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Compensatory Mitigation Work Group

White Paper

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This white paper is solely a product of the volunteer technical work group members and should not be considered an ADEQ decision document.

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INTRODUCTION

1.1. COMPENSATORY MITIGATION TECHNICAL WORKING GROUP (TWG) CHARTER

The Compensatory Mitigation TWG was one of seven TWGs established by the Arizona Department of Environmental Quality Water Division to assist the Department in developing a program to assume Clean Water Act Section 404 ("CWA § 404") permitting for Arizona. As with all other TWGs in this effort, the work and meetings of the Compensatory Mitigation TWG were guided by a Charter document, which enumerated the TWG's role, membership, leadership, and manner by which meetings would be conducted and decisions made.

The TWG's objectives were also stated in the Charter, which were to identify the current state of CWA § 404 Compensatory Mitigation, describe an ideal future state as determined by TWG consensus, and to outline possible future actions and policies that would support the ideal future state.

1.2. TWG MEMBERSHIP AND MEETINGS

The Compensatory Mitigation TWG was composed of 15 members, including the TWG Chair. TWG membership was drawn from CWA § 404 customers and their legal community, as well as representatives from existing In-Lieu Fee sponsors and public agencies and non-governmental organizations with environmental sustainability missions. This provided the TWG with public and private-sector participants, as well as a unique balance of representatives from the environmental sustainability community and land and resource development interests. Throughout the course of the TWG's activities, conversations and correspondence were polite and respectful of each participant's experience and perspective.

By group consensus, the TWG held a total of nine 90-minute meetings on a two-week cadence between August and December 2018. Because of the wide geographic diversity of the TWG membership within Arizona, group consensus was also that all meetings were held in Phoenix with remote participation available via conference call or WebEx. All meetings followed an agenda outline and guest presenters were utilized to provide specialized information not readily available to the TWG membership. Examples include presentations on the nascent "California Rapid Assessment Methodology" by ADEQ staff, the current management of the CWA § 404 Compensatory Mitigation program by US Army Corps of Engineers Regulatory Program staff, and the Compensatory Mitigation program operated by the North Carolina Department of Environmental Quality by NCDEQ's Director of Mitigation Services.

2. CURRENT STATE

The 404(b)(1) Guidelines (Subpart J) establish standards, criteria, and priority for the use of all types of compensatory mitigation, including mitigation banks, in-lieu fee mitigation and on-site/off-site permittee-responsible mitigation, to offset unavoidable impacts to waters of the United

States authorized through the issuance of permits by the U.S. Army Corps of Engineers (Corps) pursuant to section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344).

Compensatory mitigation is the third step in a sequence of actions that must be followed to offset impacts to aquatic resources. The 1990 Memorandum of Agreement between the Environmental Protection Agency (EPA) and the Department of Army establishes a three-part process, known as the mitigation sequence to help guide mitigation decisions and determine the type and level of mitigation required under Clean Water Act Section 404 regulations.

Step 1. Avoid - Adverse impacts to aquatic resources are to be avoided and no discharge shall be permitted if there is a practicable alternative with less adverse impact.

Step 2. Minimize - If impacts cannot be avoided, appropriate and practicable steps to minimize adverse impacts must be taken.

Step 3. Compensate - Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts which remain. The amount and quality of compensatory mitigation may not substitute for avoiding and minimizing impacts.

2.1. 2008 MITIGATION RULE

The Corps and the EPA promulgated a rule in 2008, codified at 33 C.F.R. Part 332 and 40 C.F.R. Part 230, Subpart J Rule, governing the requirements for compensatory mitigation for unavoidable impacts to aquatic resources resulting from CWA Section 404 permits. The primary objective of the 2008 regulations for Compensatory Mitigation for Losses of Aquatic Resources (33 CFR Parts 325 and 332) is to effectively mitigate for losses of aquatic resources by utilizing a watershed approach in the planning, implementation, management and long-term protection of mitigation projects. The Rule emphasizes the need to offset the loss of aquatic functions, with mitigation as near to the project impacts as possible.

Implementation of the Rule occurred gradually, and existing mitigation providers received a "grandfathered" status until June 2013 during which their programs could operate under the previous rule. This implementation lag coincided with the Great Recession (December 2007 through June 2009[1]), within which and subsequent to Arizona experienced a significant downturn in permitting activities. As a result, Arizona's experience with the Rule is more limited than it otherwise might have been. The Rule was specifically designed to be flexible given the wide variety of aquatic resources found nationally and the challenges with mitigating for such resources. Part of this flexibility is exhibited by preferences for certain approaches to mitigation if available. For example, the Rule identifies a hierarchy of mitigation approaches: (1) Mitigation banks, which are typically privately owned and operated and where mitigation generally is done in advance of sale of credits; (2) In Lieu Fee (ILF) Projects, which are often owned and operated by Non-governmental Organizations (NGOs) or government agencies; and (3) permittee-sponsored

[1] Temin, Peter. National Bureau of Economic Research. 2011. The Great Recession and the Great Depression: NBER Working Paper No. 15645. Issued in January 2010, Revised in December 2011.

mitigation. Permittee responsible mitigation is further divided by mitigation under a watershed approach, mitigation on-site and/or in-kind, and mitigation off-site and/or out of kind. [2]

Another example of the Rule's flexibility is the general direction to place the mitigation in the same watershed as the permitted discharges, but with flexibility on how watershed is defined. A watershed approach considers the importance of landscape position and resource type of compensatory mitigation projects for the sustainability of aquatic resource functions within the watershed. Such an approach considers how the types and locations of compensatory mitigation projects will provide the desired aquatic resource functions, and will continue to function over time in a changing landscape. It also considers the habitat requirements of important species, habitat loss or conversion trends, sources of watershed impairment, and current development trends, as well as the requirements of other regulatory and non-regulatory programs that affect the watershed, such as stormwater management or habitat conservation programs. It includes the protection and maintenance of terrestrial resources, such as non-wetland riparian areas and uplands, when those resources contribute to or improve the overall ecological functioning of aquatic resources in the watershed.

2.1.1. Types of Mitigation

In-kind means a resource of a similar structural and functional type to the impacted resource. Out-of-kind means a resource of a different structural and functional type from the impacted resource.

The Rule provides considerable flexibility for out-of-kind mitigation, but administratively the Corps, EPA and permittees have had different ideas about how to implement this flexibility. The Rule contemplates watershed plans providing one framework for interpreting when out-of-kind mitigation might be appropriate in view of past losses or priorities for restoration. Most of the decisions about out-of-kind mitigation are currently left to the Corps' District Engineer. The fundamental objective of the Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters authorized through the issuance of a CWA Section 404 permit. (33 CFR 332.2(a)(1)) The Rule identifies four types of mitigation: restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and preservation.

District Engineers may require the restoration, establishment, enhancement, and preservation, as well as the maintenance, of riparian areas and/or buffers around aquatic resources where necessary to ensure the long-term viability of those resources. Buffers may also provide habitat or corridors necessary for the ecological functioning of aquatic resources. If buffers are required by the District Engineer as part of the compensatory mitigation project, compensatory mitigation credit will be provided for those buffers.

