Levee Vegetation Research Symposium, prompted by the recognized need for additional research on issues regarding levee vegetation.[1097] In 2009 DWR and SAFCA partnered with policy makers, levee managers, and researchers from local, state and federal agencies, including CVFPB, USFWS, NMFS, CDFW and Central Valley reclamation districts to form the CLVRP.[1098] The purpose of the CLVRP is to support original scientific research about vegetation and its impacts on levees, and provide a science-based foundation to develop levee vegetation management policies and maintenance procedures.[1099]

The research produced by CLVRP is distinguished between two phases. Phase I of the CLVRP focused upon expanding the body of knowledge regarding the impacts of vegetation and burrowing mammals on levee performance.[1100] In Phase I, CLVRP published numerous reports on associations between vegetation and burrowing animals on levees; levee tree root architecture; seepage through levees with live trees, dead stumps, and herbaceous cover; effects of tree roots on levee slope stability; computer modeling to simulate levee seepage and slope stability; forces required to overturn trees (windthrow); and spatial distributions of roots around levee slurry cutoff walls.[1101] Much of the information gathered and published as part of

[1095] William Stelle, *Framing the Issue & Role of Science—A Natural Resource Agency Perspective* at 1-2, SACRAMENTO AREA FLOOD CONTROL AGENCY (Aug. 28, 2012), http://www.safca.org/symposium_2012_documents/2012_Symposium_Stelle_Transcript.pdf.

[1096] *Id.* at 2.

[1097] *California Levee Vegetation Research Program*, CAL. DEP'T WATER RESOURCES, http://wdl.water.ca.gov/floodsafe/leveeveg/ (last visited July 13, 2018).

[1098] *Id*.

[1099] *Id*.

[1100] *See* SHIELDS, *supra* note 8, at 1-9.

[1101] *Id*. at 1-2.

Phase I was included in the "CLVRP Synthesis Report" and will be described in greater detail below.

Phase II of the CLVRP is focused on integrating the research results developed in Phase I into practical guidance for DWR in their levee Operations and Management (O&M) practices.[1102] This phase includes (i) the CLVRP Synthesis Report, (ii) a study being conducted at UC Berkeley to evaluate incremental risk associated with levee vegetation, entitled "Evaluation of the Incremental Probability of Levee Failure Due to the Effects of Woody Vegetation; and (iii) the Vegetation Assessment Working Group (VAWG).[1103] The VAWG is currently focused on two efforts: the Levee Tree Assessment (LTA) Guidance, which is an attempt to produce guidelines for determining when woody vegetation poses an unacceptable threat; and Levee Vegetation Data Collection Procedures, which is an attempt to produce standardized procedures for collecting data on woody vegetation on levees.[1104]

The VAWG's LTA Guidance could provide an objective methodology for determining if woody vegetation poses an "unacceptable threat" to levee integrity. If utilized by permitting agencies, this could help enormously with problems faced by state and local levee sponsors. Since the passage of WRRDA 2014[1105] and court orders[1106], USACE is precluded from enforcing the strict terms of the ETL and PGL, and may only require levee maintainers to remove vegetation if the vegetation is proven to pose an "unacceptable threat" to levee integrity.[1107] However, the current methods of deciding which vegetation poses an unacceptable threat vary widely depending on who is conducting the analysis, because levee maintainers in general do not have a standard to go by. There are no uniform standards based on best available science in existence that levee maintainers can use to ascertain whether or not vegetation poses an objective threat.[1108] The LTA could provide those standards.

The VAWG is also working to develop standardized levee vegetation data collection procedures. This is an attempt to produce standardized procedures for collecting data on woody vegetation on levees. [1109] Similar to the LTA, this could help enormously in terms of providing uniform, objective standards, based on sound science, for collecting data on levee vegetation. This will help state and local levee sponsors in their inspection and O&M duties by providing clear

[1102] Interview with Douglas Shields (July 2017).

[1103] *See California Levee Vegetation Research Program: Current Projects and Research*, *supra* note 360.

[1104] *Id*.

[1105] *See* discussion *supra*, *Appendix 1: Federal Laws and Policies*.

[1106] *See* discussion *supra*, *Appendix 3: Case Law*.

[1107] Water Resources Reform and Development Act § 3013(g)(1).

[1108] Interview with H. Brown, *supra* note 59.

[1109] *California Levee Vegetation Research Program: Current Projects and Research*, *supra* note 360.

guidelines, and ensuring data collection accurately reflects real world threats and conditions on the levees. VAWG is also working on the "Tree-fall Data Rapid Response," which will guide the development of a mobile research team who will deploy soon after trees fall on levees to collect real-time data.[1110] This procedure will similarly use the best available science to establish uniform standards to collect real-time data, including root pit measurements, soil compaction, soil saturation, tree species, and condition. Data collected will be used in future analyses and research.

The CLVRP is also conducting a risk-based study through UC Berkeley, to evaluate the incremental probability of levee failure due to the effects of woody vegetation. The study is currently underway, and will use peer-informed risk assessment methodology to evaluate the probability of levee failure in certain segments of Central Valley levees.[1111] Similarly to the LTA, this study seeks to quantify when vegetation poses a risk to levee integrity. However, this study differs in that it will quantify the incremental probability of levee failure due to vegetation, including incremental risks posed by other factors, using selected case study levees from the Central Valley.[1112] The results could help policymakers from all agencies in terms of permitting safer levee designs, by quantifying the risks posed to levees from vegetation versus other levee risks. In other words, this will provide clarity on the relative probability of levee failure due to woody vegetation, as compared to general failure modes (e.g., encroachments, penetrations, animal burrows), and how these different risk factors influence each other.

