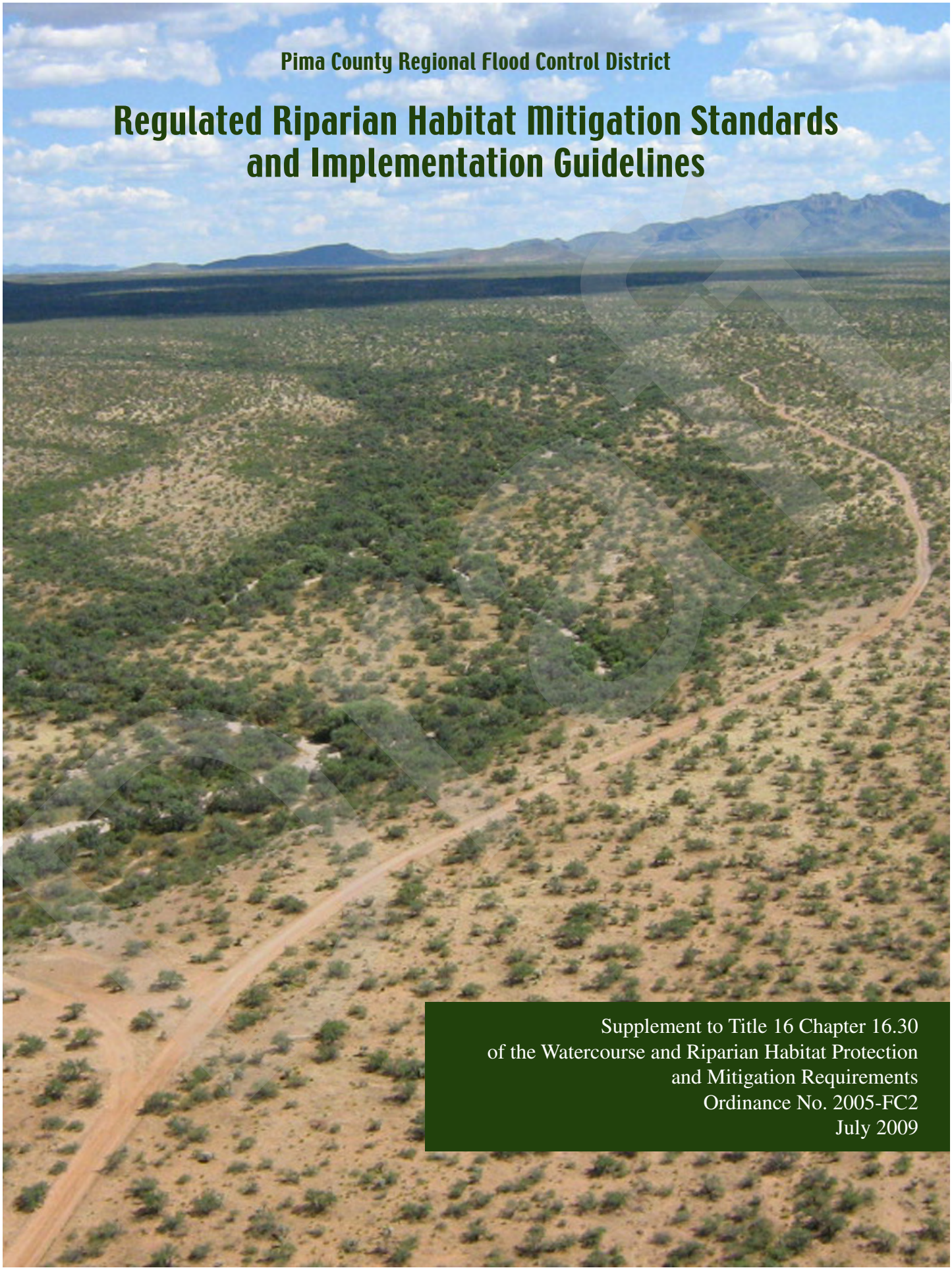
Pima County Regional Flood Control District

Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines



Supplement to Title 16 Chapter 16.30
of the Watercourse and Riparian Habitat Protection
and Mitigation Requirements
Ordinance No. 2005-FC2
July 2009

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This document was prepared by Novak Environmental, Inc. under contract to Pima County Flood Control District, Carla Fuller Danforth, Project Manager, July 2001. It contains reformatting and minor rewording of a document prepared by McGann and Associates, Inc. under contract to Pima County Flood Control District in July, 1994. The format is copyrighted by Novak Environmental, Inc. 2001

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section one:
the ordinance

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What is the history of this Ordinance?

On July 19, 1994 Pima County Board of Supervisors (Board), acting as the Board of Directors of the Flood Control District, adopted Pima County's first riparian habitat protection regulations under the Floodplain and Erosion Hazard Management Ordinance (Ordinance) as Article X, of the Pima County Code: "Watercourse and Riparian Habitat Protection and Mitigation Requirements."

In addition to the Ordinance, the Board adopted official maps indicating the general location of regulated riparian habitat (RRH), meeting certain criteria and subject to the requirements of the Ordinance. The official maps are referred to in this document as Riparian Classification Maps. The 1994 version of the Ordinance applied only to the review and approval of development plans and subdivision plats, which contain RRH within unincorporated Pima County.

In 1998, the Ordinance was revised to apply Article X to ALL properties containing RRH within unincorporated Pima County and was adopted by the Pima County Board of Supervisors on July 14, 1998.

The Board officially codified the Floodplain Ordinance and its various amendments (including Article X) as Title 16 of the Pima County Code on June 1, 1999 (also referred to as FPMO No. 1999-FC1). At this time, the "Watercourse and Riparian Habitat Protection and Mitigation Requirements" was officially changed to Title 16, Chapter 16.54 of the Pima County Code.

The most recent revision to the Ordinance occurred in 2005. At this time, new official Riparian Classification maps were adopted by the Board. The new maps were a result of studies performed for the Sonoran Desert Conservation Plan, which included mapping based on plant community structure and composition, vegetation density and the availability of water. The 2005 version of the Ordinance, FPMO No. 2005-FC2, was adopted by the Board on September 6, 2005. Under this revision, the "Watercourse and Riparian Habitat Protection and Mitigation Requirements" was officially changed from Chapter 16.54 to Chapter 16.30 of the Pima County Code.

Chapter 16.30 is referred to throughout this document as the "Ordinance".

What is the purpose of this Ordinance?

The purpose of the Ordinance is to promote stable flow and sediment transport conditions, preserve natural floodplain functions, and provide water-course management by preserving and/or enhancing riparian vegetation and habitat along water courses and floodplains and to:

- Promote benefits provided by riparian habitat resources, including but not limited to, ground-water recharge, natural erosion control and protection of surface-water quality.

- Ensure the long-term stability of natural flood-plains and survival of the full spectrum of plants and animals that are indigenous to the County by:

  1. Assuring riparian habitat acreage and existing or natural functional values are not diminishing during development;

  2. Providing continuity of riparian habitat along watercourses;

  3. Promoting land-use guidance for avoiding, minimizing and mitigating damage to important riparian areas; and

  4. Providing ecologically sound transmission between riparian habitat and developed areas.

- Promote an economic benefit to the County by providing aesthetic, recreation and wildlife values of riparian habitat for the enjoyment of residents and visitors.

The Ordinance strengthens riparian habitat protection by incorporating the riparian elements of the Conservation Lands System (CLS). The CLS categorizes and identifies locations of priority biological resources within Pima County and provides policy guidelines for the conservation of these resources.

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Importance of Riparian Habitat

Simply put, riparian habitat is the community of plants found in areas where water tends to concentrate—either temporarily or permanently—fostering the growth of plant life. A more thorough definition is that riparian habitat is the community of plants occurring in association with any spring, cienega, lake, watercourse, river, stream, creek, wash, arroyo, or other body of water, either surface or subsurface, or channel having banks and bed through which waters flow at least periodically.

Riparian habitat is a valuable resource in the Sonoran Desert. River systems in the Sonoran Desert are important corridors for resident and migratory birds, along with providing wildlife with the resources necessary to maintain their populations. Preserving and restoring riparian habitat in Pima County provides multiple benefits to people as well as wildlife by protecting the natural function of the floodplain, providing shade, natural beauty, creating passive recreational opportunities, preventing erosion, protecting water quality, increasing groundwater recharge, and reducing the urban heat island effect.

Where is the Ordinance applied?

Administration and Enforcement of the Ordinance shall apply to individual building permits, including grading and right-of-way use permits, and land development permits associated with subdivision plats and development plans issued by the County.

The Ordinance applies to all property in unincorporated areas of Pima County, which contains RRH, including state lands and property owned by Pima County. The Ordinance does **not** apply to:

- any property where Regulated Riparian Habitat is not present;
- Incorporated areas of cities or towns which have elected to assume separate floodplain management powers and duties pursuant to Section 48-3610 of the Arizona Revised Statutes, unless the property is owned by Pima County (see above) and;
- Indian and military reservations.

What is Regulated Riparian Habitat (RRH)?

Regulated Riparian Habitat (RRH) consists of Important Riparian Areas (IRA), Hydroriparian, Mesoriparian, and Xeroriparian habitats, as described below:

Important Riparian Areas (IRA):
Important Riparian Areas occur along the major river systems and provide critical watershed and water resource management functions as well as providing a framework for landscape linkages and biological corridors. Important Riparian Areas are valued for their higher water availability, vegetation density, and biological productivity, as compared to adjacent upland habitats. Important Riparian Areas are essential for floodplain management and every effort should be made to protect, restore, and enhance the structure and functions of these areas including hydrological, geomorphological, and biological functions.

Hydroriparian and Mesoriparian Habitat (Class H):

Hydroriparian: Hydroriparian habitats are generally associated with perennial watercourses and/or springs. Plant communities contain obligate or preferential wetland plant species such as willow and cottonwood.

Mesoriparian: Mesoriparian habitats are generally associated with perennial or intermittent watercourses or shallow groundwater. Plant communities may be dominated by species that are also found in drier habitats (e.g., mesquite) but contain some preferential riparian plant species such as ash or netleaf hackberry.

Xeroriparian Habitat (Classes A-D):
Riparian habitats classified as xeroriparian are generally associated with an ephemeral water supply. These communities typically contain plant species also found in upland habitats; however, these plants are typically larger and/or occur at higher densities than adjacent uplands. Xeroriparian habitat is divided into Classes A, B, C, and D, as defined in Section 2 of this document.

What is considered alteration of RRH?