Restoration should generally be the first option considered because the likelihood of success is greater and the impacts to potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation. Compensatory mitigation projects may be sited on public, state

[2] Although the Rule defines in-kind and out-of-kind based on structure and function as described in Section 2.1.1, ILF Sponsors use those terms also in the context of mitigation site location, and those terms are used in this context throughout the document.

trust or private lands. Credits for compensatory mitigation projects on public land must be based solely on aquatic resource functions provided by the compensatory mitigation project, over and above those provided by public programs already planned or in place.

Mitigation Banks

As defined in 33 CFR 332.2, a mitigation bank is a site, or suite of sites, where resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by CWA Section 404 permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor. The operation and use of a mitigation bank are governed by a mitigation banking instrument.

There are no mitigation banks in Arizona. Mitigation Banks, typically for-profit enterprises, create projects that increase aquatic resources, or their functions, independent of potential impacts or requests from permittees to purchase credits to offset their permitted impacts. However, the lack of an established procedure in Arizona for rigorously quantifying changes to aquatic resource function (an approved functional assessment methodology) has made it untenable for banks to ensure a set profit on their enterprise and so, though some have explored the possibility of setting up programs in Arizona, as yet none have. A possible augmenting factor is the overall paucity of permitted activity in the wake of the 2008 economic downturn and the experience of ILF sponsors which have had challenges with the lack of mitigation purchases.

In-Lieu Fee Sponsors

Nationwide, in-lieu fee (ILF) programs provide a small but significant percentage of the compensatory mitigation available to offset permitted impacts to aquatic resources. According to a 2015 study by the Institute for Water Resources (IWR) ILF programs account for around 11% of compensatory mitigation annually (Institute for Water Resources, 2015). In Arizona from 2001 through 2018, the average annual mitigation credits required were 16.5 and the average estimated ILF credit sold were 8.5(pers. comm. Bill Miller, US Army Corps of Engineers; Exhibit 1)

Exhibit 1. Mitigation Credits Required and Estimated In Lieu Fee Mitigation Credits Sold in Arizona from 2011 through 2018 (Source: Bill Miller, US Army Corps of Engineers)

Like mitigation banks, ILF mitigation is referred to as third-party mitigation because the responsibility for implementing compensation projects as well as the liability for ensuring that projects are successful is transferred to a separate provider than the permittee. In general, ILF – like mitigation banking – involves the restoration and protection of larger, more ecologically valuable parcels and entails more thorough scientific and technical analysis and planning than do permittee-responsible mitigation projects. As such, compensatory mitigation projects carried out under well-designed ILF programs yield ecologically successful and sustainable mitigation projects that improve the protection and restoration of watersheds and aquatic ecosystems.

ILF programs operate under a program instrument, the In-lieu Fee Enabling Instrument, developed in coordination with the Corps and the Interagency Review Team (IRT). Unlike mitigation banks, ILF programs may begin to sell credits in advance of securing a compensation site or conducting any mitigation activities. The number of these allowable 'advance credits' is defined in the program instrument and is negotiated based on the Corps and IRTs assessment of the Sponsor's ability or likelihood of program success. Thus, ILF programs do not require the significant amount of up-front funding necessary to secure a site and develop a mitigation plan in advance of selling credits. ILF programs are restricted to sponsorship by government agencies and nonprofit conservation organizations.

ILF programs operate within defined service areas. A service area is "the geographic area within which impacts can be mitigated at a specific mitigation bank or an in-lieu fee program, as designated in its instrument."33 C.F.R. § 332.2 It is also defined as "the watershed, ecoregion, physiographic province and/or other geographic area within which the. in-lieu fee program is authorized to provide compensatory mitigation required by DA permits." 33 C.F.R. § 332.8(d)(6)(ii)(A). Not only does an ILF Sponsor have a defined program service area, individual

projects created by that Sponsor have their own project service areas based on defined regions (currently defined as USGS Hydrologic Units Codes (HUC) 4 watersheds) outlined in the program's Enabling Instrument. Differing ILF programs may define their project service areas at differing geographic or watershed scales as negotiated with the Corps and IRT.

The Rule provides an option for an IRT, which can provide advice to the mitigation program administrators. The Corps has an Arizona IRT which reviews development plans for In-Lieu Fee projects and other items that the Corps wishes to discuss. Arizona Game and Fish Department and Arizona Department of Environmental Quality are represented in the IRT. The Corps maintains its discretion to decide what is appropriate mitigation, but the IRT has served as a useful sounding board for the agency. Should Arizona assume its portion of the 404 program, Arizona would need to decide if it will have an IRT or none at all. If Arizona wishes to have an IRT, it could be independent or the same as the Corps'.

Permittee-Responsible Mitigation

Permittee responsible mitigation involves developing and implementing a mitigation plan by the permittee and is done through the permit process. As noted above, the Rule favors a watershed approach and also generally prefers in-kind versus out-of-kind (mitigation with an aquatic resource that is different from the type of resource impacted.) Permittee responsible mitigation can thus take a wide variety of forms that can conform to the Rule. In general, permittee responsible mitigation is challenging and expensive but can be the only option if ILF Projects do not exist within the project service area, refuse to sell credits, or lack a sufficient number of credits (advance or released) available for sale. Challenges that can be experienced in setting up permittee responsible mitigation include (1) the lack of private land available for mitigation purposes – Arizona is only 17% privately owned and most of that is urbanized and or in agriculture and not available for sale; (2) the use of restrictive covenants which may limit or prohibit compatible human uses; (3) challenges with creating or restoring aquatic resources; (4) credit valuation for out-of-kind mitigation (restoring or protecting an aquatic resource that is different from the type impacted); (5) credit valuation for preservation including buffer and upland preservation; and (6) the administrative costs including bonding for mitigation success and providing for long term management.

A common form of onsite mitigation, particularly for residential development is the use of restrictive covenants to preserve wash corridors and avoided waters within a project. While in the past the Corps accepted these covenants and the associated preserved lands for compensatory credit, relatively little credit is given under the Rule, since it involves preservation and much of the preserved area are riparian areas outside of waters of the U.S. In addition, according to the Rule, preservation may be used when all the following criteria are met (33 CFR 332.3 (h)(1)):

> **(i)** The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
>
> **(ii)** The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological

sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;

(iii) Preservation is determined by the district engineer to be appropriate and practicable; and

(iv) The resources are under threat of destruction or adverse modifications.

The EPA has taken the position that permittee-responsible preservation sites are inadequate if they are not in eminent threat of development (threats associated with livestock grazing have not been considered eminent by EPA). The regulated community generally believes that if restrictive covenants are to be required, then preservation of these areas deserve greater credit under the Rule.

The covenants themselves have evolved over the years from a simple deed restriction to a complex covenant with an extensive list of prohibited actions. Probably the most significant is the limitation on cutting down or removing natural vegetation. These requirements have led to conflicts with adjacent home owners (the land is often in home owner association ownership and management), which seek to clear vegetation to reduce the risk of fire and in some instances to maintain views of open space. The Corps-approved form of covenant also generally restricts and sometimes prohibits the use of trails, which limits human use of the protected corridors. While this may have benefit for wildlife use, it reduces the value of open space to the surrounding community, which is charged with maintaining and managing it. The proliferation of these covenants – and answering questions and resolving disputes - has been a significant administrative burden for the Corps. Potentially, these problems could be inherited by Arizona upon assumption.