F. Synthesis Report

As discussed above, Phase II of the CLVRP includes the development and release of, "Synthesis of Levee Vegetation Research Results" ("Synthesis Report"). Following the 2007 Levee Vegetation Research Symposium, considerable research on levee vegetation was conducted by CLVRP, ERDC, and European scientists, much of which was reported in the 2012 Levee Vegetation Research Symposium. In order to better understand the big picture messages from so many nuanced and specialized research findings, a contractor for CLVRP underwent an exercise of compiling the most recent findings on levee vegetation, with emphasis on findings from 2007 to 2014.[1113] The report compiles findings based on discipline and geography, and identifies where consensus has emerged as well as remaining data gaps and controversial or unresolved issues. The Synthesis Report was prepared by F. Douglas Shields,

1110 *Id.*

1111 *Id.*

1112 *Id.*

1113 *See* SHIELDS, *supra* note 8, at 1-2.

Jr., Ph.D., P.E., D.WRE, of cbec eco engineering, and was released in January 2016. Funding for the report was provided by DWR.[1114]

The CLVRP Synthesis Report starts by describing the purpose and context of the document, which was to objectively report results of vegetation management research, adding the author's own interpretation of the implications of research results in a separate section.[1115] The introduction also emphasizes that little research on levee vegetation had been conducted prior to the research described in the report.[1116] The author describes our current situation, where past and present policies have sought to limit or prohibit woody vegetation on levees, based in part on precaution in the face of uncertainty.[1117] However, despite those policies, woody vegetation has been allowed to grow and mature, and is now in conflict with those standards.[1118] In particular, California levees support the final remnants of riparian woodlands in the entire state, and levee vegetation provides habitat for threatened and endangered species.[1119] Woody vegetation on levees also provides aesthetic enjoyment and could help contribute to levee stability and durability.[1120] However, concern for levee safety in the wake of Hurricane Katrina triggered national debate and caused USACE to take a more conservative approach to levee risk management.[1121] This prompted levee vegetation removal guidelines embodied in the ETL, and guidelines for obtaining a variance, codified in the PGL.[1122] The author offers hope that this report will be considered as USACE undergoes its WRRDA 2014 directive to consider and incorporate current science into the new levee vegetation policy.[1123]

The Synthesis Report describes the controversy over levee vegetation by listing the most common objections to woody vegetation based on the following concerns: that woody vegetation can obscure visual inspections and obstruct access for maintenance and flood fighting activities; living or dead roots from woody vegetation could facilitate through-seepage by creating macropores (holes or cavities larger than about 0.08 millimeter); wind action on vegetation and possible enhanced seepage and infiltration could negatively affect slope stability; trees subject to windthrow could create voids or pits in the levee prism; trees and shrubs could attract burrowing animals, making them more difficult to control and leading to seepage within the levee; erect or fallen trees could

1114 *Id.*
1115 *Id.* at 1-1–1-3.
1116 *Id.*
1117 *Id.* at 1-2.
1118 *Id.*
1119 Interview with H. Brown, *supra* note 59.
1120 SHIELDS, *supra* note 8, at 1-2–1-3.
1121 *Id.* at 1-3.
1122 *Id.*
1123 *Id.*

produce scour, causing erosion during high flows; tree roots could uplift hardscapes such as paved or interlocking revetments, drainages, or gates; and trees could negatively impact desirable vegetation such as grass through shading or changing the chemical nature of the soil.[1124]

Additionally, scientists in Europe, primarily from France and Germany, have conducted extensive research on levee vegetation following the 2007 Symposium.[1125] France conducted a research program dealing with the effects of trees on dikes, focusing on large tree root architecture. Tree roots were mechanically uprooted from levees with coarse, gravelly soils using noninvasive techniques to map roots and measure root decay.[1126] A university in Austria also conducted prototype-scale experiments, where the researchers constructed a test levee enclosed in a basin and stimulated flooding. They tested a variety of vegetation treatments on the effects of seepage, soil properties, and development of above and below ground plant components. [1127]

The Synthesis Report summarizes and synthesizes the findings by the aforementioned researchers and any others relevant to levee vegetation. The report categorizes all results in terms of: (1) root architecture, (2) noninvasive detection of roots, (3) root strength, (4) root decay, (5) water erosion, (6) treefall, (7) burrowing animals, (8) seepage and piping, (9) slope stability, (10) risk analysis, (11) flood fighting, (12) inspection, and (13) levee design.[1128]

1. Root Architecture

Before determining the potential for trees roots to cause seepage or treefall on levees, researchers must first determine the size and spatial distribution of tree roots, or root architecture. Many policies (including the ETL) make assumptions about tree root dimensions, so summarizing results from root architecture studies can help clarify and improve these assumptions.[1129]

Studies that analyzed root architecture included five where the excavation of pits or trenches revealed portions of tree root structures on levees, two that involved exhumation of the entire root system on selected levee trees, and one exhumation study that involved the entire root structure of a tree not growing on a levee.[1130]

Results indicated that root numbers and biomass tend to decline exponentially with width and depth from the tree.[1131] Most roots are confined to the top one-

[1124] *See id*. at 1-8.
[1125] *Id*. at 1-3.
[1126] *Id.* at 1-9, 1-11.
[1127] *Id.* at 1-11.
[1128] *Id.* at 1-3.
[1129] *Id*. at 2-1–2-2.
[1130] *Id.* at 2-1.
[1131] *Id.* at 2-10.

meter of soil, at a consistent depth, regardless of their direction from the tree, and are within the dripline[1132] of the tree. Tree roots also grow within a zone surrounding the trunk that typically is smaller in horizontal extent than the canopy.[1133] However, some exceptional tree roots, including those of cottonwoods, grow at greater depths and distances.[1134]

Results further indicated that trees growing on levee slopes differ from those on hillslopes, in that root number, extent, and biomass tend to be higher toward the bottom of levee slopes, which is the opposite case for roots on hillslopes. Roots tend to grow more downhill on levee slopes as they grow outwards horizontally. [1135]