The Ordinance considers riparian habitat to be altered on the subject property when:

There is disturbance to RRH (Class H, Xeroriparian Classes A, B, C, D, and/or IRA) that reduces vegetative volume or diminishes the value of the riparian habitat present on the site. Types of disturbances may include, but are not limited to:

- Mass grading/partial grading
- Clearing/thinning (including pruning)
- Planting of non-native (exotic) species within RRH (outside of developed areas) is discouraged
- Planting of noxious and/or invasive species
- Other modifications that may reduce vegetation volume or diminish the value of the RRH (e.g., implementing turf plantings, livestock areas, fencing, paved walking paths, roads, structures, play areas).

What triggers the need for a Riparian Habitat Mitigation Plan (Mitigation Plan)?

While any disturbance to RRH requires District review and approval, a Riparian Habitat Mitigation Plan (Mitigation Plan) is required when greater than 1/3 acre of RRH (14,520 square feet) is disturbed.

To prevent a property owner from impacting RRH in a piece-meal manner, disturbance is considered cumulative. All disturbance occurring on a property or project site after the effective date of the Riparian Classification Maps will be counted toward the 1/3 acre mitigation trigger.

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When RRH is present on a site to be developed or subdivided, the following options are available for treatment of RRH, with preference in the order shown:

1. Avoidance of habitat
2. Minimize disturbance
3. Rectify, reduce, or eliminate impact over time
4. Compensate for impact with onsite mitigation
5. Compensate for impact with a combination of onsite and offsite mitigation
6. Compensate for impact through offsite mitigation

Avoidance

The RRH is avoided and preserved.

Avoidance is required. If impacts to RRH cannot be avoided, the applicant shall provide evidence that no reasonably practicable alternative exists to the proposed impact. Reasons for impacting RRH may include the following:

- Site constraints such as steep slopes, rock outcroppings, etc.,
- Certain restrictions imposed by other Pima County Departments,
- Public Health and Safety considerations.

Modifications of Development Standards found in Section 18.07.080 of the Zoning Code are available as incentives for preservation of RRH. Modified Development Standards include:

- Reduction in minimum setbacks
- Reduction in minimum lot size
- Reduction in the quantity of plants required to be installed within required Bufferyards
- Reduction in number of required parking spaces
- An owner or developer may request additional development standard modifications which promote the purpose of the Ordinance.

Modified Development Standards may be allowed if:

- A mitigation plan required by the Ordinance would be unnecessary if the development standard modification is granted; or
- Development within the RRH cannot reasonably be avoided and a modification is applied for as part of a mitigation plan submitted pursuant to the Ordinance.

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See Page 11 for more information related to Modified Development Standards. Detailed information can be found in Chapter 18.07 of the Pima County Zoning Code, which can be viewed at:

http://www.pimaxpress.com/

Minimize Disturbance

Measures that can be taken to minimize impacts to RRH include:

- Reducing grading limits;
- Reducing building footprints;
- Reorienting the structure to minimize impacts;
- Reducing width, length, and/or relocating driveways and parking areas;
- Utilizing modified development standards offered under Chapter 18.07 of the Zoning Code.

Disturbance with Onsite Mitigation

If it is demonstrated that avoidance is not feasible and the amount of disturbance cannot be minimized below 1/3 acre, the RRH may be removed as long as an approved Mitigation Plan is implemented.

This alternative is available only when it can be demonstrated that there is no "reasonably practical alternative" to the proposed impact and that impacts are minimized to the greatest extent possible. An approved RHMP is required before disturbance to RRH is permitted and must address how impacts will be minimized, rectified or eliminated over time.

In some instances, the use of Modified Development Standards may be requested as part of a Mitigation Plan submitted to Pima County. (See Chapter 18.07 of the Pima County Zoning Code.)

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Disturbance with Offsite Mitigation

Offsite mitigation will be allowed when it has been demonstrated that preservation or onsite mitigation is not feasible. All offsite mitigation proposals will require review and approval by the District and the Board.

Offsite mitigation includes the following options:

- Mitigation may be performed on another parcel of land with approval of the District. The proposed parcel must contain comparable riparian habitat, or may be used if the parcel is suitable for enhancement or restoration of degraded riparian habitat. The alternate parcel must be under the same ownership as the parcel impacted by development or if under different ownership, must record deed restrictions that protect the mitigated area(s) in perpetuity.

- For Master Planned Communities and large commercial developments, exchange of land in-lieu of onsite mitigation may be allowed. Land exchange proposals must provide multiple benefits such as preservation of valuable habitat corridors, provide habitat connectivity, and proximity to habitat preserved on public land, parks, preserves and habitat restoration projects.

- A financial contribution in-lieu of onsite mitigation. RRH may be removed or altered concurrent with payment of an in-lieu fee which may be used for purchase of property with riparian habitat, educational programs, invasive species management, or towards restoration on property currently owned by the District.

Alternative Riparian Habitat Mitigation (ARHMP)

For larger developments (those that are required to go through the platting, specific plan, comprehensive plan, and/or rezoning processes), an additional option to the basic requirements for mitigation of IRA, Class H, and Xeroriparian Classes A-D is available. Applicants may propose an Alternative Riparian Habitat Mitigation Plan (ARHMP). An ARHMP is designed to support the success of on-site preservation of riparian areas and the mitigation of disturbed habitat, as well as serve the special needs of a given project within the context of its natural resources and riparian areas. The minimum requirements for an ARHMP are subject to negotiation between the District and

ARHMP (continued)

development interests. Proposed ARHMP must preserve, enhance, provide connectivity, and/or restore an impacted riparian system and/or its surrounding areas. Please be advised that proposal of an ARHMP is subject to the discretion and approval of the District and the Board.

How does RRH relate to Fire Safety Zones?

Structures shall be sited on the property to allow for a fire safety zone that meets the requirements of the Fire District directive for defensible space and shall be located so that impacts to RRH are minimized or avoided.

Vegetation may be removed in the area adjacent to structures in order to accommodate fire safety zones, per the requirements of the Fire District directive for defensible space.

Applicants requesting a waiver to the mitigation requirements under the fire code must provide documentation from their local Fire District specifying defensible space requirements. As part of a mitigation plan, the applicant shall show the defensible space envelope and detail the extent of impacts to the habitat.

Exceeding local Fire District's requirements for vegetation removal within the fire safety zone will be considered disturbance to RRH and will require mitigation.

Modified Development Standards

To encourage the preservation of RRH on sites to be subdivided or developed, Section 18.07 of the Pima County Zoning Code allows for the use of Modified Development Standards, these include:

Setback Reductions

Setback reductions may be approved by the Zoning Administrator pursuant to procedures and standards included in Section 18.07.070 of the Zoning Code. The code can be viewed at:

http://www.pimaxpress.com/

Subdivision Lot Size Reductions

A reduction in lot size may be approved at the time of subdivision platting when such a reduction allows for the preservation of riparian habitat. The sum of the reductions in lot size area may not exceed the area of riparian habitat preserved and the preserved area must be owned by a homeowners association, shown in a surveyable manner on the recorded subdivision plat, and protected by recorded covenants running with the land. Additionally, the number of lots allowed by the reduction cannot exceed the number of lots allowed without the reduction. When such conditions are met, the following lot size reductions may be approved:

- Minimum lot sizes for CR-1 and GR-1 subdivisions may be reduced from 36,000 square feet to 18,000 square feet.
- Minimum lot sizes for CR-2 subdivisions may be reduced from 16,000 square feet to 12,000 square feet.
- Minimum lot sizes for CR-3 and CMH-1 subdivisions may be reduced from 8,000 square feet to 7,000 square feet.

Off-Street Parking Space Reductions

The number of off-street parking spaces required may be reduced pursuant to Chapter 18.75 of the Zoning Code if such an adjustment will not result in increased traffic or danger to persons or property.

Bufferyard Quantity Reductions

The number of trees to be planted in a required Bufferyard, in accordance with Chapter 18.73 may be reduced by one tree per 300 square feet of riparian habitat preserved. The number of trees required in the Bufferyard may be reduced up to 50% when RRH is preserved.

Additional Development Standard Modifications

An owner or a developer may request additional development standard modifications that promote preservation of RRH. The request shall be subject to the appeals process or a development agreement approved by the Pima County Board of Adjustment.

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Board of Supervisors approval of a Mitigation Plan is required when:

- Disturbance of Class H and/or IRA exceeds 1/3 acre and exceeds 5% of the property's total RRH.
- Offsite mitigation for impacts to any riparian classification is proposed, including an ARHMP.

District-only approval of a Mitigation Plan is required when onsite mitigation is proposed and:

- Disturbance exceeds 1/3 acre of Xeroriparian habitat (Class A-D)
- Disturbance of Class H and/or IRA exceeds 1/3 acre and is less than 5% of the property's total RRH.

Revisions to Board approved Mitigation Plans

Minor revisions to Board approved Mitigation Plans may be approved by the Chief Engineer, if the revisions do not result in substantial changes to mitigation requirements. Substantial changes to a mitigation plan will require review and re-approval by the Board. Minor revisions include the following:

- Modification to location of onsite mitigation area (s)
- Modification to plant species specified on the Mitigation Plan
- Modification to irrigation plan
- Modification to seeding method