2.1.2. Mitigation Plan Requirements (33 CFR 332.4)

For individual permits, the permittee must prepare a draft mitigation plan and submit it to the district engineer for review. After addressing any comments provided by the district engineer, the permittee must prepare a final mitigation plan, which must be approved by the district engineer prior to issuing the individual permit. The approved final mitigation plan must be incorporated into the individual permit by reference. The final mitigation plan must include the following information:

Objectives. A description of the resource type(s) and amount(s) that will be provided, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project will address the needs of the watershed or other geographic area of interest.

Site selection. A description of the factors considered during the site selection process. This should include consideration of watershed needs, on-site alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration,

establishment, enhancement, and/or preservation at the compensatory mitigation project site. (See § 332.3(d).)

Site protection instrument. A description of the legal arrangements and instrument, including site ownership, that will be used to ensure the long-term protection of the compensatory mitigation project site (see § 332.7(a)).

Baseline information. A description of the ecological characteristics of the proposed compensatory mitigation project site and, in the case of an application for a DA permit, the impact site. This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s) or the geographic coordinates for those site(s), and other site characteristics appropriate to the type of resource proposed as compensation. The baseline information should also include a delineation of waters of the United States on the proposed compensatory mitigation project site. A prospective permittee planning to secure credits from an approved mitigation bank or in-lieu fee program only needs to provide baseline information about the impact site, not the mitigation bank or in-lieu fee project site.

Determination of credits. A description of the number of credits to be provided, including a brief explanation of the rationale for this determination. (See § 332.3(f).)

Mitigation work plan. Detailed written specifications and work descriptions for the compensatory mitigation project, including, but not limited to, the geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water, including connections to existing waters and uplands; methods for establishing the desired plant community; plans to control invasive plant species; the proposed grading plan, including elevations and slopes of the substrate; soil management; and erosion control measures. For stream compensatory mitigation projects, the mitigation work plan may also include other relevant information, such as planform geometry, channel form (e.g., typical channel cross-sections), watershed size, design discharge, and riparian area plantings.

Maintenance plan. A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.

Performance standards. Ecologically-based standards that will be used to determine whether the compensatory mitigation project is achieving its objectives. (See § 332.5.)

Monitoring requirements. A description of parameters to be monitored in order to determine if the compensatory mitigation project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting on monitoring results to the district engineer must be included. (See § 332.6.)

Long-term management plan. A description of how the compensatory mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of

the resource, including long-term financing mechanisms and the party responsible for long-term management. (See § 332.7(d).)

Adaptive management plan. A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. (See § 332.7(c).)

Financial assurances. A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards (see § 332.3(n)).

Other information. The district engineer may require additional information as necessary to determine the appropriateness, feasibility, and practicability of the compensatory mitigation project.

2.1.3. Monitoring and Management Requirements (33 CFR 332.6 and 332.7)

Monitoring the compensatory mitigation project site is necessary to determine if the project is meeting its performance standards, and to determine if measures are necessary to ensure that the compensatory mitigation project is accomplishing its objectives. The submission of monitoring reports to assess the development and condition of the compensatory mitigation project is required, but the content and level of detail for those monitoring reports must be commensurate with the scale and scope of the compensatory mitigation project, as well as the compensatory mitigation project type.

The mitigation plan must provide for a monitoring period that is sufficient to demonstrate that the compensatory mitigation project has met performance standards, but not less than five years. A longer monitoring period must be required for aquatic resources with slow development rates (e.g., forested wetlands, bogs).

Long-term protection may be provided through real estate instruments such as conservation easements held by entities such as federal, tribal, state, or local resource agencies, non-profit conservation organizations, or private land managers; the transfer of title to such entities; or by restrictive covenants. This agreement can be in the form of a Conservation Land Use Agreement between the ILF sponsor and the EPA/ACOE.

Compensatory mitigation projects shall be designed, to the maximum extent practicable, to be self-sustaining once performance standards have been achieved. Where active long-term management and maintenance are necessary to ensure long-term sustainability (e.g., prescribed burning, invasive species control, maintenance of water control structures, easement enforcement), the

responsible party must provide for such management and maintenance. This includes the provision of long-term financing mechanisms where necessary.

If the compensatory mitigation project cannot be constructed in accordance with the approved mitigation plans, the permittee or sponsor must notify the district engineer. A significant modification of the compensatory mitigation project requires approval from the district engineer.

The permit conditions or instrument must identify the party responsible for ownership and all long-term management of the compensatory mitigation project. A long-term management plan should include a description of long-term management needs, annual cost estimates for these needs, and identify the funding mechanism that will be used to meet those needs. Any provisions necessary for long-term financing must be addressed in the original permit or instrument.

2.2. Important Considerations for Mitigation Banks and ILF Programs

Mitigation Banks vs ILF Programs

There are several important differences between in-lieu fee programs and mitigation banks. First, in-lieu fee programs are generally administered by state governments, local governments, or non-profit non-governmental organizations while mitigation banks are usually (though not always) operated for profit by private entities. Second, in-lieu fee programs rely on fees collected from permittees to initiate compensatory mitigation projects while mitigation banks usually rely on private investment for initial financing.

Most importantly, mitigation banks must achieve certain milestones, including site selection, plan approval, and financial assurances, and implementation of restoration actions before they can sell credits, and generally sell a majority of their credits only after the physical development of compensation sites has begun. In contrast, in-lieu fee programs generally initiate compensatory mitigation projects only after collecting fees, and there has often been a substantial time lag between permitted impacts and implementation of compensatory mitigation projects. Additionally, in-lieu fee programs have not generally been required to provide the same financial assurances as mitigation banks. For all of these reasons, there is greater risk and uncertainty associated with in-lieu fee programs regarding the implementation of the compensatory mitigation project and its adequacy to compensate for lost functions and services.

Adaptive Management Plan

A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. (See § 332.7(c).)

Advance Credits

The Rule requires that the in-lieu fee program instrument establish a cap on the number of credits that the program can sell before securing a compensatory mitigation project site and conducting aquatic resource restoration, establishment, enhancement, and/or preservation at that site. These

are defined as ‘‘advance credits’’. The Rule also limits sponsorship of in-lieu fee programs specifically to governmental or non-profit natural resource management entities. District Engineers and IRT members should carefully evaluate the capabilities and demonstrated performance of these natural resource management entities prior to approving them as in-lieu fee program sponsors in order to minimize the risks associated with allowing advance credit sales.

Advance Credits for ILF Programs

The in-lieu fee program instrument may make a limited number of advance credits available to permittees when the instrument is approved. The number of advance credits will be determined by the District Engineer, in consultation with the IRT, and will be specified for each service area in the instrument.

Advance Credit Sale Fulfillment

As released credits are produced by in-lieu fee projects, they must be used to fulfill any advance credits that have already been provided within the project service area before any remaining released credits can be sold or transferred to permittees. Once previously provided advance credits have been fulfilled, an equal number of advance credits is re-allocated to the sponsor for sale or transfer to fulfill new mitigation requirements, consistent with the terms of the instrument. The number of advance credits available to the sponsor at any given time to sell or transfer to permittees in a given service area is equal to the number of advance credits specified in the instrument, minus any that have already been provided but not yet fulfilled.