Key influences on root architecture include tree species and the environment. For instance, cottonwood roots extend further than valley oaks, and root length is greater in coarse/gravelly soil than in sandy/silty soil.[1136] In fine/sandy soils, root density per stem is high and roots tend to grow in bundled or oblique angles, whereas in gravelly soils, root density is lower with fewer roots of larger diameter.[1137] In porous material, roots tend to be near the surface when the primary source of water is rainfall, but are more likely to have a tap root when there is groundwater access.[1138]

Root morphologies include plate, heart, and tap root.[1139] Root patterns include conical, disk-shaped, or cylindrical.[1140] One study showed that root pattern and morphology does not depend on species as much as environmental conditions, like soil, access to water, and local constraints.[1141] In other words, the study indicated that within the same soils and environment, different species have the same root architecture. However, another study showed stronger variation by species rather than environmental conditions.[1142]

2. Noninvasive Detection of Roots

Noninvasive detection of roots is important for many of the same reasons as determining root architecture. Studies attempt to similarly map root architecture, but without destroying vegetation and the levee embankment, which could

[1132] Dripline refers to the area under the tree, defined by the outermost circumference of the tree canopy.

[1133] SHIELDS, *supra* note 8, at 2-11.

[1134] *Id.* at 2-14 – 2-16.

[1135] *Id.* at 2-11.

[1136] *See id.* at 2-14 – 2-19.

[1137] *Id.* at 2-15.

[1138] *Id.*

[1139] *Id.*

[1140] *Id.* at 2-18–2-19.

[1141] *Id.* at 2-15.

[1142] *Id.* at 2-15–2-16.

potentially provide faster, cheaper answers to questions of root distribution than other methods.[1143]

The Synthesis Report presented three studies of root detection in levee embankments using noninvasive techniques. The first used ground-penetrating radar, electrical resistivity and electromagnetic induction at levee sites, and was not effective in all sites.[1144] The second used ground-penetrating radar but reported it unsuccessful, and suitable for certain soil textures only.[1145] The third used electrical resistivity to detect roots buried in containers of soil in the laboratory, but showed poor overall performance, especially in finer soils.[1146]

Results indicated that it is currently uncertain how valuable these techniques are, especially lacking field validation.[1147] Right now there does not seem to be a proven reliable technology to detect roots using noninvasive methods, although this remains a ripe opportunity for future research.

3. Root Strength

Root strength, including tensile and bending strength, is important to ascertain in order to figure out how trees influence levee stability. Sometimes levee failures occurs when a large block of material slumps off, and vegetation could contribute to this by adding weight and wind loads. However, roots could also make slopes more stable by reducing moisture in soil and through direct reinforcement. Analyzing root strength is relevant to both of these issues.[1148]

Research results generally indicate that tree root strength declines with root diameter.[1149] Most studies showed that root strength for any given tree root of the same diameter and in the same environment is more or less the same, regardless of species.[1150] Small roots are much more numerous than large, and make much more significant contribution to soil strength.[1151] All but one study showed that larger roots are more likely to pull out of the ground but also offer resistance to bending, whereas fine roots cannot resist bending forces as well.[1152]

Root contribution to soil strength also varies with the size and distribution of roots, and with their tensile strength.[1153] Because root density declines exponentially with depth, "contribution of roots to soil strength declines sharply

1143 *Id*. at 3-1.
1144 *Id.* at 3-1.
1145 *Id.*
1146 *Id.*
1147 *Id.*
1148 *Id.* at 4-1.
1149 *Id.* at 4-4–4-5.
1150 *Id.* at 4-6.
1151 *See id.*
1152 *Id.* at 4-1–4-3.
1153 *Id.* at 4-6.

with depth."[1154]

4. Root Decay

Root decay is important to study because some argue that voids left by decaying roots induce "piping," or water seepage into levee soil, which could lead to levee failure.[1155] Other things that can cause these voids include: shrinkage cracks, hydraulic fractures, contact surfaces, animal tunnels, relict root holes, soil pipes, manmade activities, encroachments, and other penetrations.[1156]

The Synthesis Report analyzed studies that showed much of the evidence of old decaying roots leading to piping, and therefore levee failure, is anecdotal.[1157] In other words, people may see trees upturned on failed levees and assume that tree roots are the cause. However, it is impossible to prove causation in many of these anecdotal cases. Fears around root decay also include the fear of removing dead, decaying roots, because that too is thought to potentially exacerbate seepage.

The Synthesis Report presented both applied and theoretical studies. One conducted in California involved the excavation into actual levees, revealing living, dead and decaying roots. This study found no voids left by decaying roots. [1158] Another was conducted in France, where researchers buried root samples in levees, then underwent exhumation after two and four years to allow for decay. Decay rates were closely related to tree species, as opposed to root diameter, although root diameter did affect decay rate in that smaller roots tend to decay faster.[1159]

Whether decaying roots leave voids depends largely on soil type. Voids from decaying roots were only found in cohesive soils.[1160] There were no reports of decaying roots creating tubular voids in sandy soils. This is important information for California policymakers because Central Valley levees are characterized by sandy soils.

Studies further showed that root decay interactions with surrounding soil differ depending on the number of tree roots. [1161] The death of a single tree creates different effects to the soil than the death of many trees. This is because, when one tree dies the living roots of surrounding trees rapidly colonize zones around the decaying roots. This does not happen when a group of trees die, as

1154 *Id.*
1155 *Id.* at 5-1.
1156 *Id.*
1157 *Id.*
1158 *Id.* at 5-3.
1159 *Id.* at 5-5.
1160 *Id.* at 5-4.
1161 *Id.* at 5-2.

there may not be sufficient living roots in the vicinity of the dead tree to fill the voids.

The combined studies and reports demonstrate that decayed roots generally have not been implicated in pipe formation, other than by anecdote.

5. Roots and Erosion

During flood events, river currents and waves can erode levees. Differing views exist as to whether tree-root-penetrated levees impact levee performance in this situation. One theory is that trees can reduce erosional threats to the levee.[1162] A differing theory is that trees can exacerbate erosion by concentrating flows between tree trunks or by shading turf/grass development.[1163] This segment of the Synthesis Report looked at studies that aimed to better understand if and how trees on levees influence levee erosion.