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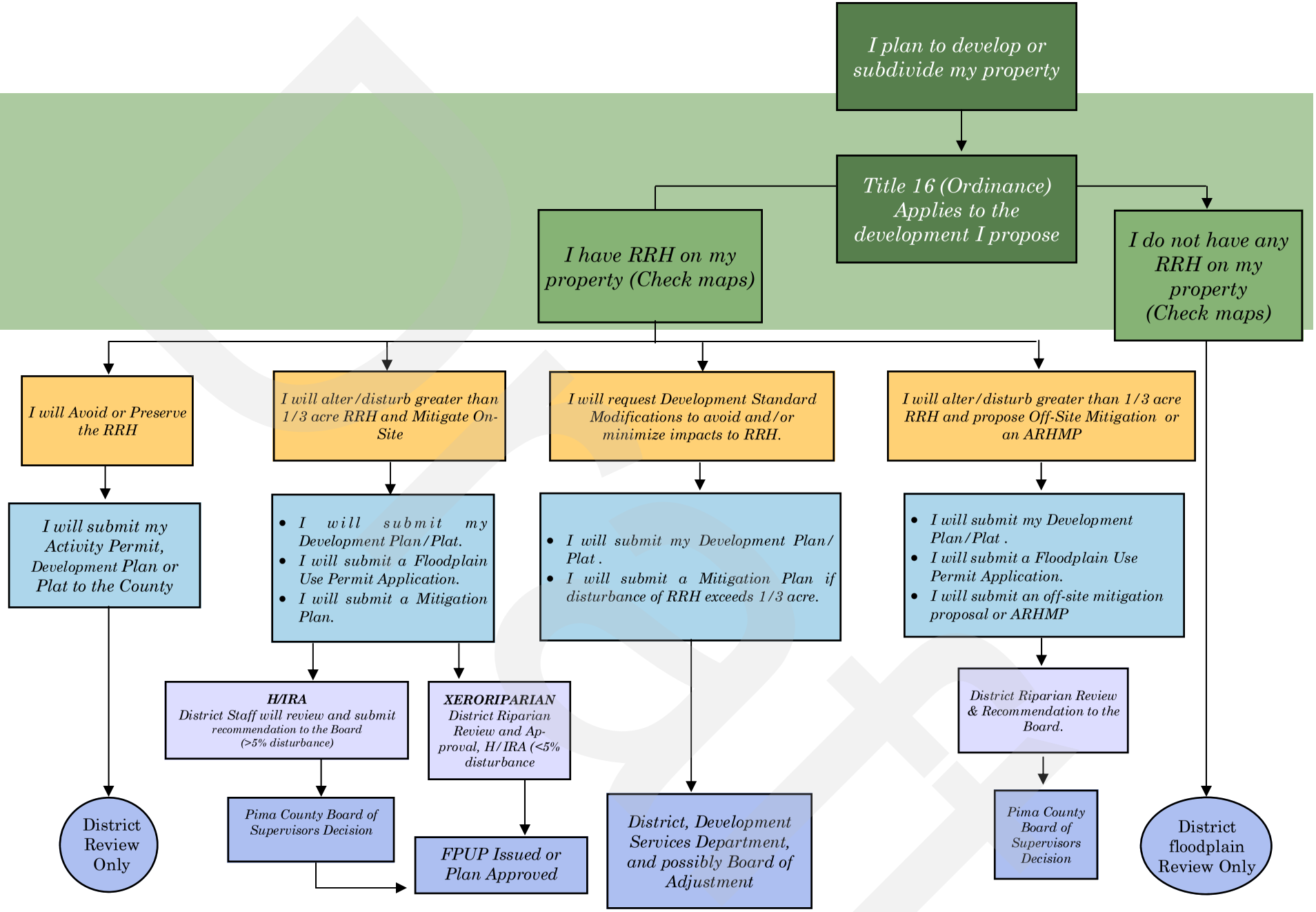

Overview of Submittal and Review Process

How do I appeal an approval decision?

Appeals related to the application and administration of the Ordinance may be filed using the procedures outlined in Chapter 16.56 of the Ordinance, Appeals and Variances.

Do I have to comply with the Ordinance?

All Mitigation areas will be inspected at least once during the five year maintenance period for compliance with the approved Mitigation Plan.

Sites found to be not in compliance with the approved Mitigation Plan will be subject to enforcement action pursuant to Chapter 16.64 of the Ordinance, Enforcement. The Code can be viewed at:

http://www.rfcd.pima.gov/rules/pdfs/ord2005_fc2.pdf

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section two:
riparian classifications, descriptions, mitigation, & monitoring requirements

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Riparian Classification Maps

The official maps illustrating the location of Regulated Riparian Habitat (RRH) are on file at the offices of the Pima County Regional Flood Control District and can be viewed on the Pima County MapGuide website at:

www.dot.pima.gov/gis/maps/mapguide

97 E. Congress, 3rd Floor,
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Typical Habitat/ Real Estate Parcel Map

Additional riparian information can be viewed on the Pima County Regional Flood Control District's website:

www.rfcd.pima.gov.

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The Ordinance and associated maps identify three classifications of riparian habitat; IRA, Class H, and Xeroriparian (Classes A, B, C, and D).

What is Important Riparian Area (IRA)?

- IRAs provide critical watershed and water resource management functions, as well as providing a framework for landscape linkages and biological corridors.
- IRAs include Hydroriparian, Mesoriparian, and Xeroriparian habitat areas, as well as those areas that provide connectivity between the Hydroriparian, Mesoriparian, and Xeroriparian areas.
- IRAs are valued for their higher water availability, vegetation density, and biological productivity, compared to adjacent uplands.
- IRAs are part of the Conservation Lands System and particular development processes, such as new rezoning, specific plan, and comprehensive plan requests, require a 95% conservation goal of the total acreage of lands within IRAs.
- IRAs are also essential for floodplain management and every effort should be made to protect, restore, and enhance the structure and functions of these areas, including hydrological, geomorphological, and biological functions.

Example of Important Riparian Area Habitat—Davidson Canyon

Example of Important Riparian Area Habitat—Pantano Wash

What is Hydroriparian Habitat?

Hydroriparian habitat is generally associated with perennial watercourses, where plant species such as cottonwood and willow are present. This is the rarest type of riparian habitat in Pima County and is vital to wildlife species who utilize the habitat for critical life cycle stages.

Example of Hydroriparian Habitat

What is Mesoriparian Habitat?

Mesoriparian habitats are associated with areas of shallow groundwater and/or intermittent stream flow. Mesquite bosques are characteristic of this habitat type.

Example of Mesoriparian Habitat

What is Hydroriparian/ Mesoriparian Habitat?

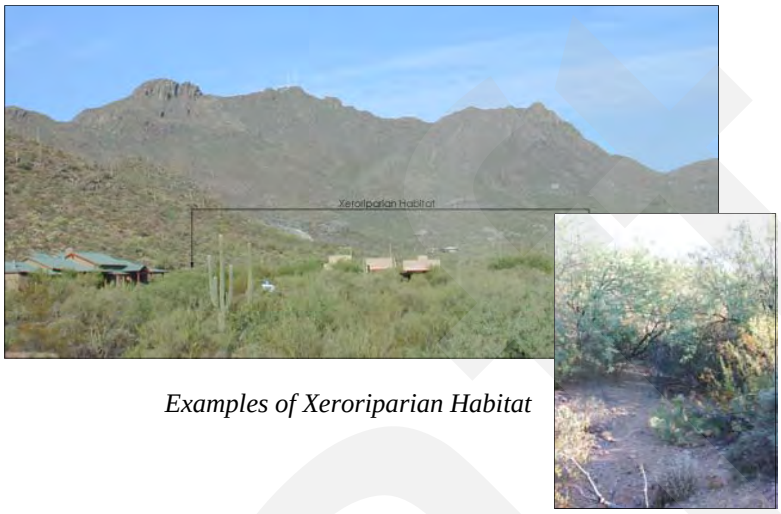
Hydroriparian habitat (deciduous canopy). Pantano Wash

Mesoriparian habitat (deciduous canopy). Black/Brawley Wash

Mesoriparian habitat (deciduous canopy). Tanque Verde Creek

What is Xeroriparian Habitat?

Xeroriparian habitat is typically associated with ephemeral streams (those that flow only in response to rainfall). The plant species present are similar to those found in upland areas but plant densities are greater due to the relative abundance of water.



Examples of Xeroriparian Habitat

Xeroriparian habitats have been further subdivided into four sub-classes based on the total vegetation volume present.

Xeroriparian A: The most dense Xeroriparian subcategory.

Xeroriparian B: Moderately dense Xeroriparian subcategory.

Xeroriparian C: Less dense Xeroriparian subcategory.

Xeroriparian D: Less to sparsely dense xeroriparian subcategory that provides hydrologic connectivity to other riparian habitat areas.

Xeroriparian Densities

Habitat Type	*Total Vegetative Volume*
Xeroriparian A	*Greater than 0.856 cubic meters per square meter (M^3/M^2)*
Xeroriparian B	*Less than or equal to 0.856 M^3 / M^2 and greater than 0.675 M^3/M^2*
Xeroriparian C	*Less than or equal to 0.675 M^3/M^2 and greater than 0.500 M^3/M^2*
Xeroriparian D	*Less than or equal to 0.500 M^3/M^2*

What does Xeroriparian Habitat look like?

Examples of Xerororiparian Class A Habitat
Black/Brawley Wash

Examples of Xerororiparian Class B Habitat
Santa Cruz River Watershed

What does Xeroriparian Habitat look like? (continued)

Examples of Xerororiparian Class C Habitat
Santa Cruz River Watershed

Examples of Xerororiparian Class D Habitat
Black/Brawley Wash

What is the Goal of Habitat Mitigation?

The goal of riparian regulations and the mitigation standards is to promote the preservation and restoration of high quality riparian habitat and encourage the integration of riparian open space within the fabric of our urban and suburban environment.

When is Mitigation Required?

Onsite mitigation is required when greater than 1/3 acre (14,520 square feet) of RRH is disturbed. See "Overview of the Riparian Habitat Protection Ordinance" pages 2—6.

What is the Purpose of Onsite Mitigation?

The purpose of onsite mitigation is to provide new habitat of similar value to RRH that will be disturbed as a result of site development.

The Ordinance requires that replacement habitat (mitigation area) be of similar or equal value to the removed habitat within 5 years of installation.

What are Onsite Mitigation Requirements?

Onsite mitigation must include:

- **Mitigation Area Location** Onsite mitigation shall be located, to the extent practicable, in a manner that enhances the overall function of natural open space within a property or project area and contributes to the overall value of riparian habitat protected within the property. The site should be selected based upon its potential to support the required planting density without long term supplemental irrigation (i.e., within the floodplain, drainage swales and/or low-lying areas). To the extent compatible with other public health, safety, and welfare considerations, mitigation will be integrated into flood control infrastructure and will utilize water harvesting to the maximum extent possible. Water harvesting features, such as microbasins and swales will be required if the mitigation area is proposed outside of a naturally sustaining riparian ecosystem, such as a floodplain or naturally low-lying land feature, such as a drainage swale or depression in the land, where water accumulates.

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What are Onsite Mitigation Requirements? (continued)

- **Planting and Seeding** of trees, shrubs, and understory as required to re-establish a natural riparian plant community similar to habitat removed.

- **Irrigation** to facilitate the establishment of plants and to assist in re-establishment of riparian habitat within 5 years.

- **Maintenance** for a period of 5 years to ensure re-establishment of riparian. Maintenance practices for riparian habitats will differ from maintenance practices used on traditional aesthetic landscape areas. Refer to Appendix C for Maintenance Requirements.

- **Monitoring** for a period of five full calendar years, to ensure that the Riparian Habitat Mitigation Plan (RHMP) is implemented and being maintained.

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What makes a Riparian Habitat Mitigation Plan (RHMP) successful?

A successfully mitigated habitat will:

- Include all layers of site-appropriate vegetation in a naturalistic condition.
- Include sufficient diversity of plant species and structure to provide food and cover for a variety of wildlife.
- Develop into and function primarily as riparian habitat and should not be modified for other activities.
- Retain leaf litter which acts as a mulch to hold soil moisture and recycle nutrients into the soil for plant use.
- Establish vegetation to help prevent erosion and increase infiltration into groundwater aquifers.

Diversity of plant species and layers in a Mitigation Area.