Credit Costs

The cost of compensatory mitigation credits provided by a mitigation bank or in-lieu fee program is determined by the sponsor. For in-lieu fee programs, the cost per unit of credit must include the expected costs associated with the restoration, establishment, enhancement, and/or preservation of aquatic resources in that service area. These costs must be based on full cost accounting, and include, as appropriate, expenses such as land acquisition, project planning and design, construction, plant materials, labor, legal fees, monitoring, and remediation or adaptive management activities, as well as administration of the in-lieu fee program. The cost per unit credit must also take into account contingency costs appropriate to the stage of project planning, including uncertainties in construction and real estate expenses. The cost per unit of credit must also take into account the resources necessary for the long-term management and protection of the in-lieu fee project. In addition, the cost per unit credit must include financial assurances that are necessary to ensure successful completion of in-lieu fee projects.

Credit Stacking vs Credit “Double Dipping”

Under no circumstances may the same credits be used to provide mitigation for more than one permitted activity. However, where appropriate, compensatory mitigation projects, including mitigation banks and ILF projects, may be designed to holistically address requirements under multiple programs and authorities for the same activity.

Financial Assurances
The District Engineer shall require sufficient financial assurances to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with applicable performance standards. In cases where an alternate mechanism is available to ensure a high level of confidence that the compensatory mitigation will be provided and maintained (e.g., a formal, documented commitment from a government agency or public authority) the District Engineer may determine that financial assurances are not necessary for that compensatory mitigation project.

Functional Assessment/Mitigation Replacement Ratios
If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used. 2. The District Engineer must require a mitigation ratio greater than one-to- one where necessary to account for the method of compensatory mitigation (e.g., preservation), the likelihood of success, differences between the functions lost at the impact site and the functions expected to be produced by the compensatory mitigation project.

Hydrologic Unit Codes Service Areas
In urban areas, a U.S. Geological Survey 8- digit hydrologic unit code (HUC) watershed or a smaller watershed may be an appropriate service area. In rural areas, several contiguous 8-digit HUCs or a 6-digit HUC watershed may be an appropriate service area.

ILF Fund Deposits
The program account must be established at a financial institution that is a member of the Federal Deposit Insurance Corporation. All interests and earnings accruing to the program account must remain in that account for use by the in-lieu fee program for the purposes of providing compensatory mitigation for DA permits. The program account may only be used for the selection, design, acquisition, implementation, and management of in-lieu fee compensatory mitigation projects, except for a small percentage (as determined by the District Engineer in consultation with the IRT and specified in the instrument) that can be used for administrative costs.

Mitigation Responsibility Transfer
When a permittee's compensatory mitigation requirements are satisfied by a mitigation bank or in- lieu fee program, responsibility for ensuring that required compensation is completed and successful shifts from the permittee to the bank or in-lieu fee sponsor. This occurs when the sponsor issues a receipt to the permittee assuming these responsibilities for all mitigation, thereby validating the issued permit.

Performance Standards and Milestones
The approved mitigation plan must contain performance standards that will be used to assess whether the project is achieving its objectives. Performance standards may be revised in accordance with adaptive management to account for measures taken to address deficiencies in the compensatory mitigation project. Performance standards may also be revised to reflect changes in management strategies and objectives if the new standards provide for ecological benefits that are

comparable or superior to the approved compensatory mitigation project. No other revisions to performance standards will be allowed except in the case of natural disasters.

Preservation Credits

Preservation may be used to provide compensatory mitigation for activities authorized by DA permits when all the following criteria are met: (i) The resources to be preserved provide important physical, chemical, or biological functions for the watershed; (ii) The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the District Engineer must use appropriate quantitative assessment tools, where available; (iii) Preservation is determined by the District Engineer to be appropriate and practicable; (iv) The resources are under threat of destruction or adverse modifications; and (v) The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).

Project Specific Credit Release

The mitigation banking instrument must provide a schedule for additional credit releases as appropriate milestones are achieved. Implementation of the approved mitigation plan shall be initiated no later than the first full growing season after the date of the first credit transaction.

2.3. Mitigation Ratio-Setting Procedure

The South Pacific Division (SPD) of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation requirements. (U.S. Army Corps of Engineers, South Pacific Division, Special Public Notice 12501-SPD, Updated January 11, 2017). The MRSC procedure includes completion of a checklist to determine the amount of acreage or credits necessary as compensatory mitigation. The checklist comprises a 10-step process that allows for a functional comparison of impacted waters

and proposed mitigation parcels, establishes baseline mitigation ratios, and authorizes adjustment of those ratios based on specified criteria. The 10-step process is: establishes baseline mitigation

1. Identification and Classification of Waters
2. Functional Assessment
    a. Qualitative Impact-Mitigation Comparison
    b. Quantitative Impact-Mitigation Comparison
    c. Preservation Baseline Ratio
3. Preservation Adjustment
4. Mitigation Site Location
5. Net Loss of Aquatic Resource Surface Area
6. Type Conversion
7. Risk and Uncertainty
8. Temporal Loss
9. Final Mitigation Ratio
10. Final Compensatory Mitigation Requirements

2.3.1. Identification and Classification of Waters (Step 1)

Step 1 of the MRSC is the identification and classification of impacted waters and proposed mitigation sites.

2.3.2. Impact-Mitigation Functional Comparison (Step 2)

If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used. 2. The District Engineer must require a mitigation ratio greater than one-to- one where necessary to account for the method of compensatory mitigation (e.g., preservation), the likelihood of success, differences between the functions lost at the impact site and the functions expected to be produced by the compensatory mitigation project.

2.3.2.1. Qualitative Impact-Mitigation Comparison (Step 2a)

The MRSC procedure dated January 2017 offers the following list of functions to consider for a qualitative assessment but allows for alternate lists of functions to be used.

- Short- or long-term surface water storage
- Subsurface water storage
- Moderation of groundwater flow or discharge
- Dissipation of energy
- Cycling of nutrients
- Removal of elements and compounds

- Retention of particulates
- Export of organic carbon
- Maintenance of plant and animal communities

Appendix A describes a qualitative functional assessment accepted by the Corps of Engineers and used for individual permitting processes in Arizona. This same qualitative assessment method was criticized by EPA for under-estimating the functional value of ephemeral drainages.

2.3.2.2. Quantitative Impact-Mitigation Comparison (Step 2b)

Steps 2a, 2b, and 2c of the MRSC are mutually exclusive, and provide a comparison of the impact and mitigation sites based functional values. In order to proceed using Step 2b, the MRSC requires an accepted method for conducting the assessment quantitatively. Arizona is unique in the SPD in that there is no quantitative assessment tool for identifying the functions and services of the aquatic resources in the state, which are predominately ephemeral drainage systems flowing only in direct response to storm events.

CA Rapid Assessment Methodology (CRAM)

California is currently developing a model to provide a quantitative rapid assessment (CRAM). The model includes several modules based on the wetland type. This methodology is based on a three-phased approach; 1) develop a defined wetland inventory for the geographic area that adequately categorizes all wetland types represented; 2) develop various qualitative modules that address the unique parameters of each wetland type represented in the geographic area and; 3) development of a functional assessment to provide a quantitative function within a wetland type. Currently, California is field testing the ephemeral module and subsequent functional assessment for ephemeral system. This ephemeral module may be useful to Arizona and is expected to be complete in mid-2020. This Work Group recommends ADEQ continue to monitor and participate in the development of CRAM for all wetland types in Arizona. Once the wetland inventory is complete, ADEQ should begin to determine which modules would be useful in Arizona and modify as needed to address wetland present in Arizona. Early estimates from ADEQ staff is it may take 18 months to adapt the ephemeral module and will require outside consulting assistance. Additional resources will be required to adopt various modules and ensure assessment fitness with all wetlands in Arizona. The process to develop an Arizona Rapid Assessment Methodology for all wetlands could take 10+ years as compared to California.