Compiled research included three published studies, which observed levee failure rates in relation to the width of waterside forest stands. One study was conducted in a lab and quantified the effects of woody riparian species on floodplain soil erosion rates.[1164] This study found that trees counteracted but did not eliminate fluvial erosion. Other studies included in the Synthesis Report assessed 41 tree-root-penetrated levees in the Midwest after a 2008 flood.[1165] That effort produced no evidence that tree roots had an impact on levee performance. Another study analyzed the Missouri River flood of 1993, and found that woody vegetation may have saved levees from failure in multiple cases.[1166] Observations also indicated that strips of herbaceous vegetation and small trees protected levees during hurricane events.

The Synthesis Report included findings from recent and ongoing lab tests aimed at quantifying the capacity of grasses/herbaceous plants to provide protection to levee slopes from waves and overtopping. The study noted that additional studies are needed to fully assess these potential benefits.[1167] There is also a lack of information on vegetation leading to scour, and additional studies are needed to further analyze this issue.

Results of the compiled research indicate that vegetation on or riverward of the waterside levee toe helps significantly in saving levees from the impacts from wave wash and reducing erosion during high water.[1168] Further, the presence of a floodplain forest protects levees against direct attack from water

1162 *Id.* at 6-1–6-2.
1163 *Id.*
1164 *Id.* at 6-2.
1165 *Id.* at 6-4–6-5.
1166 *Id.* at 6-2.
1167 *Id.* at 6-1.
1168 *Id.* at 6-8.

currents[1169] However, there is still a need for a guidance or standard approach for assessing the beneficial effects woody vegetation on erosion from river currents and erosion from waves, as well as scour.

6. Treefall

When trees fall or are uprooted, roots leave spaces or pits in the ground. There is a common fear that these pits can in turn lead to levee failure, and this is often used as justification for prohibiting woody vegetation on levees. The research compiled in this section focused on the force required to pull over trees, to better ascertain when trees on levees pose a hazard to levee stability due to treefall.

Of the studies analyzed, one included winching tests of valley oaks and cottonwoods.[1170] This study found that the force required to topple trees is directly proportional to tree size. Pits left by overturned trees are also directly proportional to tree size. Two other studies provided compilations of data on root pit size for overturned trees.[1171] These studies produced regressions for pit size in terms of tree diameter at breast height. Studies also analyzed the potential for remaining root pits to lead to seepage.[1172] Results indicated that pits on the landside levee toe of a large enough size increased the risk of erosion and piping. However, on the waterside slope, pits as large as five feet deep and 60 feet wide had essentially no effect on seepage.

Results indicate that large trees have the greatest potential to cause large root pits, and thus cause the greatest potential threat.[1173] However, wind forces required to topple healthy trees are extremely rare in the Central Valley.[1174] Small trees could overturn in high wind events, but produce smaller pits, which are unlikely to endanger a levee.[1175] Where large, isolated trees grow at the top or landside toe of a small levee embankment, and fail by overturning rather than breaking, these tress could pose risks to levee integrity.[1176] However, removing existing large trees from levees could also increase the risk of overtopping, seepage, and slope instability, so more information and research is needed to manage potentially hazardous trees in these situations.[1177]

1169 *Id.*
1170 *Id.* at 7-1.
1171 *Id.* at 7-8–7-11.
1172 *Id.* at 7-1–7-2.
1173 *Id.* at 7-10.
1174 *Id.* at 7-1.
1175 *Id.*
1176 *Id.* at 7-12.
1177 *Id.*

7. Burrowing Animals

Burrowing animals, especially ground squirrels and Botta's pocket gophers, frequently utilize Central Valley levees.[1178] Other mammals and reptiles can also impact California levees, as well as worms, insects and reptiles.[1179] The relationship between burrowing animals and woody vegetation on levees is important to understand, because some feel that woody vegetation may attract more burrowing animals. Burrowing animals pose a threat to levee failure, because while burrowing they create voids that can collapse or weaken the levee, cause seepage, or disturb soil at a burrow entrance, promoting erosion.[1180]

Several studies in the report implicated rodent burrows as the cause, or probable causing factor, in levee failure. A literature review documented the range, depths and lengths of ground squirrel burrows, and field studies mapped burrows in two California levees.[1181] Numerous other experiments and studies showed burrows were the dominant cause of seepage through levee embankments, even when large trees or stumps are present.[1182] One study conducted in Sacramento found squirrel burrows in 98% of levee segments examined and gopher burrows in 95%. Landside densities of burrowing animals averaged three times greater than waterside densities.[1183]

Studies showed that, "in general, burrows were less frequent in areas with tree cover and leaf litter, but burrows became more frequent when landsides of grassed levees were adjacent to fruit or nut crops."[1184] Pocket gophers and ground squirrels both generally prefer barren areas devoid of trees, leaf litter, riprap, gravel and pavement. Pocket gophers also generally avoid leaf litter, tree boles and gravel.[1185]

More information is needed regarding whether the presence or absence of trees on levees has much impact on burrowing mammal abundance when the levees are adjacent to crop fields. This is especially pertinent because results indicate that levees close to fruit and nut crops are much likelier to contain burrowing animals.[1186] A debate remains as to habitat associations among animal populations. Most studies suggest that converting woody vegetation to grassland will increase the probability of the occurrence of burrowing animals, but anecdotal reports suggest a positive relationship with beavers and woody

1178 *Id.* at 8-1.
1179 *Id.*
1180 *Id.*
1181 *Id.*
1182 *Id.*
1183 *Id.* at 8-2.
1184 *Id.* at 8-1.
1185 *Id*. at 8-3.
1186 *Id*. at 8-8.

vegetation.[1187]

8. Seepage and Piping

During floods, concentrated seepage can lead to piping, and one theory is that living or dead trees can create paths to facilitate this piping.[1188] Roots can also change seepage patterns and alter soil moisture within the levee embankment, either degrading or improving overall slope stability.[1189] Plant cover generally increases permeability of soils, but in some situations, can reduce permeability, and the seriousness of seepage caused by changes in soil permeability is controversial.[1190] The studies presented in this section aim to shed light on the effects trees can have on seepage and piping in levees.