Diversity of plant species and layers—Tanque Verde Creek.

What makes a RHMP unsuccessful?

Common flaws in implementing RHMP's:

- *Planting only trees and failure to use all the plant species identified in the RHMP. Planting shrubs, succulents, forbs, and grasses are key components. All the vegetation layers need to be present in order for the habitat to function properly.*
- *Placement of landscaping rock, and other intensive landscaping measures within the mitigation area.*

Common flaws in maintaining a Mitigation Area include:

- *Pruning or shaping of trees and shrubs,*
- *Removal of ground cover vegetation, leaf litter and woody debris.*

Other activities that diminish the habitat value of Mitigation Areas include:

- *Installing fencing or walls that hinder wildlife movement, diverts natural drainage, or prevents surface water drainage from reaching existing riparian habitat.*
- *Using the mitigated habitat for livestock grazing or as recreation areas (e.g., children's play areas, paved walking paths, gazebos).*

Avoid intensive landscaping in "Avoided" Habitat Area.

Avoid "Hedged" shrub and pruned trees in Mitigation Areas.

1. Where to locate your Mitigation Area

Basic Requirements:

You must locate your mitigation area within or adjacent to RRH or in areas where conditions are optimal for plant survival. To ensure the long term viability of the mitigation area, and to the extent allowable with respect to the minimum mitigation area size, the plant density should be similar to that which naturally exists and can be supported by site conditions. Where it is not possible to meet all mitigation requirements onsite, see "Options for Treatment of RRH" pages 7-10.

Options to Basic Requirements:

You may locate your Mitigation Area outside of RRH if you can demonstrate that this will enhance the overall habitat value of the site along with providing verification the area will support the required planting density without long-term supplemental irrigation.

An example of an acceptable non-adjacent location would be replanting previously disturbed natural drainages or constructed detention basins. See Pima County Regional Flood Control District Technical Policy, TECH-009 (Appendix G) for guidelines on planting within these areas. Unacceptable areas would be planting in parking lots, in areas with high volumes of vehicle and pedestrian traffic, areas that will be landscaped, or within active recreational areas.

Other Guidelines:

The Mitigation Area should be one continuous area that provides continuity of habitat. If one continuous area is not feasible, several areas in a density that creates habitat may be used. The mitigation area shall not consist of scattered trees used as amenity landscaping on the site.

If the mitigation area cannot be placed adjacent to preserved habitat, an alternative location shall be chosen based on water availability, to facilitate growth/maintenance of habitat, such as areas of shallow ground water, the floodplains of ephemeral, intermittent, and perennial streams, low-lying areas, or water harvesting basins that collect and infiltrate sufficient water to support riparian plant species. If approved by Pima County Development Services Department (DSD), the mitigation area may be located within designated Natural Open Space (NOS). If this option is chosen, design guidelines provided by DSD for planting within NOS must be followed.

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2. Grading and Erosion Control Requirements

Basic Requirements:

If the mitigation area will be placed within an already disturbed area, it is recommended the area be graded to collect and retain stormwater runoff to help reduce supplemental irrigation requirements. Grading must be done so as not to disturb additional habitat.

Harvesting of stormwater runoff from other areas of the site is encouraged and acceptable, if consistent with applicable county, state, and federal regulations. See Appendix D for Water Harvesting Guidelines.

Other Guidelines:

Follow requirements found in the *Pima County Grading Manual* and the *Pima County Stormwater Detention/Retention Manual.*

3. Irrigation System Requirements

Basic Requirement:

For subdivision plats and development plans, an automatic irrigation system shall be installed within the Mitigation Area to provide water to:

- All transplanted/salvaged trees and shrubs
- All planted nursery stock trees and shrubs

The irrigation system must be capable of providing appropriate volumes of water to the trees and shrubs.

Options to Basic Requirements:

An automatic bubbler or other irrigation system capable of efficiently providing water to the tree and shrub root zones may be proposed. It must be demonstrated that the alternative irrigation system will provide sufficient irrigation water at the appropriate intervals, to ensure establishment of mitigation plantings.

Individual homeowners may not be required to install an extensive automatic irrigation system if it can be demonstrated that they will provide adequate supplemental irrigation to ensure plants are established (see Appendix C).

Other Guidelines:

Subdivision plats and development plans must meet all requirements in the *Pima County/City of Tucson Standard Specifications for Public Improvements.*

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Basic Mitigation Requirements (continued)

4. Required Maintenance

Basic Requirement:
Your RHMP must include the statement:

"The project owner, and/or the Owner's successors, agree to preserve and protect the Mitigation Area for the duration of the project. Further, the project owner and/or their successors agree to actively maintain the mitigated area for a period of not less than five years. Maintenance activities shall include, but not be limited to, the regular operation of the irrigation system, the replacement of dead trees and shrubs, and the removal of noxious and/or invasive plant species."

You, or your successors, are bound to perform the maintenance outlined in this statement.

Other Guidelines:
You must follow the Maintenance Guidelines found in Appendix C. See Appendix E for a list of noxious and/or invasive plant species and best management practices (BMPs) for control of these species.

What are the Important Riparian Area (IRA) Mitigation Standards?

IRA is a classification defined by the CLS, regulated under the Ordinance, and is characterized by hydroriparian, mesoriparian, and xeroriparian plant communities. The mitigation ratio for disturbance of IRA is 1.5:1.0, while the plant quantity requirement is determined by the underlying riparian classification.

For example, if a property owner will be disturbing 1.0 acre of Important Riparian Area with underlying Xeroriparian Class C habitat, the mitigation requirement would be calculated as follows:

1.0 acre x 1.5 = 1.5 acre of mitigation plantings

1.5 acre of mitigation plantings x 45 trees/ac = 68 trees required for mitigation

1.5 acre of mitigation plantings x 70 shrubs/ac = 105 shrubs required for mitigation

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1. Amount of Mitigation Required

Basic Requirement:

Minimum Size: For Class H the mitigation ratio is 1.5:1.0. For example, if you are disturbing 1.0 acre of Class H habitat, you must provide the equivalent of 1.5 acres of mitigation plantings. The actual size of the mitigation area provided shall be the minimum necessary to ensure the long-term viability of the mitigation plantings, accounting for topography, frequency of inundation and existing vegetation, but in no case shall be less than 70 % of the disturbed area, after the mitigation ratio is applied, unless an on-site vegetation survey has been provided that justifies sustainability of a more densely planted area. The 70% minimum mitigation area is based upon the maximum Total Vegetative Volume for each class of riparian habitat at maturity, and as such represents the smallest area within which the required number of plantings can be accommodated for that habitat classification.

Option to Basic Requirements:

The applicant may hire a qualified professional to prepare a RHMP based upon an onsite vegetation survey to be submitted to the District for review and approval. See Appendices F and G for field mapping and vegetation survey requirements. For larger developments, an ARHMP may be allowed, subject to District and Board review and approval (see Section 1, page 9).

If it is demonstrated that the full mitigation requirement cannot be completed onsite, a combination of onsite and offsite mitigation will be allowed.

2. Trees: How many and what kind are required

Basic Requirements:

How many: At least 90 trees per acre of disturbance, after the mitigation ratio is applied.

What size: All trees planted must be at least 15 gallon size.

Species diversity: No more than 75% of the trees used in the Mitigation Area can be of a single species. A minimum of 3 tree species are required. Use existing tree species as a guide for species selection.

Options to Basic Requirements:

If using the basic requirement, 50% of the trees may be installed using 15 gallon and 50% of the trees may

be installed using 5 gallon if you add 20% to the total required number of trees.

Other Guidelines:
You must select trees from the Approved Class H Plant List found in Appendix B. Select trees appropriate for your location (listed by watershed in Appendix B) and install using standard, approved planting methods (Appendix C). In general, existing native plants found on site are a good indicator of appropriate mitigation plants. Native species identified within the mapped habitat found on-site, but not found on the approved plant list may be allowed pending review and approval by District staff.

3. Shrubs: How many and what kind are required
Basic Requirement:
How many: 100 shrubs per acre of disturbance, after the mitigation ratio is applied.
What size: All shrubs must be 5 gallon or larger.
Species diversity: No more than 35% of the shrubs selected may be of a single species. A maximum of 1 shrub species may be selected from the "cacti & succulents" section of the approved plant list. A minimum of 5 shrub species is required unless an onsite vegetation survey is performed that justifies less diversity.

Option to Basic Requirements:
If using the basic requirement, all shrubs may be installed at 1 gallon if you add 20% to the total required number of shrubs.

Other Guidelines:
You must select shrubs from the Approved Class H Plant List found in Appendix B. Select shrub species appropriate for your location (listed by watershed in Appendix B) and install using standard, approved planting methods (Appendix C). In general, existing native plants found on site are a good indicator of appropriate mitigation plants. Native species identified onsite but not found on the approved plant list may be allowed pending review and approval by District staff.

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What are the Class H Mitigation Standards? (continued)

4. Seeding/Understory requirements

Basic Requirement:

You must hydroseed/hydromulch all disturbed areas within the Mitigation Area with the approved Class H seed mix and seeding requirements (Appendix B). Follow standard, approved planting methods found in Appendix C. It is recommended the applicant contact seed vendors prior to submitting the RHMP to determine plant species availability.

Option to Basic Requirements:

You may also seed the area using these methods:

- Drill seeding with crimped straw mulch,
- Broadcast seeding and raking into seedbed with straw or other appropriate mulch.

Site-specific seed mixes may be proposed and approved if they better reflect existing/desired conditions.

What are the Xeroriparian Mitigation Standards?

1. Amount of required Mitigation

Basic Requirement:

For xeroriparian habitat the mitigation ratio is 1:1. For example, if you are disturbing 1.0 acre of Class C habitat you must provide the equivalent of 1.0 acre of mitigation plantings. The actual size of the mitigation area provided shall be the minimum necessary to ensure the long-term viability of the mitigation plantings, accounting for topography, frequency of inundation and existing vegetation, but in no case shall be less than 70% of the disturbed area, unless an on-site plant survey has been provided that justifies sustainability of a more densely planted area. The 70% minimum mitigation area is based upon the maximum Total Vegetative Volume for each class of riparian habitat at maturity, and as such represents the smallest area within which the required number of plantings can be accommodated for that habitat classification.

If it is demonstrated that the full mitigation requirement cannot be completed onsite, a combination of onsite and offsite mitigation will be allowed.

Option to Basic Requirements:

The applicant may hire a qualified professional to prepare a RHMP based upon an onsite vegetation

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survey to be submitted to the District for review and approval. See Appendices F and G for field mapping and vegetation survey requirements. For larger developments, an ARHMP may be allowed, subject to District and Board review and approval (see Section 1, page 9).