Hydrogeomorphic Assessment Methodology

Information can be found here; https://wetlands.el.erdc.dren.mil/hgmhp.html The Corps in Arizona see more value in the development of a qualitative functional assessment similar to CRAM vs. the HGM method. Completion of a working and tested HGM methodology for use in determining mitigation ratios in Arizona would require considerable more time (up to 15 years) than the CRAM (pers. Comm. Bill Miller, US Army corps of Engineers).

2.3.2.3. Preservation Baseline Ratio

For preservation mitigation sites, the baseline ratio is based on expected functional loss at the impact site. Little guidance is provided, outside the following suggestions

- 1:1 for impacts to low value waters;
- 3:1 for impacts to moderate value waters;
- 5:1 for impacts to high value waters.

2.3.3. Preservation Adjustment (Step 3)

Adjustments are made for preservation mitigation sites based on functions, threat, and degree of protection, as outlines in ***Table 1***.

Table 1 Preservation Adjustments:

A. Baseline ratio based on expected functional loss at impact site (1:1 low; 3:1 Moderate; 5:1 high). Copy to step 2.c in checklist.
B. Describe existing functions by requiring FCAM where available (otherwise make qualitative determination) (note: these are all within a range of high functional scores): Low end of range (>75% of reference standard FCAM score) (+5) Medium part of range (>85%) (+3) High end of range (>95%) (+1) *Assumption: waters of the U.S. and riparian buffer can fall into any category, but upland buffer should always assumed to be in low part of the range.
C. Level of threat: Low (+5) (increasing/continuing trend of development in watershed) Medium (+3) (site shown as developed in specific/general plan) High (+1) (development entitlements/permits in place)
D. "Degrees" of long-term protection: Low (management plan) (+5) Medium (restrictive covenant/deed restriction) (+3) High (conservation easement) (+1)
E. Total adjustment (add steps B-D). Copy adjustment to step 3 in checklist.
Supporting information: Impacted aquatic resource(s): Describe functional loss at impact site, preferably based on functional or condition assessment data. Preserved aquatic resource(s)/site(s): Describe aquatic resource functions at preserved site, preferably based on functional or condition assessment data. Threat: Describe threat to preserved site based on local planning document(s), pending/issued development permits, watershed study/plan, etc. Protection type: Describe type of long-term protection.

Source: 12501.2-SPD Instructions for Preparing Mitigation Ratio Setting Checklist

Adjustment of +15 is possible; if added to 5:1 preservation baseline ratio, this could result in a 20:1 ratio.

2.3.4. Mitigation Site Location (Step 4)

Step 4 in the MRSC is a ratio adjustment based on the location of a mitigation site with respect to the impact site. This is generally determined based on whether both sites are located within the

same watershed as defined by the appropriate HUC. There is no defined standard HUC level for use in completing the MRSC. For this project, the Corps has indicated a preference for using the HUC-6 designation.

2.3.5. Net Loss of Aquatic Resource Surface Area (Step 5)

Per the MRSC instructions, credit can only be given for this step if establishment or re-establishment of aquatic features is to be completed by proposed mitigation actions, so there is either no adjustment made or an adjustment of 1 acre of mitigation per acre of impact if there is no establishment or re-establishment proposed (i.e. for rehabilitation, enhancement, and preservation).

2.3.6. Type Conversion (Step 6)

Out-of-kind mitigation can result in an increase to the mitigation ratio if the mitigation site presents lower quality or less valuable habitat. However, if it is determined that the mitigation site has or will have a rare, unique, or valuable resource type for the determined watershed, a decrease of the mitigation ratio could be applied. Scoring for this category can range from +4 for out-of-kind habitat that is common to -4 for restoration or conversion of rare and valuable habitat. The scoring for this category compares the impact sites and the mitigation sites by assessing the rarity of the stream or habitat type and the overall functional benefit to the watershed.

2.3.7. Risk and Uncertainty (Step 7)

Risk and uncertainty is assessed so that the mitigation ratio reflects the uncertainty inherent in some mitigation activities. Factors that are considered include: 1) permittee-responsible mitigation; 2) mitigation site did not formerly support targeted aquatic resources; 3) difficult-to-replace resources (see 33 CFR 332.3(e)(3) and (f)(2)); 4) modified hydrology (e.g., high-flow bypass); 5) artificial hydrology (e.g., pumped water source); 6) structures requiring long-term maintenance (e.g., outfalls, drop structures, weirs, bank stabilization structures); 7) planned vegetation maintenance (e.g., mowing, land-clearing, fuel modification activities); 8) e.g., shallow, buried structures (riprap, clay liners), and 9) absence of long-term preservation mechanism.

Each element of risk is scored from +0.1 to +0.3 based on the amount of uncertainty.

The MRSC instructions note that the cost of uncertainty is factored into the cost of credits for ILF projects, in which case no ratio adjustment would occur at this step.

2.3.8. Temporal Loss (Step 8)

Temporal loss associated with mitigation activities that begin after impacts are made and the amount of time it takes for a mitigation activity to reach full, functional potential are considered in this step. Ratio adjustments are applied based on the amount of time required for the planting, establishment, and growth of vegetation. The temporal adjustment to the mitigation ratio is .05 per month and generally assumes a 20-month time-frame (adjustment of +1) for herbaceous growth, a

40-month time frame (adjustment of +2) for woody shrubs, and a 60-month (adjustment of +3) or 5-year time frame for tree species.

2.3.9. Final Mitigation Ratio (Step 9)

The final ratios determine the amount of acreage credits that are generated by each mitigation parcel when compared to each impacted drainage class.

Step 9 of the MRSC is the calculation of final mitigation scoring ratios from the MRSC. The mitigation ratios for each impact class and mitigation site are compiled and summarized**.**

2.3.10. Final Compensatory Mitigation Requirements Summary (Step 10)

The total acres of impacted areas by drainage class are applied to the number of mitigation credits provided based on the final mitigation ratios.

3. IDEAL FUTURE STATE

The CM TWG stakeholders believe that an ideal future state would embrace the flexibility provided by the Rule and focus on exacting improvements to the mitigation ratio setting standard operating procedures and other guidance measures defined by the Corps. Examples of identified improvements and stakeholder recommendations are listed here:

1. Approval of a quantitative functional assessment method (rapid assessment or HGM) that ensures more consistency in determining functional values
2. In the interim, while awaiting the development of a quantitative functional method, have an approved qualitative method
3. Through the development of a rapid assessment or HGM, establish clear and objective mitigation ratios to reduce and eliminate the current variability found between project managers and stream functions;
4. More credit for preservation in the mitigation ratio setting to allow for more in-kind mitigation of ephemeral systems
5. Incentivize restoration and establishment mitigation projects by reducing ratio penalties for risk and uncertainty
6. More certainty in determining long term management requirements (define “long term” in a way that does not cause ILF and permittee responsible mitigation to be cost prohibitive). The Rule only requires long-term management and does not define “long term”. Existing site protection and enabling instruments identify perpetuity which is not defined in AZ statute. Through new enabling agreements with ADEQ, revise the financial assurance and perpetual maintenance requirements for ILF sponsors which represent about 2/3 of mitigation credit fees currently charged;
7. Consider opportunities for use of public, state owned or State Trust lands as mitigation banks or ILF mitigation areas
8. More flexibility in mitigation approaches (e.g. groundwater recharge as 404 mitigations would improve aquatic resource functions therefore recharge should be considered appropriate 404 mitigation; possible credit for permittee responsible on-

site creation and restoration post construction). Negotiate with EPA to allow out-of-kind mitigation to occur in order to support state priorities for restoration of perennial or groundwater-supported waters.