Studies analyzed include three field experiments, which reviewed and examined the effects of trees on water movement through levee embankments. One of these field experiments examined downslope water movement from a longitudinal trench excavated near the levee crown for a segment with no woody vegetation. This was compared with a similar trench containing a dead/decaying stump. [1191] Water flowed more easily through the region with the stump, but in both segments, change to water flow was dominated by animal burrows.[1192] The second of these experiments examined downslope water movements from a trench excavated along a levee crest.[1193] Trees were present on both water and landside levee slopes. The experiment showed that water movement was only governed by animal burrows and soil stratigraphy, and did not change depending on root presence.[1194] The third experiment examined flow from an experimental basin surrounded by levees, with segments of shrubby willows.[1195] Flow patterns on embankments with willows versus those with only grass had identical responses.[1196]

Models, including 2-D and 3-D models, examining the effects of woody vegetation on seepage were also included in the Synthesis Report. The models decreased or increased hydraulic loads to evaluate results in seepage discharge on the levee slope. The results showed that flow was affected within the immediate vicinity of the root zone, but nowhere else.[1197] Another study

[1187] *Id*. at 8-9.
[1188] *Id*. at 9-1.
[1189] *Id*.
[1190] *Id*. at 9-2.
[1191] *Id.* at 9-2–9-4.
[1192] *Id.* at 9-1–9-2.
[1193] *Id.* at 9-4–9-5.
[1194] *Id*. at 9-1, 9-4–9-5.
[1195] *Id.* at 9-1, 9-5.
[1196] *Id.* at 9-5.
[1197] *Id.* at 9-6–9-7.

analyzed "vertical defect," (the effects of a root that creates a small-diameter vertical void through the soil surface) and found that although the presence of voids destabilized wetting patterns, overall effects were slight because the permeability of the surrounding soil controlled flow into and between voids.[1198]

Results from the above as well as other studies presented in this section indicate that roots have little effect on soil permeability, and it is essentially impossible to establish a pattern of hydraulic conductivity relative to vegetation cover on levees.[1199] Results also indicated the importance of macropores, rather than voids. Macropores occur from shrinkage cracks, hydraulic fractures, contact surfaces, rodent burrows, soil pipes or root growth and root death.[1200] The worst seepage scenarios in terms of levee stability occur when a zone of elevated hydraulic conductivity occurs at the landside levee toe, which is usually caused by animal burrows.[1201]

9. Slope Stability

Levee slopes can collapse or slide, causing levee failure. This usually happens when driving forces, like soil weight, exceed resisting forces. Additional driving forces can include earthquakes, vehicle traffic, and possibly woody vegetation.[1202] There are conflicting perspectives on how woody vegetation impacts soil strength and levee stability. Woody vegetation is thought to affect slope stability in four main ways: (1) mechanical reinforcement by woody vegetation roots; (2) soil arching between trees (vegetation creates soil masses between trees, which has stabilization effects); (3) enhanced filtration/evapotranspiration associated with vegetation (woody vegetation dries soils, which are, up to a certain point, stronger than wetter soils); and (4) additional loading from the weight of trees and from wind forces on aboveground portions of trees transferred through roots to the soil.[1203] The Synthesis Report analyzed the most recent science with respect to each of these arguments to gain a clearer understanding of how trees on levees actually affect slope stability.

The Synthesis Report analyzed simulations, 2-D numerical simulations including early work in the 1990s, follow-up work and application of the fiber bundle model, streambank stability analyses, an ERDC model, a simulation conducted at UC Berkeley, and European models.[1204] The report also analyzed

1198 *Id.* at 9-7–9-9.
1199 *Id.* at 9-2–9-3.
1200 *Id.*
1201 *Id.* at 9-14.
1202 *Id.* at 10-1.
1203 *Id.* at 10-1–10-2.
1204 *Id.* at 10-1.

two 3-D numerical simulations, including one from ERDC.[1205] These geotechnical models can be used to assess slope stability and can be modified to include the effects of vegetation.

Results varied widely with site conditions, however "there is a strong consensus that woody vegetation significantly improves levee slope stability with respect to shallow failure planes."[1206]

Trees generally increase slope stability, "except under the most unusual conditions," such as "very high winds acting on a tree at the top of a levee slope."[1207] Further, large-scale tree removal or clear-cutting on levees could lead to massive slope failures.[1208] Therefore, any large-scale removal of trees from levees should be done with caution.

10. Risk Analysis

Risk is defined as the total probability of failure within a given interval of time, multiplied by expected consequence.[1209] In this context, we typically describe levee "failure" as functional, meaning that the levees have admitted enough water to the protected area to produce damage.[1210] Risk analyses are important to determine the probability of levee failure. For the purposes of levee vegetation, risk analyses are important in determining the relative risk woody vegetation poses to levees.

The Synthesis Report includes a German study, which predicted frequencies from levees overtopping and incorporated the effect of failure due to vegetation.[1211] Another study evaluated levee failure probability for several Sacramento area levees. This study found that vegetation effects on total composite failure ranged from less than 1% to 3%.[1212]

The Synthesis Report also included a review of a large database of California levee performance records. The review indicated no documented influence of levee vegetation on any known breaches.[1213] The review also found that vegetation had either a documented or perceived influence on levee performance in only 16 out of 7,424 records.[1214] The Synthesis Report also includes the Delta Risk Management Strategy (DRMS), which computed probabilities of failure of

[1205] *See generally id.* at 10-4–10-11 (summarizing the results of various studies that can ultimately be used to assess slope stability).