2. Trees: How many and what kind are required

Basic Requirements:

How many:

- Xeroriparian A: At least 75 trees per acre of disturbance.
- Xeroriparian B: At least 60 trees per acre of disturbance.
- Xeroriparian C: At least 45 trees per acre of disturbance.
- Xeroriparian D: At least 30 trees per acre of disturbance or 1 tree per existing tree (depending upon method chosen to calculate mitigation requirement). Vegetation in Xeroriparian D mitigation areas must be replaced in like-kind from existing species (see Appendix F).

What size: At least 50% of the trees planted must be 15 gallon size. The remaining 50% must be at least 5 gallon.

Species Diversity: No more than 75% of the trees used in the Mitigation Area can be of a single species. A minimum of 3 tree species are required. Use existing tree species as a guide for species selection.

Option to Basic Requirements:

If you use all 15 gallon trees instead of 50% 5 gallon, the total quantity of required trees may be reduced by 20%.

Other Guidelines:

You must select trees from the Approved Xeroriparian Plant List (Appendix B). Select trees appropriate for your location (listed by watershed in Appendix B) and install using standard, approved planting methods (Appendix C). In general, existing native plants found onsite are a good indicator of appropriate mitigation plants. Native species identified onsite but not found on the approved plant list may be allowed pending review and approval by District staff.

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3. Shrubs: How many and what kind are required

Basic Requirements:

How many:

- Xeroriparian A: 90 shrubs per acre of disturbance.
- Xeroriparian B: 80 shrubs per acre of disturbance.
- Xeroriparian C: 70 shrubs per acre of disturbance.
- Xeroriparian D: Replace in like-kind and density. (See Appendix F for determining onsite shrub density and composition).

What size: 50% must be 5 gallon or larger, the remaining 50% may be 1 gallon.

Species Diversity: You may use any shrub species found on the approved Xeroriparian shrub list in Appendix B. A maximum of 1 shrub species may be selected from the "cacti & succulents" section of the approved plant list. No more than 35% of the shrubs selected may be of a single species. A minimum of 5 shrub species is required. Use existing shrub species as a guide for species selection.

Options to Basic Requirements:

If all shrubs planted are 5 gallon, the required number of shrubs may be reduced by 20%.

4. Seeding/Understory requirements

Basic Requirement:

You must hydroseed/hydromulch all disturbed areas within the Mitigation Area with the approved Xeroriparian seed mix and seeding requirements (Appendix B). Follow standard, approved planting methods found in Appendix C.

Options to Basic Requirements:

You may also seed the area using these methods:

- Drill seeding with crimped straw mulch,
- Broadcast seeding and raking into seedbed with straw or other appropriate mulch.

Site-specific seed mixes may be proposed and approved if they better reflect existing/desired conditions.

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section three:
mitigation plan components

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SUBMITTAL REQUIREMENTS:
Mitigation Plans Submitted to the District for review and approval shall include the following basic information.

The District encourages applicants to meet with staff prior to submittal of a Mitigation Plan to discuss site constraints and requirements. Typically the following items are required:

- Evidence that no reasonably practicable alternative exists to the proposed impact to Regulated Riparian Habitat (RRH) and the impact has been minimized to the maximum extent practicable.
- Delineation of RRH in accordance with the 2005-FC2 Riparian Classification Maps, or site specific delineation of RRH (see Appendices F and G)
- Mitigation Planting Plan
- Development plan or tentative plat
- A detailed site plan (single-lot development)
- A completed Floodplain Use Permit application (single-lot development)
- Summary of requested development standard modifications, if applicable
- A copy of the Native Plant Preservation and/or Landscape Plan, if applicable.

Note: For specific plan requirements see the riparian habitat mitigation plan checklists for single-lot and development review projects, included in Appendix A.

Pima County Riparian Classification Maps (see section 2, page 17, Riparian Classification Maps) were prepared at a scale of 1" = 2,000', providing a general location of RRH. The actual habitat boundaries may be shifted relative to the parcel boundaries shown on the maps due to rectification of aerial photographs with the parcel map base.

If an applicant feels the boundaries of the RRH shown on the Riparian Classification Maps are inconsistent with what is existing on the site, then the applicant may request a modification of the boundaries. In order to modify the boundaries of RRH on a site, the applicant must follow guidelines outlined in TECH-116, found in Appendix G.

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Additionally, if the applicant feels that the Riparian Classification Maps do not accurately reflect the onsite total vegetative volume, the applicant can submit an onsite vegetation survey for consideration in determining mitigation requirements (TECH-116, Appendix G).

IRA boundaries are part of the Conservation Land System (CLS) mapping adopted by the Pima County Board of Supervisors and are not subject to adjustment or modification. These areas have been delineated based upon a variety of resource values in addition to the presence of riparian vegetation, and are intended to provide for the establishment of an integrated natural open space system within Pima County.

Site Specific Delineation of RRH

SITE SPECIFIC DELINEATION OF RRH

Subdivisions and Commercial Sites

The RRH Delineation shall be prepared at the same scale as the plat or development plan, and shall include:

- A recent aerial photograph of the site.
- Site specific limits of the Regulated Riparian Habitat boundaries.
- Limits of development on the site.

Riparian Classification Maps and recent aerial photographs are available at:
www.dot.pima.gov/gis/maps/mapguide/

Single-Family Residential

The RRH Delineation shall be prepared at the same scale as the site plan and shall include:

- A recent aerial photograph of the site.
- Location of parcel boundaries and RRH delineated on the aerial photograph.
- Limits of development on the site, including existing and proposed improvements, grading limits including fire safety zone, driveways, utility lines, pools and walls/fencing.

MITIGATION PLANTING PLAN

Residential, Commercial, and Single-Lot Development

The Mitigation Planting Plan shall use plant quantities required by the guidelines or plant quantities determined by an onsite vegetation survey. The Mitigation Plan shall be prepared at the same scale as the plat, development plan or site plan. If a Native Plant Preservation Plan is required, the mitigation plan shall be prepared at the same scale. The Mitigation Plan shall include, at a minimum (also see Mitigation Plan Checklists found in Appendix A for detailed requirements):

1. Scale, north arrow, location map, brief description of site location, and other general information as appropriate for the project.
2. Site specific delineation of RRH.
3. Proposed finished grades within the mitigation planting area. Finished grades shall be depicted by contours (1- or 2-foot contour interval) or by other methods that clearly depict the finished grades and slope conditions.
4. Grading limits.
5. Fire safety setbacks, if applicable.
6. Proposed mitigation planting area.
7. Within the mitigation planting area, locate mitigation plantings in a manner that imitates natural conditions (i.e., not planted in rows).
8. A plant list or schedule that identifies plant species, quantities, and plant size and seeding requirements at time of installation.
9. Calculations as described in the next section.
10. Irrigation requirements as described on page 29.
11. Maintenance requirements as described on page 30.
12. Monitoring point locations. Show location, directionality and number each point on the plan.

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CALCULATIONS and QUANTITIES FOR DISTURBANCE AND MITIGATION

A summary of area and quantity calculations shall be shown on the Mitigation Planting Plan, and shall include:

- Total area of RRH present onsite, by classification.
- Area of RRH that will be disturbed, by classification.
- Minimum required mitigation planting area and the size of the mitigation area as proposed, by classification. See Appendix C for determining planting density within the mitigation area.
- Minimum quantity of plants required by classification, size, (trees: 15 gallon, 5 gallon, etc. , shrubs: 5 gallon, 1 gallon, etc.), and species.

Mitigation Irrigation Plan and Maintenance Requirements

MITIGATION IRRIGATION PLAN

Residential and Commercial Development

Irrigation system shall be designed and installed as required under *City of Tucson and Pima County Standard Specification for Public Improvements (2003),* see Appendix C.

Single-Family Residential

Homeowners with single-family lots may meet the irrigation requirement with a statement included on the mitigation plan that defines the method of irrigation and a statement of basic maintenance.

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How will the mitigated area be monitored and what is the responsibility of the property owner?

The property owner is responsible for implementing and maintaining the mitigation area per the Mitigation Plan and submitting an annual monitoring report for mitigated areas on their property. Although, it is the property owners responsibility, within multi-lot developments a single report may be coordinated and submitted for multiple lots (e.g., Home Owners Associations). The initial annual monitoring report shall be considered the "as-built" mitigation plan and provide information regarding any deviations from the approved plan based on plant species availability or problems encountered during installation.

In addition to the annual monitoring requirement, a representative of the County will visit the Mitigation Area at least once during the five year establishment period to assess compliance with the Mitigation Plan.

Success of the Mitigation Plan

The mitigation plan shall be considered successful when 80% of the plants are living and actively growing (without significant die back or loss) after one year without supplemental irrigation (see page C-9). The monitoring plan will provide an assessment of success. During the monitoring period, the responsible party shall be required to provide annual reports to the District documenting progress toward success. If the site is not progressing as anticipated, proposed corrective actions shall be provided in the monitoring report.

What is the timeframe for monitoring?

Mitigation areas must be monitored following installation, which occurs during the first growing season following completion of construction. The Mitigation Area must be maintained and monitored for five calendar years. Each calendar year has multiple growing seasons typically determined by climate, location, temperature, daylight hours, and rainfall. In Southern Arizona there are three main growing seasons;

March—May "Spring growing season"

July—September "Monsoon season" of summer rains

September—November "Fall growing season"

Submittal of the annual monitoring report is required for compliance with the Mitigation Plan. The District will send out a courtesy reminder annually to property owners with an approved Mitigation Plan. Failure to submit the annual report will require an inspection of the property by District staff to verify compliance with the approved Plan, and possibly enforcement action.

What must be included in the Monitoring Report ?

Monitoring reports shall include the following information:

1. 11" x 17" copy of the approved Mitigation Plan, with photo monitoring point locations identified and numbered.

2. Photographic documentation:

   - Photographs shall be numbered to correlate with the monitoring points identified on the Mitigation Plan. Number of monitoring points will be based on site constraints, so that the entire mitigation area(s) is documented.

   - A minimum of one photograph per monitoring point is required. If the mitigation area cannot be captured by one photograph, several points shall be used.

3. A plant monitoring schedule that identifies plant species, quantities, and plant size at time of installation with plant condition noted. Deviations from the approved Mitigation Plan must be highlighted and an explanation provided with the initial monitoring report submittal, provide copies of receipts for plant material and seed mix.
   Note: a plant schedule identifying plant species, quantities, and plant size at time of installation will have been submitted as part of the original mitigation plan.

4. Verify replacement of dead trees and shrubs from previous year(s), if applicable. Property owners shall verify through submittal of the following:
   - Nursery receipts for replacement plants
   - Photographs of replacement plants
   - Note replacement tree and shrub locations on the Mitigation Plan.