9. In tandem with # 5 and 8 above, target restoration to where it is most needed (prioritization);
10. Larger ILF Service Areas, which would be beneficial to ILF managers and permittees alike. Need the ability to use watersheds and ecoregions to establish service areas (Please see attached Level III Ecoregions of Arizona Map). Currently, EPA and Corps follow only HUC's. The Rule recognizes the physiographic ability of ecoregions as justification for identifying an appropriate mitigation site location. This approach should be utilized more.
11. Start off using same IRT for Arizona program until there is a new, defined role of IRT for Arizona's program.
12. Implementation windows defined in the Rule currently require implementation of restoration actions for Advanced credits within 3 years of the initial credit sale. This is unrealistic in areas with low credit sales as the sponsor is required to complete all feasibility studies and submit to the Corps and IRT for approval prior to implementation.
13. Improve communication between the regulated community and ILF sponsors for credit needs. Recommendation to provide a 5-year planning window.
14. Opportunity for state owned or State Trust lands to potentially combine ESA and 404 mitigation needs.

As discussed briefly above, Arizona has unique challenges with mitigation under the Rule, which contains a number of preferences that reflect more national trends in compensatory mitigation than are reflected in on the ground conditions in Arizona. Nevertheless, the Rule has flexibility in its conditions that can be adapted to Arizona.

For example, the Rule favors mitigation banks and Arizona of course has no such banks. While we could undertake an effort to evaluate in depth why banks have not been established, the Rule does allow for ILF projects as a second choice and Arizona has a number of such projects. These are struggling financially with lack of demand for credit sales and so encouraging establishment of mitigation banks is likely to further erode ILF viability. To its credit, the Rule is flexible enough to allow ILF mitigation in the absence of mitigation banks.

The emphasis on in-kind mitigation along ephemeral streams over out-of-kind mitigation to support perennial streams or other groundwater-supported riparian ecosystems is similarly out of step with environmental conditions in Arizona. The most threatened aquatic resources are those associated with perennial runoff or groundwater-supported systems. These same systems have suffered disproportionate historic losses, as compared to truly ephemeral stream systems. Conversely, mitigation for ephemeral systems, the most common impacted by development, presents challenges due to the lack of impaired resources in need of restoration or the availability of private land for creation of new systems.

The need for a strategic and comprehensive approach to compensatory mitigation in Arizona's watersheds is critical, given the historic losses of surface waters and related functions due to dams, incompatible development, water withdrawals, non-native/invasive species, industrial discharges, incompatible agricultural practices, road construction, fire suppression, mining, land conversion/development, and the future threat of climate change.

The Rule has the flexibility to allow for the "trading up" from impacts on ephemeral streams to mitigation that would involve restoration or enhancement of perennial or shallow groundwater conditions that would be considered out of kind. Applying the Rule in this fashion can have significant positive impacts to Arizona's most valuable aquatic resources: streams, springs and shallow water tables that support wetlands and riparian forests. These aquatic systems being limited in Arizona should be provided with a higher prioritization for mitigation opportunities including preservation as they are limited and have highest potential for loss but require long-term management and protections. Currently ILF sponsors in Arizona can conduct purchase restoration actions under the Rule to protect these resources. The Rule generally allows preservation as a form of mitigation but identifies it as a low priority. However, Arizona is uniquely situated given the availability of lands held by the State Land Department in trust for the benefit of public education and other public institutional beneficiaries. For many of these lands, an appropriate use is likely to be for open space preservation via ILF or mitigation banking. Adopting policies within the framework of the Rule that allows for preservation of these lands would have substantial public benefits both for the environment and public education.

The long lead time to establish and qualify a mitigation bank for credit sales, together with the relatively small number of credits that are assessed and purchased annually, has served as a disincentive to potential mitigation bank providers. This has led to the current state wherein In-Lieu Fee sponsors and on-site permittee-responsible mitigation are the only option available other than out-of-kind and/or out-of-watershed mitigation. For this reason, the CM TWG members support having a strong ILF program in Arizona.

4. IDENTIFIED GAPS

There is an outstanding question if ADEQ will inherit the old Corps covenants or will Corps continue to hold and enforce them.

As discussed above, many of the challenges for Section 404 permittees and mitigation providers in Arizona arise from the fact that there currently is no quantitative functional assessment methodology to assess the intermittent and ephemeral waters or episodic riverine environments that are predominant in the state. Until a quantitative functional method is approved in Arizona, a qualitative method should be approved and vetted with the EPA to reduce contention in individual project reviews and approvals.

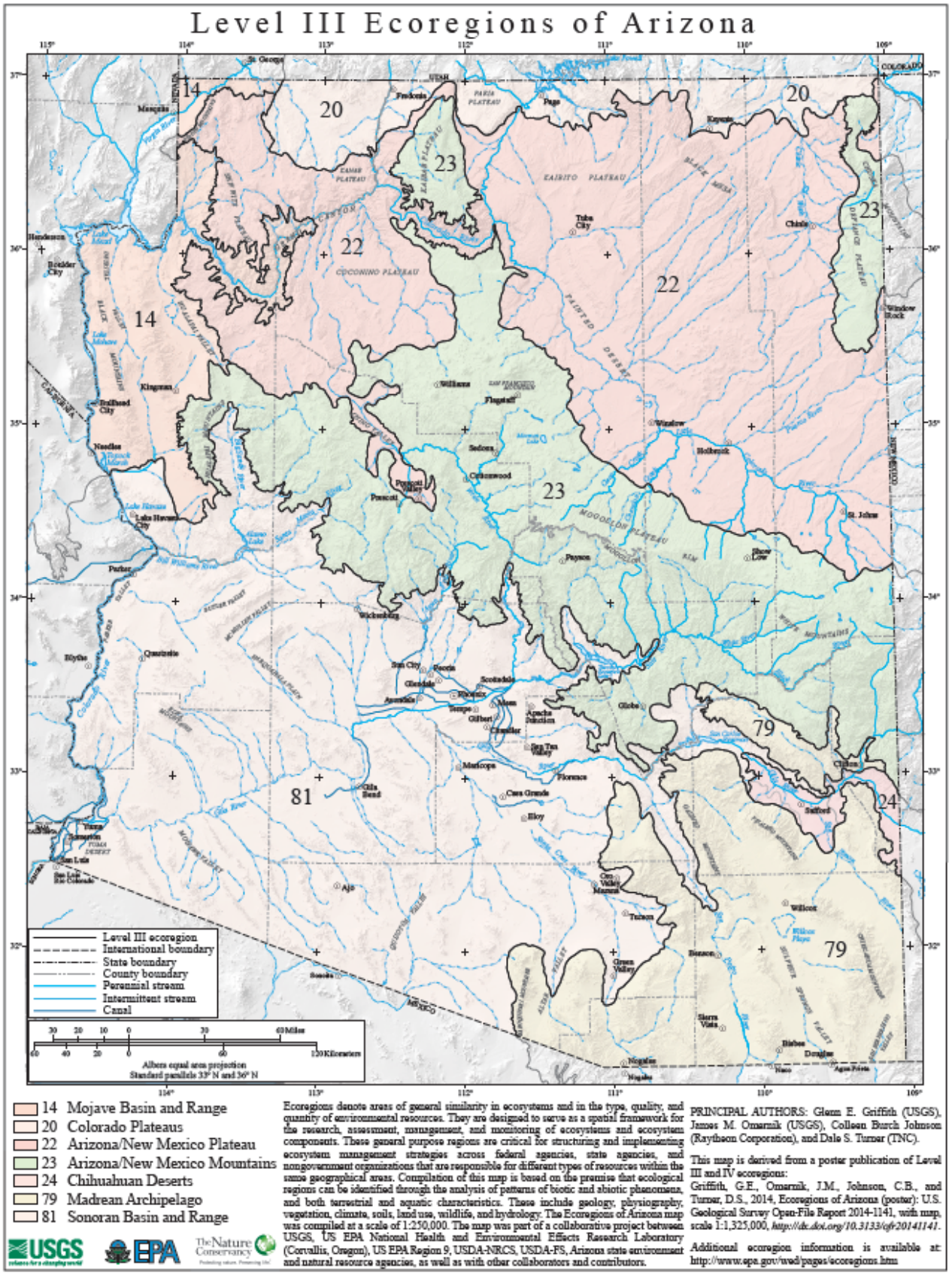
Development of a mitigation ratio approach specific to Arizona and approved by EPA will need to be developed as part of development of the State's 404 program.