[1206] *Id.* at 10-13–10-14.

[1207] *Id.* at 10-14.

[1208] *Id.*

[1209] *Id.* at 11-1.

[1210] *Id.*

[1211] *Id.* at 11-6.

[1212] *Id.*

[1213] *Id.* at 11-7–11-8.

[1214] *Id.* at 11-7.

Delta levees.[1215] DRMS demonstrated that the probability of levee failure due to seismic events is far greater than for failures caused by vegetation-related processes.

Results indicated that the probability of vegetation affecting levees and leading to failure is small compared to that of other sources.[1216] However, more work is required to accurately quantify these effects in a comparative risk analysis.

11. Flood Fighting

Flood-fighting requires levee embankments to be intensively monitored for signs of leakage, overtopping, erosion, or other forms of distress. If imminent problems arise, personnel, material, and equipment must be rapidly deployed for temporary erosion protection, to control seepage, to raise levees, or to build temporary flood protection structures.[1217] USACE policies state that vegetation restricts levee access and visibility during flood fighting activities.[1218] The Synthesis Report analyzes data to ascertain whether and to what extent vegetation impedes flood fighting activities.

The author notes that, "there is almost no literature dealing with the effects on flood-fighting activities of trees and shrubs growing on or near levees."[1219] Thus, much of the information used in this section of the Synthesis Report came from transcripts from the 2007 and 2012 Levee Vegetation Research Symposia.

Woody vegetation can act as a visual barrier, or can complicate emergency activities by requiring additional vegetation removal during flood fighting activities. However, at least 3 engineers with flood fighting records noted they never personally witnessed significant adverse impacts from woody vegetation on flood fighting.[1220] Trees near levees can aid flood fighting by serving as source of brush for temporary structures or making soft, moist soils more trafficable.[1221] Waterside trees protruding above water help show conditions below the surface that flood-fighters might not otherwise see.[1222]

Participants of the 2007 and 2012 Symposia generally felt that woody vegetation did not adversely impact flood fighting activities.[1223] However, the Synthesis Report noted that there is still a need for additional studies and

1215 *Id.* at 11-5, 11-8.
1216 *Id.* at 11-9.
1217 *Id.* at 12-1.
1218 ETL 1110-2-583, *supra* note 1.
1219 SHIELDS, *supra* note 8, at 12-4.
1220 *Id.* at 12-4.
1221 *Id.*
1222 *Id.*
1223 *Id.*

surveys on the subject of vegetation influencing flood fighting activities.[1224]

12. Inspection

Federal regulations require regular inspection of levees to detect flaws, such as erosion, slumping, or other signs of distress.[1225] One major rationale for prohibiting woody vegetation on or immediately adjacent to levees is its impact on visibility and accessibility for inspections.[1226] The Synthesis Report aimed to ascertain whether and to what extent woody vegetation impedes levee inspections.

No scientific research exists regarding vegetation effects on routine levee inspections.[1227] Maintenance guidance documents suggest that walking inspections may be preferable to driving in areas of dense wooded vegetation, which may be more labor intensive and have a higher associated cost.[1228] Other approaches to inspections could include a cleared viewing corridor, cluster methods of vegetation placement, selecting of appropriate vegetation, and pruning strategies.[1229] The State of California's vegetation management guidelines for levees in 2007 provided DWR's interim levee vegetation inspection criteria. These criteria prescribed pruning and thinning of vegetation to maintain visibility corridors. [1230]

The author presented the above creative solutions to deal with problems posed by woody vegetation on levee inspections, but acknowledged the lack of data or surveys to provide empirical evidence of these issues.[1231] Therefore, there is a recognized need for additional research on this subject.

13. Levee Design

There have been experimental designs to attempt to counter key concerns that woody vegetation can pose to levees.[1232] Among other things, these experimental designs include planting berms, the inclusion of metal or plastic materials in the levee embankment, overbuilt sections, and root barriers.[1233] Each of these levee designs are analyzed in more detail in *Part IV: Solutions*.

1224 *Id.* at 12-4–12-6.
1225 *Id.* at 13-1.
1226 *Id.*
1227 *Id.*
1228 *Id.* at 13-2–13-3.
1229 *Id.* at 13-3–13-4.
1230 CVFPP, *supra* note 5, at 4-13.
1231 SHIELDS, *supra* note 8, at 13-4–13-5.
1232 *Id.* at 13-3–13-4.
1233 *Id*.

14. Summary and Conclusions

The Synthesis Report presented the most current, best available science on the issues of levee vegetation. The science presented in the report generally demonstrated that seismic activity and burrowing animals are significantly more detrimental to levee reliability than any other risk factor studied, and California burrowing animals tend to be associated with habitat types other than woody vegetation.[1234] Further, the risk of tree overturn due to windthrow is small in California, due to California wind conditions.[1235] There was also little evidence of decaying roots causing piping in Central Valley levees due to Central Valley soil types, and the fact that voids tend to quickly be filled by live tree roots.[1236] However, piping could result following mass clear cutting of trees.[1237]

Vegetation can mitigate the effects of water erosion from overtopped waves or a flood surge, but woody vegetation can also promote local scour, depending on many environmental factors.[1238] Existing data shows that woody vegetation does not necessarily affect hydraulic conductivity on levee slopes.[1239] Modeling can help predict the influence of vegetation on slope stability, but current models are not able to accurately predict real-world effects.[1240] Research so far indicates that woody vegetation generally helps slope stability in almost all conditions.[1241]

A better risk analysis methodology is needed to fully quantify risks posed by levee vegetation relative to other risks.[1242] However, existing risk analysis methods indicate small risks from the effects of woody vegetation on California levees as compared to other risk factors.[1243]

Currently, inspecting officials usually drive along levee tops in order to inspect the levees.[1244] Some of the inspectors voiced concerns with levee vegetation, in that it impairs their ability to visually inspect the levee.[1245] Suggestions to combat this include walking inspections or trimming trees to allow for views under the canopy.[1246] Woody vegetation also poses potential risks to flood fighting activities, although this differs based on opinion and