5. If the site is not progressing as anticipated, proposed corrective actions shall be provided in the annual monitoring report. Depending upon the extent of problems encountered, a meeting with staff may be required.

6. Monitoring reports shall be submitted to the RFCD at:

   Pima County Regional Flood Control District
   ATTN: Water Resources Division Staff
   97 E. Congress St., 2nd Floor
   Tucson, Arizona 85701

   Place Floodplain Use Permit (FPUP) number or development project number (P12XX-XXX) on the envelope.

Development Plan or Subdivision Plat Submittal Timeframe

DEVELOPMENT PLAN OR SUBDIVISION PLAT

The Mitigation Plan shall be submitted as early as possible during the development review process. For subdivision plats, a Preliminary Mitigation Plan must be approved prior to Tentative Plat approval and a Final Mitigation Plan must be approved prior to Final Plat approval, with exception for Mitigation Plans that will require BOS approval. For Mitigation Plans requiring BOS approval, a Final Mitigation Plan must be submitted and approved prior to approval of the tentative plat.

The Mitigation Plan shall be submitted to the Subdivision Review Coordinator as a separate sheet labeled "Riparian Habitat Mitigation Plan" along with the Tentative Plat and Final Plat, or Development Plan. The submittal shall include one hard copy and one electronic copy in pdf file format.

The Mitigation Plan shall be updated to reflect any changes in the development plan or plat that occur between the preliminary and final approvals. If revisions modify disturbance to RRH or the size/location of the mitigation area, a revised Mitigation Plan will be required prior to approval of the final plat or development plan. No grading permits shall be issued until the revised Mitigation Plan is approved to ensure the final Development Plan or Plat are reconciled.

Any revisions to the grading limits during the Improvement/Grading Plan review process that may require revision of the riparian habitat mitigation plan must be submitted to RFCD staff for review and approval.

Single-Lot Development Submittal Timeframe

A single-lot development Mitigation Plan should be submitted along with the site plan at the time of FPUP application.

Summary of Requested Development Standard Modifications

SUMMARY OF REQUESTED DEVELOPMENT STANDARD MODIFICATIONS

A narrative summary of requested Development Standard Modifications, if any, shall be included with the Mitigation Plan. If applicable, show locations of the Development Standard Modifications on the Development Plan or Tentative Plat. All Development Standard Modifications shall be subject to approval by the Pima County Development Services Department and, in certain cases, the Subdivision Development Review Committee (SDRC) and Board of Adjustment.

section four:
frequently asked questions

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Answers to Frequently Asked Questions

Q. The map does not show habitat where we are building on our property. Why are we required to mitigate?

A. The maps indicate the general location of Regulated Riparian Habitat (RRH). The actual habitat boundaries may be shifted relative to the parcel boundaries shown on the Pima County MapGuide maps (http://www.dot.pima.gov/gis/maps/mapguide/.) Habitat boundaries must be verified using current aerial photos and/or field mapping.

Q. Can I plant "non-native" species on my property?

A. Yes, although it is not encouraged. You may plant non-native species on your property, outside of designated mitigation areas. Planting noxious and/or invasive species on the property is prohibited. See Appendix E for a listing of noxious and invasive plant species.

Q. Can I get credit towards the required plantings on the Mitigation Plan for landscaping done previously?

A. Only if you can show when and what species of plants were installed, and that plants are thriving and located within an area that provides habitat value. Only plants listed on the approved plant list will count toward your mitigation requirement. Native species not included on the list may be counted toward your mitigation requirement if those species naturally occur within riparian habitat on the property. Any plant species not included on the approved plant list will require District review and approval. The property owner can verify previous plantings in a number of ways, including but not limited to, photographic documentation, receipts or dated verification from a landscaping company.

Q. Will my mitigation plantings be inspected?

A. Yes. A representative of the District will visit the Mitigation Area at least once during the five year maintenance period to assess compliance with the Mitigation Plan. Compliance will also be assessed through submittal of an annual monitoring report by the property owner (see pages 41- 42).

Q. When will I need to do my Mitigation Planting?

A. Planting should occur during the first growing season following completion of construction. The best time to plant is in the spring (March through May) or in the fall (September through November). Avoid planting during the hottest, driest part of the summer (May through early July) or when freezing temperatures may occur. Seed application is most effective when applied prior to the rainy season, either in late July or in the fall, prior to winter rains, to ensure proper seed germination.

Q. Do I need to install a drip irrigation system?

A. Newly planted trees and shrubs require irrigation in order to establish a healthy root system. Even drought tolerant plants must be irrigated during their initial, formative years. Any type of irrigation system will work but drip is the most efficient and lessens the chance of plant loss. Subdivision and commercial sites require automatic irrigation systems.

Q. How do these riparian mitigation standards compare to the Native Plant Preservation Ordinance (NPPO) standards?

A. The NPPO was adopted for the purpose of preserving individual plants and plant communities native to Pima County. The native plant species protected under the NPPO are primarily upland plant species, such as agave and cacti, which are typically not found within riparian habitat areas. In contrast, the Riparian Habitat Ordinance is primarily for protection of the ecosystem associated with riparian habitat, which consists of vegetation, soils, organic matter/ dead debris, and the availability of water. The Ordinance seeks to preserve the natural function of the floodplain and retain valuable habitat, important to survival of many of our native wildlife species. Although each ordinance serves a different function, i.e., preservation of individual upland plant species or plant communities vs. preservation of the ecosystem associated with watercourses, they are complimentary to each other in that both are preserving plant communities unique to the Sonoran Desert and are required for a properly functioning natural desert ecosystem.

Q. Do I need both a riparian habitat mitigation plan and a native plant preservation plan?

A. Yes. When 1/3 acre of RRH has been disturbed, a grading permit is required, thus requiring the need for a Native Plant Preservation Plan (NPPP). The NPPP is required to mitigate for impacts to primarily upland areas and associated plant communities, while the riparian habitat mitigation plan is required to mitigate for impacts to RRH. Although a number of the plant species required for mitigation by each ordinance overlap, the plant communities they are mitigating for are typically separate.

Q. Can I use plants required by NPPO toward my mitigation requirement?

A. Possibly. Several of the native plant species protected by the NPPO are also found on the approved plant list (Appendix B). Plants used for your NPPP may also be used toward your riparian habitat mitigation requirement if they are found on the approved plant list and are planted within an area that creates habitat value. Plants planted in upland areas cannot be used toward your riparian habitat mitigation requirement.

Q. My property is in a xeroriparian habitat. How long will it take for my Mitigation Plan to be approved?

A. On average, a mitigation plan review can be completed within 10 business days, although this timeframe may vary due to workload constraints. Review of the mitigation plan can be completed concurrently with review of the Floodplain Use Permit (FPUP), provided the mitigation plan is submitted with the FPUP application. For development review projects, review times are dictated by the Development Services Subdivision Coordination Department. The Subdivision Coordination website can be viewed at: http://www.pimaxpress.com/SubDivision/Default.htm.

Q. My property is in a Class H or IRA habitat. How long will it take for my Mitigation Plan to be approved?

A. The review and approval time for Mitigation Plans within Class H or IRA habitat depends on whether or not the disturbance also exceeds 5% of the total riparian habitat on the property. If the disturbance does not exceed this threshold, the Mitigation Plan will proceed on a similar timeline to the Floodplain

Use Permit or development review process. If disturbance exceeds the threshold, the Mitigation Plan must be approved by both District staff and the Board of Supervisors (BOS). See page 14 for mitigation plan approval process. The time required for the entire approval process varies according to BOS meeting schedules and Mitigation Plan preparation time. Minimum time to schedule a BOS agenda item is 3-4 weeks. This can be scheduled during the same time your building plans are being reviewed by Development Services or during the development review process. The amount of time it takes to review and approve any Mitigation Plan is highly dependent upon the thoroughness and accuracy of the initial Mitigation Plan submittal.

Q. The area that I'm developing has already been disturbed, why am I being required to mitigate?

A. There are several reasons why you might be required to mitigate.

One reason is for compliance with federal and county regulations promoting continuity of habitat and flood conveyance along watercourses. The Ordinance recognizes the value in maintaining and restoring continuous corridors of habitat so that the County's rich, diverse and potentially rare plants and animals continue to thrive and essential natural floodplain functions are maintained.

In addition, in arid regions like Pima County, riparian habitat is almost always associated with watercourses, and is thus associated with potential flood hazards. Continuous corridors for floodwater conveyance are extremely important for public safety. Not only that, but vegetation can actually reduce flood hazards by reducing flow velocities, attenuating flood waters, and preventing erosion.

In some parts of Pima County, Important Riparian Areas may have been removed long ago, fragmenting the vital ecologic and flood hazard reduction role of riparian habitat from the land. Restoring habitat in a particular area can help to reconnect fragmented habitat corridors.

Another reason may be that the area was disturbed in violation of the Ordinance, and the mitigation is being required to correct that violation.

Q. Where can I find the plants and seed mixes that I need?

A. A list of local nurseries, seed vendors, and landscaping companies who can provide the appropriate native species is included in Appendix B.

Q. Why is it important to preserve riparian habitat for wildlife?

A. According the Arizona Riparian Council (http://azriparian.org/) approximately 60-75% of Arizona's resident wildlife species are dependant on riparian habitat to sustain their populations, by providing food, shelter, and protection from predators.

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appendix A
mitigation plan submittal checklists

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PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
Riparian Habitat Mitigation Plan Checklist for Single-Lot Development

Applicability: Pursuant to Chapter 16.30.050.A of the Pima County Floodplain and Erosion Hazard Management Ordinance No. 2005-FC2 (Ordinance), if an applicant demonstrates to the satisfaction of the District that alteration of regulated riparian habitat cannot reasonably be avoided, a mitigation plan shall be submitted to the District for approval when more than 1/3 acre (14,520 square feet) of regulated riparian habitat is disturbed.

Additionally, if the 1/3 acre (14,520 square feet) disturbance lies within either an Important Riparian Area (IRA) or Hydroriparian/Mesoriparian (Class H) habitat, and exceeds 5% of the total regulated riparian habitat on the property, the mitigation plan will require Pima County Board of Supervisors (BOS) approval.

Plan Review Timeframes: On average, a mitigation plan review can be completed within 10 business days, although this timeframe may vary due to workload constraints. Review of the mitigation plan can be completed concurrently with review of the Floodplain Use Permit (FPUP), provided the mitigation plan is submitted with the FPUP application. If BOS approval is required, please account for the additional time required for final approval, which averages 3-4 weeks. The schedule for BOS regular session meetings as well as the Clerk of the Board (COB) deadline for agenda submittals may be viewed at: http://www.pima.gov/cob/schedule.htm. The plan must be submitted to the District for review and approval no later than one week prior to the COB deadline.