ADEQ will need financial agreements with the ILF sponsors. Ideally, existing agreements between the Corps and ILF sponsors can be transferred to ADEQ.

5. CONCLUSIONS AND RECOMMENDATIONS

Assuming this program means removing the Corps from the decision making in determining appropriate mitigation. There are concerns among stakeholders about EPA's enhanced role in a state program. In the past EPA has been critical of Corps mitigation decisions and this makes it difficult to predict what the program will look like if EPA is in a primary oversight role.

The CM TWG stakeholders have made the recommendations outlined in Section 3 because they believe the Rule provides the flexibility to allow for those improvements. The CM TWG stakeholders recommend these improvements whether or not the State assumes the CWA 404 program.


Level III Ecoregions of Arizona
14 Mojave Basin and Range
20 Colorado Plateaus
22 Arizona/New Mexico Plateau
23 Arizona/New Mexico Mountains
24 Chihuahuan Deserts
79 Madrean Archipelago
81 Sonoran Basin and Range
Level III ecoregion
International boundary
State boundary
County boundary
Perennial stream
Intermittent stream
Canal
Albers equal area projection
Standard parallels 33° N and 36° N
Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas. Compilation of this map is based on the premise that ecological regions can be identified through the analysis of patterns of biotic and abiotic phenomena, and both terrestrial and aquatic characteristics. These include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The Ecoregions of Arizona map was compiled at a scale of 1:250,000. The map was part of a collaborative project between USGS, US EPA National Health and Environmental Effects Research Laboratory (Corvallis, Oregon), US EPA Region 9, USDA-NRCS, USDA-FS, Arizona state environment and natural resource agencies, as well as with other collaborators and contributors.
PRINCIPAL AUTHORS: Glenn E. Griffith (USGS), James M. Omernik (USGS), Colleen Bursch Johnson (Raytheon Corporation), and Dale S. Turner (TNC).
This map is derived from a poster publication of Level III and IV ecoregions:
Griffith, G.E., Omernik, J.M., Johnson, C.B., and Turner, D.S., 2014, Ecoregions of Arizona (poster): U.S. Geological Survey Open-File Report 2014-1141, with map, scale 1:1,325,000, http://dx.doi.org/10.3133/ofr20141141.
Additional ecoregion information is available at: http://www.epa.gov/wed/pages/ecoregions.htm
USGS
EPA
The Nature Conservancy

Appendix A

Qualitative Functional Assessment Method Current State

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1.1.3.2. **Error! Bookmark not defined.**
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1. QUALITATIVE FUNCTIONAL ASSESSMENT METHOD

This section describes a qualitative functional assessment that was accepted by the Corps of Engineers and used for individual permitting processes in Arizona. This same qualitative assessment method was criticized by EPA for under-estimating the functional value of ephemeral drainages.

A list of 11 hydrologic, chemical, and biotic functions was developed to provide an assessment of the functions within each drainage class (***Table 1***). These functions are consistent with those identified in the MRSC procedure dated October 2013.

Table 1. Functions Evaluated in WestLand's Qualitative Functional Assessments accepted by the Corps.

Hydrologic Functions
Hydrologic Connectivity
Subsurface Flow and Groundwater Recharge
Energy Dissipation
Sediment Transport/ Regulation

Appendix A

Qualitative Functional Assessment Method Current State

Chemical Functions
Elements, Compounds, and Particulate Cycling
Organic Carbon Export/Sequestration
Biotic Functions
Aquatic Invertebrate Fauna
Presence of Fish and Fish Habitat Structure
Riparian/Wetland Vegetation Structure
Age Class Distribution of Wooded Riparian or Wetland Vegetation
Native/Non-native Vegetation

Scoring for these 11 functions is based on available data, published literature, field data collected within planned impact areas and mitigation lands, aerial photos, and planned mitigation activities. The categories are scored qualitatively on a six-rank scale: none, low, low-moderate, moderate, moderate-high and high. Based on this scale a numeric score is assigned as identified in ***Table 2***.

Table 2. Numeric Scores assigned to the Qualitative Functional Score

Qualitative Functional Score	Numeric Score
None	0
Low	1
Low-Moderate	2
Moderate	3
Moderate-High	4
High	5

Appendix A

Qualitative Functional Assessment Method Current State

1.1. HYDROLOGIC FUNCTIONS

1.1.1. Hydrologic Connectivity

Hydrologic connectivity scoring assesses the connectivity between surface waters to downstream receiving waters through both surface and shallow subsurface flow.

Scoring for this category is based on the ability of a stream class or mitigation site to transmit either perennial or ephemeral flow from an upstream source to the downstream receiving water. Any natural or artificial impedance in a channel would slow the flow rate of water. An example of artificial impedance would be a highway or railroad. An example of natural impedance would be a broad, flat channel with deep sand and gravel bed.

A “high” or “5” would be given to a system that transmits virtually all water from its upstream source to the downstream receiving water. A “low” or “1” would be given to a system that transmits virtually no water from its upstream source to the downstream receiving water.

1.1.2. Subsurface Flow and Groundwater Recharge

Subsurface flow and groundwater recharge scoring assesses the potential for surface water to infiltrate the channel bed and to continue to move vertically to recharge local or regional groundwater aquifers or laterally to support riparian vegetation and contribute to material cycling.