1234 *Id.* at 15-6.
1235 *Id.* at 15-3.
1236 *Id.*
1237 *Id.*
1238 *Id.* at 15-6.
1239 *Id.*
1240 *Id.* at 15-6–15-7.
1241 *Id.* at 15-7–15-8.
1242 *Id.* at 15-8–15-9.
1243 *Id.* at 15-2.
1244 *Id.* at 15-8.
1245 *Id.*
1246 *Id.*

evidence is anecdotal.[1247] More research is needed on woody vegetation effects relative to inspections and flood fighting activities on levees.[1248]

In conclusion, levee vegetation research has made enormous strides in the past few years, stemming from the recognized need for additional research following the 2007 Levee Research Symposium. Since then, researchers in California, nationwide, and abroad have conducted field tests, modeling, and reports to better analyze the effects of woody vegetation on levees. There are still many areas where further research is needed, but California policymakers have never been more equipped to utilize state of the art scientific research in decision-making.

[1247] *Id.*

[1248] *Id.* at 15-8–15-9.

ATTACHMENT 1: TIMELINE OF FEDERAL AND STATE POLICIES REGARDING VEGETATION MANAGEMENT ON CALIFORNIA LEVEES

May 1955: United States Army Corps of Engineers ("Corps", or USACE) releases Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project (USACE, revised May, 1955).

1958: State of California accepts responsibility for Sacramento River Flood Control System.

April 1959: USACE releases Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California (USACE, April 1959).

October 1996: Water Resources Development Act (WRDA) Section 202(9) directs USACE to review vegetation management guidelines to "address regional variations in levee management and resource needs."

September 2001: USACE issues Engineering Regulation 500-1-1 (ER 500-1-1).

August 2005: Hurricane Katrina and levee failures in New Orleans trigger national response and attention to flood control systems nationwide.

February 2006: California Governor declares state of emergency for California levee system.

May 2006: California Governor signs AB 140, providing $4 Billion in bonds for levee repair and flood control; and AB 142, which appropriates $500 million from the general fund to DWR for levee evaluation and repair.

November 2006: Propositions 84 and 1E pass, establishing FloodSAFE California.

2007: "California Levees Roundtable" is established, creating a collaborative, group process that includes the United States Corps of Engineers, as well as state and local policy-makers.

2007: National Levee Safety Act passes (WRDA 2007, Title IX—National Levee Safety Program).

February 2007: United States Army Corps of Engineers conducts Nationwide levee inspection.

April 20, 2007: USACE releases Final Draft White Paper: Treatment of Vegetation with Local Flood-Damage-Reduction Systems.

August 2007: First research symposium on levee vegetation issues is held in Sacramento.

December 2007: USACE releases Literature Review, synthesizing existing literature on levee vegetation issues.

2008: Central Valley Flood Protection Act (CVFPA) passes.

March 2009: California's Central Valley Flood System Improvement Framework is released.

April 2009: USACE Issued Engineering Technical Letter (ETL) 1110-2-571, establishing a nationwide vegetation policy.

October 2009: Public Law (PL) 84-99 **is** updated and released, establishing guidelines for federal emergency relief funding eligibility.

January 2010: California Levee Vegetation Research Program (CLVRP) releases Circular No. 1: Summary of CLVRP.

February 2010: USACE issues draft Policy Guidance Letter (PGL), which adopts a new variance process**:** Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls – 75 Fed. Reg. 6364-68.

April 2010: California Department of Water Resources (DWR) and California Department of Fish and Wildlife (DFW) submit extensive comments on ETL and PGL.

December 2010: USACE issues: Literature Review—Vegetation on Levees.

March 2011: DWR (prepared by URS) distributes Memo on the Influence of Vegetation on Levee Past Performance, finding no instances in California of woody vegetation contributing to levee failure.

June 2011: Plaintiffs file lawsuit in *Friends of the River v. United States Army Corps of Engineers,* 870 F. Supp. 2d 966 (E.D. Cal. 2012).

September 2011: USACE releases the report: Initial Research into the Effects of Woody Vegetation on Levees.

November 2011: USACE proposes System-Wide Improvement Framework Policy (SWIF).

December 2011: CLVRP releases paper: California Levee Vegetation Research Needs/Priorities and CLVRP Circular No. 2: Summary of Research Completed to Date.

December 2011: Research and Development Workshop held in Sacramento.

February 2012: Draft Policy Guidance Letter: Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls (77 Fed. Reg. 9637) (PGL) is released.

March 2012: 2012 Central Valley Flood Protection Plan (CVFPP) is released, establishing California's Levee Vegetation Management Strategy.

May 2012: Plaintiffs file complaint in *California Department of Fish and Game v. United States Army Corps of Engineers,* 2:12-at-00745 (E.D. Cal. Filed May 22, 2012).

August 2012: Second symposium on levee vegetation issues is held in Sacramento: Levee Vegetation Research Symposium 2012.

January 2014: CLVRP Studies are released - Vol 1: Review of Literature and Case Histories; Vol. 2 & 3: descriptions and data from two field seepage experiments; Vol. 4: results of study of burrowing mammal activity; Vol. 5: geometries of openings caused by roots or animal burrows on piping or seepage-induced slope failure; Vol. 6: results of analyses of influence of tree roots on levee embankment stability.

April 2014: USACE issues new ETL, clarifying and updating previous ETL (ETL 1110-2-583 Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures).

June 2014: Congress enacts and signs into law Water Resources Reform and Development Act of 2014 (WRRDA).

July 2014: USACE issues Engineer Circular (EC) 1165-2-216, clarifying use of Rivers and Harbors Act/Section 408.

August 2014: CLVRP releases Circular No. 3: New Research and Steps.