Submittal Requirements: The mitigation plan shall follow the requirements outlined in the Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines (Guidelines), which can be viewed at: http://rfcd.pima.gov/riparian/mitigat/mitstand.pdf.

Avoidance Justification:

- ☐ If the property contains developable areas outside of the regulated riparian habitat, but improvements are encroaching into regulated riparian habitat, evidence that no reasonably practicable alternative exists to the proposed impacts and evidence that the impact has been minimized to the maximum extent practicable will be requested at the time of riparian habitat mitigation plan submittal. The applicant shall provide justification regarding why habitat could not be avoided. Examples of why habitat could not be avoided include site constraints, such as steep slopes which are regulated under the Zoning Code, allowance for legal use of the property requiring encroachment into habitat areas or public health and safety considerations such as traffic control (driveway access relative to major roadways) and fire safety zones.

Mitigation Plan Checklist: This serves as a list of general requirements for the mitigation plan as outlined in the Guidelines:

- ☐ Minimum size of the mitigation planting plan is 11” x 17” – Two sets required.
- ☐ Plan is to a measurable scale of 1” = 100’ or larger.
- ☐ Scale and north arrow.
- ☐ Label the plan “Riparian Habitat Mitigation Plan”.
- ☐ Indicate the parcel ID number, parcel address, property owner name, and FPUP number.
- ☐ Show the site specific limits of the Regulated Riparian Habitat. Include the riparian habitat classification type in the legend and label the line type on the plan. Use the following line type and legend descriptions:

Line Type Description	Legend Description
IRA	Important Riparian Area (with underlying class...)*
H	Class H habitat*
XA -D	Class (A, B, C, or D) Xeroriparian habitat*

* add (rectified or field verified) as applicable

- ☐ Proposed finished grades within the mitigated area. Finished grades shall be depicted by contours (1 or 2 foot contour interval) or by other method that clearly depicts the finished grades and slope conditions.
- ☐ Limits of disturbance. Show grading limits for all existing and proposed improvements including utility lines, driveways, and septic systems. If your local fire district requires the creation of defensible space around the structure, extend the grading limits

to show the additional area of disturbance. As part of the submittal, provide documentation of the defensible space requirement from the local fire district. This area of disturbance can be subtracted from the total disturbance calculation.

- ☐ Most recent available aerial photograph. An aerial photograph can be used as a base for your site plan to meet this requirement, and is actually preferred. Aerial photographs for all of Pima County may be available at our office located at 97 E. Congress Street, 3rd floor or through the Pima County MapGuide web site: (http://www.dot.pima.gov/gis/maps/mapguide/).

- ☐ Delineate the mitigation area. The mitigation area shall be shown either as a general location on the mitigation plan or as a detailed planting plan which indicates locations of individual trees and shrubs. If the mitigation area is shown as a general location, provide a table of the number of trees and shrubs per area, or depict the number of trees and shrubs, per area, directly on the plan. The minimum size required for the mitigation area shall be no less than 70% the size of the area disturbed (see Section 2 and Appendix C of the Guidelines). For example, if you will be disturbing 1 acre of Xeroriparian habitat, you are required to mitigate 0.70 acre of land. Alternatively, if an on-site vegetation survey has been performed, use planting densities determined by the survey, which may be less than or greater than 70%. If it is demonstrated that the full mitigation requirement cannot be completed on-site, a combination of on-site and off-site mitigation will be allowed. If you will be enhancing existing riparian habitat, space the trees and shrubs within the undisturbed area, according to the individual plant species mature canopy width.

  Locate your mitigation area where there is potential to enhance existing habitat or create habitat with value equal to that removed from the site. Ideally, the mitigation area shall be placed adjacent to existing habitat or enhancing existing habitat. If this option is not possible due to site constraints, the mitigation area shall be placed in locations that receive sufficient water to facilitate growth and maintain healthy habitat (i.e., drainage swales, low-lying areas, etc.). The mitigation area shall be one continuous area in a density that creates habitat, as the site allows. Mitigation areas are to be located away from improved areas, to prevent the desire to maintain the natural area as part of the landscaping adjacent to improvements. Mitigation plantings shall be installed per the approved planting methods outlined in the Guidelines. The following note shall be placed on the mitigation plan, *"Mitigation area(s) to be left in a natural state. No disturbance shall occur within the mitigation area(s) without RFCD review and approval. Such disturbance includes but is not limited to secondary impacts such as the presence of livestock, fencing, intensive landscaping, outdoor play areas, etc."*

- ☐ Calculations and quantities for disturbance and mitigation. Calculations shall include the following; total area of regulated habitat on-site, by classification, area of regulated habitat which will be disturbed, by classification and area of proposed mitigation, by classification (for Class H or IRA, this calculation will be 0.70 x 1.5 x area of disturbance). Disturbance and mitigation calculations shall be in acres, to the nearest hundredth (ex., 0.33 acres). Plant quantity calculations shall include quantity of trees and shrubs, as required by the Guidelines, multiplied by the area of proposed mitigation, by classification.

- ☐ A planting list or schedule that identifies plant species, quantities and sizes at the time of installation. The planting schedule shall list a minimum of 3 tree species, no more than 75% of any one species and 5 shrub species, no more than 35% of any one species. A list of approved plant species can be viewed in Appendix B of the Guidelines. Tree and shrub sizes shall be in accordance with Guideline requirements (see Section 2).

- ☐ Seeding requirement. Mitigation area is to be seeded with a minimum of 12 species from the approved plant list (see Guidelines, Appendix B). Seeding methods include; hydroseeding, drill seeding with crimped straw mulch or broadcast seeding and raking into seedbed with straw or other approved mulch. Place a list of the 12 plant species on the mitigation plan, and the following note, *"Mitigated area will be (insert method of seed placement) with a minimum of 12 species from the approved (Class H or Xeroriparian) plant list found in Appendix A of the "Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines." If plant species listed on the mitigation plan are unavailable, replacement species from the approved plant list may be selected based upon availability. Of the 12 species, 4 shall be shrubs, 4 shall be annuals/perennials/vines, and 4 shall be grasses."* The property owner is encouraged to consult with the seed vendor regarding seed mix requirements. If plant species and/or seeding rates change after mitigation plan approval, due to plant species availability, the property owner/applicant shall provide information regarding changes to the original mitigation plan with the first monitoring plan submittal ("as-built" mitigation plan).

- ☐ Method of irrigation. Irrigation methods may include an automatic system such as drip or a manual method such as hand watering. Irrigation method must demonstrate that adequate irrigation will be provided to the new plants during the five year establishment period. Use of on-site water harvesting methods is encouraged. A note shall be placed on the plan that identifies the type of irrigation method chosen.

- ☐ Plant establishment. Native plants are well adapted to annual rainfall amounts in the Tucson Basin. To create a successful mitigation area, initial plant establishment is essential. Once a healthy root system is established (one to three years), plants

shall be "weaned" from supplemental irrigation. The intent is to adjust the irrigation schedule until plants can survive on natural rainfall. This can be accomplished by decreasing the frequency of irrigation each year. While decreasing supplemental irrigation, monitor plant health. During times of drought, the plants may require additional irrigation. Place the following note on the mitigation plan: *"Once plants have established (approximately 1 to 3 years after installation), supplemental irrigation will be decreased in accordance with standard landscaping practices."*

- ☐ Identify construction methods that protect riparian habitat to be left unaltered.

- ☐ Place the basic statement of maintenance on the plan as outlined in Section 2, "Required Maintenance", of the Guidelines.

- ☐ Note the growing season mitigation will be implemented by placing the following note on the mitigation plan, "*Mitigation plan implementation shall be completed by the first growing season following completion of construction, which is projected to be* (select one season*) March-May, 20XX/July-September, 20XX/September-November, 20XX."*

- ☐ An annual monitoring submittal for a period of five full years following mitigation plan implementation will be required to ensure the plan is implemented and maintained. Photo monitoring points will be based upon site constraints, so that the entire mitigation planting area(s) is documented. A minimum of one photograph per monitoring point is required. If the mitigation planting area cannot be captured by one photograph, several points shall be used. The monitoring plan shall be noted on the mitigation plan as follows, *"A monitoring plan, in accordance with the Guidelines, will be submitted annually for a period of five years following implementation of the mitigation plan. Any changes from the approved mitigation plan shall be noted on the monitoring plan submittal."* Submittals shall be labeled "Annual Monitoring Report for FPUP No. XX-XXX" and sent to the following address: Pima County Regional Flood Control District, ATTN: Water Resources Division Staff, 97 E. Congress Street, 2nd floor, Tucson, AZ 85701. **Note address for sending monitoring plan submittals on the mitigation plan**.

Compliance: It is the responsibility of the permittee to ensure the trees and shrubs received from the nursery are the correct plant species as noted on the mitigation plan (i.e., native plants). The most common problem encountered is the substitution of non-native and/or hybrid mesquites for native species. Arizona has only 3 native species of mesquite. Those species include: Velvet mesquite (*Prosopis velutina*), Screwbean mesquite (*Prosopis pubenscens*) and Western Honey mesquite (*Prosopis glandulosa Torr*. Var. *torreyana*). The western honey mesquite has not been included on the approved plant list, since it is typically found outside of Pima County. The predominant species within Pima County is velvet mesquite. It is important that whoever installs the plants verify with the nursery, both prior to purchase and prior to installation, species nativity and conformance with the species listed on the mitigation plan. If, upon inspection by the District, the plants installed are found to be non-native (exotic) species, the permittee shall, at their expense, plant adequate native species to satisfy the requirements of the mitigation plan. A statement requiring verification of plant species nativity prior to installation will be a condition of the FPUP, to be agreed to and initialed by the permittee at the time of FPUP issuance.

An application for a FPUP provides the District with the authority to enter the subject property to inspect the mitigation area to ensure continued compliance with the permit during the five year maintenance period.

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Pima County Regional Flood Control District
Water Resources Division

Development Review Mitigation Plan Checklist

Applicability: Pursuant to Chapter 16.30.050.A of the Pima County Floodplain and Erosion Hazard Management Ordinance No. 2005-FC2 (Ordinance), if an applicant demonstrates to the satisfaction of the District that alteration of regulated riparian habitat cannot reasonably be avoided, a mitigation plan shall be submitted to the District for approval when more than 1/3 acre (14,520 square feet) of regulated riparian habitat is disturbed.

Additionally, if the 1/3 acre (14,520 square feet) disturbance lies within either an Important Riparian Area (IRA) or Hydroriparian/Mesoriparian (Class H) habitat, and exceeds 5% of the total regulated riparian habitat on the property, the mitigation plan will require Pima County Board of Supervisors (BOS) approval.