Scoring for this function is based on the permanence and volume of flow through the feature coupled with the impedance of the channel. A “low” or “1” would be given to a low-order ephemeral stream with compact bed soils, shallow bedrock or impenetrable horizons, or high clay content, and sparse xeroriparian buffer. A “high” or “5” would be given to a large perennial stream with a silt or gravel bed substrate, meso- or hydroriparian or wetland vegetation buffer, and deep low-impedance soils promoting infiltration and hyporheic exchange through the stream bed.

1.1.3. Energy Dissipation

Energy dissipation scoring assesses the ability of the watershed to dissipate the high energy of flood waters, leading to slower velocities, reduced potential for erosion, enhanced groundwater recharge, and support of riparian vegetation.

Scoring for this function is based on three parameters: the relative sinuosity of the channel, the roughness and gradient of the channel, and the ability of the adjacent floodplain to hold and attenuate flood flows. A “low” (“1”) score would be given to a relatively straight, high gradient stream with a sandy bottom or a constrained buffer and floodplain with minimal riparian vegetation. A “high” (“5”) score would be given to a highly sinuous or braided channel with low gradient, cobbles and/or woody vegetation and debris within the channel, and an accessible floodplain with a well-developed riparian buffer.

1.1.4. Sediment Transport Regulation

Sediment transport and regulation scoring assesses the ability of the waters to regulate the transport of sediment downstream and the ability to minimize excessive sediment loss and gains.

Scoring for this segment is a qualitative evaluation of the channel geometry, the ability of upstream and lateral features to provide sediment to the system, and the ability of the system to attenuate sediment loads.

1.2. CHEMICAL FUNCTIONS

1.2.1. Elements, Compounds, and Particulate Cycling

Elements, compounds, and particulate cycling scores assess the ability of a stream class to regulate the transport of elements, compounds, and particulates. This function includes the capacity to reduce harmful pulses of nitrogen and phosphorus to downstream waters. Riparian vegetation aids in the sequestration of nutrients which can be released during flood events and through subsurface movement. Riparian vegetation is also a critical component in the denitrification process, which can prevent excessive nitrogen levels that lead to eutrophication and hypoxia.

The cycling of elements, compounds, and particulates is evaluated using channel width, upland and riparian vegetation volume and composition, stream gradient, and bed characteristics. A low score is given to a high-gradient, low-order headwater stream with reduced or degraded riparian buffer and/or excessive chemical input. A high score would be given to a higher order stream with a healthy riparian buffer, active hyporheic zone, and features that have the ability to retard excessive nutrient pulses through capture and storage (such as roughness, sinuosity, or vegetation).

1.2.2. Organic Carbon Export/Sequestration

Organic carbon export and/or sequestration evaluate(s) the production, retention, and transport of organic nutrients through the riparian system. Riparian vegetation is capable of producing and exporting significantly higher amounts of organic carbon than typical desert upland vegetation.

Scoring for this function includes an evaluation of channel geometry, frequency of flow, stream connectivity, stream and riparian area substrates, and riparian buffer width, density, and species composition. A low score would be given to a narrow ephemeral stream with little to no connectivity and a minimal riparian buffer. A high score would be given to a wide perennial stream with a well-defined riparian buffer, dense vegetation, and healthy soils that could generate large amounts of organic material for sequestration or export.

1.3. BIOTIC FUNCTIONS

1.3.1. Aquatic Invertebrate Fauna

Aquatic invertebrate fauna scoring assesses the presence of aquatic invertebrate fauna within the water features. This score is also an indication of the extent of prey base available to higher order species, including aquatic-feeding amphibians, reptiles, and fish.

Scoring for this metric is based on the number of aquatic invertebrate orders that are estimated to be present within impact areas and mitigation sites. If no invertebrates are present, a score of "none" ("0") is given to the site. Scoring is then determined by the estimated average number of taxonomic orders present within a site, with one order scoring "low" ("1") and five or more orders scoring "high" ("5").

1.3.2. Presence of Fish and Fish Habitat Structure

Scoring of this function assesses the presence and diversity of fish and the presence and quality of fish habitat based on methods outlined in Stacey et al. (2006)[3].

A score of "none" is given for systems supporting no fish. A score of "low" ("1") is given for the presence of non-native fish only, while a score of "moderate" or "3" is given for the presence of both native and non-native species. A "high" ("5") score would be given for sites that have native species only. Fish habitat structure is an aggregate of three factors, including the presence of riffles and pools, the amount of underbank cover, and the amount of woody debris within the channel. The presence of riffles and pools is scored based on estimated area containing pools with a score of "none" for a lack of pools up to a score of "high" for pools that are present along at least 50 percent of the feature. Underbank cover is scored in the same manner. Large woody debris is a qualitative evaluation of the amount of large woody debris within each drainage class. The three rankings were considered and a composite score between "none" and "high" is assigned based on the combination of conditions noted within each impacted drainage class or mitigation site.

1.3.3. Riparian/Wetland Vegetation Structure

Riparian/wetland vegetative structure scoring evaluates the volume and density of vegetation within the riparian areas. The extent and density of riparian vegetation directly affects the ability of the riparian area to perform many of the functions in this analysis. The density of riparian vegetation is also important in determining the overall quality of the riparian ecosystem.

For this function, total vegetation volume (TVV) is measured within the impact areas, both instream (if present) and within riparian and upland habitat. Total vegetative volume is measured on a gradient scale and is expressed as cubic meters of vegetation per square meter of surface area. The scoring categories were as follows:

None (0) = concrete or artificially lined wash
Low (1) = TVV (< 0.25)
Low-Moderate (2) = TVV (0.26 to 0.50)

[3] Stacey, P. B., Jones, A.L., Catlin, J.C., Duff, D.A, Stevens, L.E., and C. Gourley. 2006. User's Guide for the Rapid Assessment of the Functional Conditions of Stream-Riparian Ecosystems in the American Southwest. Wild Utah Project. available at: www.wildutahproject.org\resources\

Moderate (3) = TVV (0.51 to 0.75)
Moderate-High (4) = TVV (0.76 to 1.0)
High (5) = TVV (> 1.0)

For mitigation sites an estimate of the anticipated TVV upon achieving mitigation success should be used.

1.3.4. Age Class Distribution of Woody Riparian or Wetland Vegetation

This function ranks the age class distribution structure of woody vegetation. A robust age-class distribution provides diverse habitat niches and demonstrates the health and permanency of the riparian and/or wetland community present at the site.

Scoring for this function is based on the measurement and classification of shrub and tree ages. The age classes considered include seedling, sapling, mature, and senescent. If one class is present, the feature is scored “low” (“1”); if two classes are present, “low-moderate” (“2”); three classes, “moderate” (“3”); and all four classes, “moderate-high” (“4”). A “high” (“5”) score is given if all four classes were present along with wetland vegetation. For restoration mitigation sites, estimates were based on anticipated growth and recruitment levels at each site upon achievement of mitigation success.

1.3.5. Native/Non-native Woody Vegetation Species

Native/non-native woody vegetation species scoring provides a qualitative evaluation of the proportion of non-native woody species in the community. Non-native vegetation can have detrimental impacts on other plant and animal species, and it can alter soil and chemical functions and compositions.

A high score is given for classes or areas with less than five percent cover of non-native species, and a low score indicates greater than 50 percent cover of non-native species.

For establishment or restoration mitigation sites, estimates should be based on anticipated conditions at each site upon achievement of mitigation success.