March 2016: CLVRP issues Synthesis of Levee Vegetation Research Results, a report synthesizing the most current global research, models and studies on levee vegetation issues.

ATTACHMENT 2: DEFINING LEVEE TERMINOLOGY

LEVEE

"A levee is a manmade earthen embankment that provides flood protection from temporary high water. . . Levees usually lie parallel to and on either side of a channel, or they encircle a protected area. Levees help to protect against rising floodwaters, or temporary high waters, by confining water in a deeper floodway. . . Levees are often constructed from material obtained from the riverside, and the land between the levees is called the floodway, batture, or foreshore. .. Levees in California tend to be smaller (in cross section_ and older than earthen dams. "[1249]

A typical levee cross section consists of the embankment crown, slopes, and toes, described by their location on the landside or riverside of the levee. See figure 24 below.

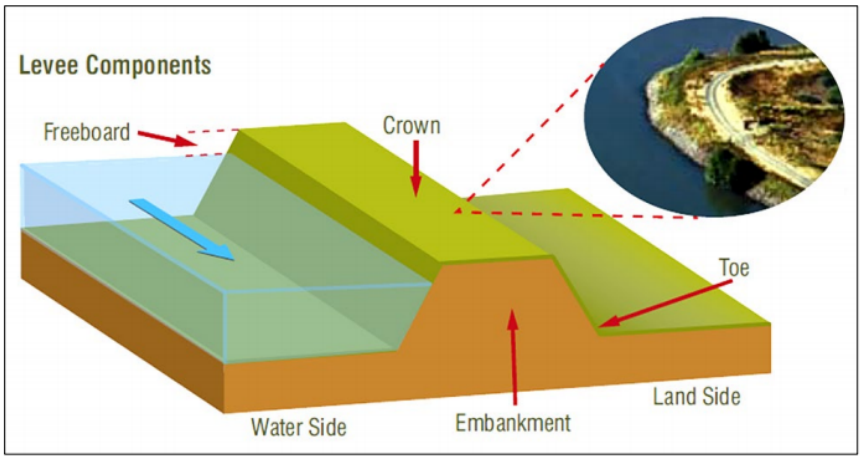

Figure 24: Basic Levee Components[1250]

[1249] SHIELDS, *supra* note 8, at 1-4.

[1250] *Id*. at 1-5.

MAINTENANCE

"Levees tend to deteriorate over time if they are not carefully maintained."[1251] Maintenance usually includes the removal of vegetation via mowing or burning, replanting and managing desirable vegetation, controlling unwanted animals, filling animal burrows, and repairing damaged areas.[1252] Damaged areas could be caused by "erosion by wave wash or currents, underseepage, through-seepage, animal burrows, ruts, foot traffic by animals or humans, and slips or slides.[1253] Maintenance can also involve upkeep of access through roads and ramps, upkeep of appurtenant structures, and stockpiles of emergency construction materials.[1254]

FAILURE MODES

Levees tend to fail during high-water periods.[1255] Failure mechanisms include breaching, overtopping, seepage, and slumping.[1256] A breach usually refers to a situation where part of the levee itself breaks, creating a hole in a segment of the levee and allowing water to flow freely to the landside.[1257] Overtopping refers to a situation where water passes over the top of the levee, often causing erosion that eventually leads to a levee breach.[1258] Through-seepage can also lead to levee failure by triggering subsurface internal erosion, and can even form continuous voids or pipes within the levee, which progressively enlarge until a segment of levee washes out completely.[1259] Through-seepage is usually initiated with cracks or macropores (holes or cavities larger than about .08 millimeter), although those are not necessary to trigger seepage failures.[1260]

Underseepage is the passage of water below the levee, often manifested by localized upwellings or sand boils on the landside.[1261] In situations like this, the soils under the levee can become fluid and levee failure can be very rapid.[1262]

Slope instability is characterized by the slope surface of the levee slumping or collapsing, and is often characterized by seepage patterns causing embankment pressure.[1263]

1251 *Id.* at 1-4.

1252 *Id.*

1253 *Id.*

1254 *Id.*

1255 *Id.* at 1-5.

1256 *Id.*

1257 *Levees 101: Understanding Levee Failures*, U.S. ARMY CORPS ENGINEERS, http://www.usace.army.mil/National-Levee-Safety/About-Levees/Levees-101/#4 (last visited Feb. 25, 2018).

1258 *Id.*

1259 SHIELDS, *supra* note 8, at 1-5.

1260 *Id.*

1261 *Id.* at 1-6.

1262 *Id.*

1263 *Id.*

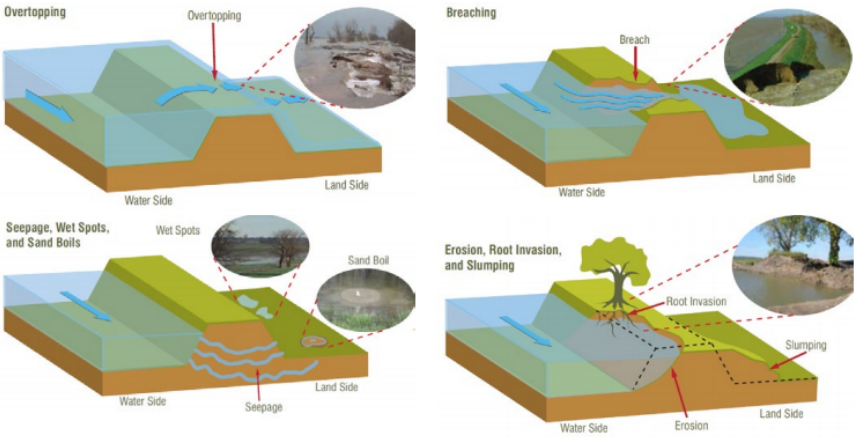

Figure 25: Levee Failure Modes[1264]

Levee failures are often caused by a combination of the aforementioned forces, with one form of failure causing or contributing to another.[1265]

1264 *Id.*

1265 *Id.*