Plan Review Timeframes: Review times are dictated by Development Services Subdivision Coordination Department. The Subdivision Coordination website can be viewed at: http://www.pimaxpress.com/SubDivision/Default.htm. When BOS approval is required, additional time may be necessary for final approval, which averages 3-4 weeks. The schedule for BOS regular session meetings as well as the Clerk of the Board (COB) deadline for agenda submittals may be viewed at: http://www.pima.gov/cob/schedule.htm. The mitigation plan shall be submitted as early as possible during the development review process. For subdivision plats, a Preliminary Riparian Mitigation Plan or "Mitigation Concept" will be required at the Tentative Plat submittal. The Preliminary Mitigation Plan will be evaluated for location and extent of disturbance relative to regulated riparian habitat, location of mitigation areas, and inclusion of field mapping/on-site vegetation survey information, if performed. The checklist items noted in grey below shall be included on the Preliminary Riparian Mitigation Plan. A final Riparian Mitigation Plan must be approved prior to Final Plat approval, and shall include all items noted on this checklist. The only exception is when BOS approval is necessary. A final mitigation plan must be approved by the BOS prior to approval of the tentative plat, to prevent unnecessary expense and effort on behalf of the applicant, should the BOS request changes to the mitigation plan and/or site design. Revisions to the plat or development plan that may affect any component of the riparian habitat mitigation plan will require submittal of a revised mitigation plan for additional review and approval.

Submittal Requirements: The mitigation plan shall follow the requirements outlined in the *Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines* (Guidelines), which can be viewed at: http://rfcd.pima.gov/riparian/mitigat/mitstand.pdf.

Avoidance Justification:

- ☐ During the planning phases of the project, the location and extent of Regulated Riparian Habitat on the project site shall be evaluated for the proposed use. Site improvements shall be designed to avoid and minimize disturbance to riparian habitat areas. If the parcel to be developed contains developable areas outside of the Regulated Riparian Habitat, but improvements are encroaching into the habitat, evidence that no reasonably practicable alternative exists to the proposed impacts and evidence that the impact has been minimized to the maximum extent practicable will be requested at the time of mitigation plan submittal. The applicant shall provide justification regarding why habitat could not be avoided. Examples of why habitat could not be avoided include site constraints, such as steep slopes which are regulated under the Zoning Code or public health and safety considerations such as traffic control (location of access roads relative to major roadways).

Mitigation Plan Checklist

The following list is provided as minimum mitigation plan requirements. Additional information may be requested upon review of the mitigation plan.

- ☐ The mitigation plan shall be prepared at the same scale as the plat or development plan.
- ☐ Scale, north arrow, location map, brief description of site location, project number and other general information as appropriate for the project.

- ☐ Label the plan "Riparian Habitat Mitigation Plan"

- ☐ Show site specific limits of the Regulated Riparian Habitat. Include the riparian habitat classification type in the legend and label the line type on the plan. Use the following line type and legend descriptions:

Line Type Description	Legend Description
IRA	Important Riparian Area (with underlying class...)*
H	Class H habitat*
XA -D	Class (A, B, C, or D) Xeroriparian habitat*

* add (rectified or field verified) as applicable

- ☐ Existing site topography (1 or 2 foot contour interval, if available).

- ☐ Proposed finished grades within the mitigated area. Finished grades shall be depicted by contours (1 or 2 foot contour interval) or by other methods that clearly depict the finished grades and slope conditions.

- ☐ Limits of disturbance/grading limits, including building envelopes, septic systems, utilities, drainage infrastructure, off-site improvements, fire safety setbacks, etc. Temporary disturbance, such as equipment storage areas, shall also be included in the limits of disturbance.

- ☐ Most recent aerial photograph. Utilize the aerial photograph taken for the Native Plant Preservation Plan, or, if unavailable, aerial photographs from the MapGuide web site can be used: (http://www.dot.pima.gov/gis/maps/mapguide/).

- ☐ The mitigation area shall be shown as a detailed planting plan which indicates locations of individual trees and shrubs. For a Preliminary Riparian Habitat Mitigation Plan submittal, depicting the general location of the mitigation area is acceptable. The minimum size required for the mitigation area shall be 70% of the size of the area disturbed, or, if field mapping was performed, use planting densities found on-site to determine size of mitigation area (see Section 2 and/or Appendix F and G of the Guidelines). On-site mitigation shall be located to the extent practicable, in a manner that enhances the overall function of natural open space within the project area and contributes to the overall value of riparian habitat protected within the property. This can be accomplished by locating your mitigation area adjacent to existing habitat or by enhancing existing habitat. If this option is not possible due to site constraints, the mitigation area shall be placed in locations that receive sufficient water to facilitate growth and maintain healthy habitat (i.e., drainage swales, low-lying areas, detention basins, water harvesting basins, etc.). The mitigation area shall be one continuous area in a density that creates habitat, as the site allows. Mitigation areas are to be located away from improved areas, where feasible, to prevent the desire to maintain in a manner similar to adjoining landscaped areas. For residential developments, placement of mitigation areas and protected riparian habitat within common areas maintained by the Home Owners Association (HOA) shall be required. Common areas containing mitigation plantings shall be delineated and labeled separately from "landscaped" common areas on the tentative and final plats.

- ☐ Mitigation plantings shall be installed per the approved planting methods outlined in the Guidelines. The following note shall be placed on the mitigation plan, *"Mitigation area(s) to be left in a natural state. No disturbance shall occur within the mitigation area(s) without RFCD review and approval"*

- ☐ Calculations and quantities for disturbance and mitigation. Calculations shall include the following; total area of regulated habitat on-site, by classification, area of regulated habitat which will be disturbed, by classification (for Class H or IRA, the area to be disturbed shall be multiplied by 1.5), minimum required mitigation area (70% of the size of the area disturbed), by classification, and the size of the mitigation area as proposed, by classification (mitigation area must be a minimum of 70% of the size of the area disturbed, unless technical data is provided that justifies an alternative planting density). Disturbance and mitigation calculations shall be in acres, to the nearest hundredth (ex., 0.33 acres). Plant quantity calculations shall include quantity of trees and shrubs, as required by the Guidelines, multiplied by the area of proposed disturbance, by classification (for Class H or IRA, the area of proposed disturbance shall be multiplied by 1.5 prior to multiplying by the quantity of trees and shrubs).

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- ☐ Provide a planting list or schedule that identifies plant species, quantities and sizes at the time of installation. The planting schedule shall list a minimum of 3 tree species, no more than 75% of any one species and 5 shrub species, no more than 35% of any one species. This requirement may be modified upon submittal of an onsite plant survey performed by a qualified professional. A list of approved plant species can be viewed in Appendix A of the Guidelines. Tree and shrub sizes shall be in accordance with Guideline requirements (see pages 16-17 and 21-22).

- ☐ Seeding requirement. Mitigation area shall be seeded with a minimum of 12 species from the approved plant list (see Guidelines, Appendix A). Seeding methods include; hydroseeding, drill seeding with crimped straw mulch or broadcast seeding and raking into seedbed with straw or other approved mulch. Provide a list of the 12 species on the mitigation plan. Of the 12 species, 4 shall be shrubs, 4 shall be annuals/perennials/vines, and 4 shall be grasses. Add the following note, "*Mitigated area will be (insert method of seed placement) with a minimum of 12 species from the approved (Class H or Xeroriparian) plant list found in Appendix A of the "Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines." If plant species listed on the mitigation plan are unavailable, replacements species from the approved plant list may be selected based upon availability. Of the 12 species, 4 shall be shrubs, 4 shall be annuals/perennials/vines, and 4 shall be grasses. Any changes to the seed mix shall be noted on the first monitoring plan submittal.*"

- ☐ Method of irrigation. Irrigation method shall include an automatic system such as drip, sprinklers, or other automatic irrigation system. The method of irrigation must demonstrate that adequate water will be provided to the new plants during plant establishment. Use of water harvesting methods is encouraged as a supplement to irrigation in addition to providing long-term benefits to the plants. A note shall be placed on the plan that identifies how mitigation plantings will be irrigated, including identification of an irrigation water source.

- ☐ Plant establishment. Native plants are well adapted to annual rainfall amounts in the Tucson Basin. To create a successful mitigation area, initial plant establishment is essential. Once a healthy root system is established (one to three years), plants shall be "weaned" from supplemental irrigation. The intent is to adjust the irrigation schedule until plants can survive on natural rainfall. This can be accomplished by decreasing the frequency of irrigation each year. While decreasing supplemental irrigation, monitor plant health. Establishment of the mitigation area will be considered successful when 80% of the plants are living and actively growing (without significant die back or loss) after one year without supplemental irrigation. During times of drought, the plants may require additional irrigation. Place the following note on the mitigation plan: *"Once plants have established (approximately 1 to 3 years after installation), supplemental irrigation will be decreased in accordance with Appendix C of the Guidelines."*

- ☐ Place the basic statement of maintenance on the plan as outlined on pgs. 18 and 23 of the Guidelines.

- ☐ Identify construction methods that protect riparian habitat to be left unaltered.

- ☐ Identify the party(s) responsible for implementation of the mitigation plan, monitoring of the mitigation area and the entity or individual responsible for long term ownership and management of the mitigated area(s).

- ☐ Place the following note on the mitigation plan, "*Mitigation plan implementation shall be completed by the first growing season following completion of construction, which is projected to be* (select one season*) March-May, 20XX/July-September, 20XX/September-November, 20XX."* If development of the site will not occur immediately, provide the note above with an approximate date of site development. A good rule of thumb to follow is that once riparian habitat has been impacted, mitigation must occur.

- ☐ An annual monitoring plan submittal for a period of five full years following mitigation plan implementation will be required to ensure the plan is implemented and maintained. The mitigation area shall be documented by establishing photo monitoring points. Photo monitoring points will be based upon site constraints, so that the entire mitigation area(s) is documented. A minimum of one photograph per monitoring point is required. If the mitigation area cannot be captured by one photograph, several points shall be used. Show location and directionality of the monitoring points on the mitigation plan. The monitoring plan shall be noted on the mitigation plan as follows, "*A monitoring plan, in accordance with the Guidelines, will be submitted annually for a period of five years following implementation of the mitigation plan. Any changes from the approved*

mitigation plan shall be noted on the monitoring plan submittal." Submittals shall be labeled "Annual Monitoring Report for P12XX-XX" and sent to the following address: Pima County Regional Flood Control District, ATTN: Water Resources Division Staff, 97 E. Congress Street, 2nd floor, Tucson, AZ 85701. **Note address for sending monitoring plan submittals on the mitigation plan.** The individual or entity responsible for implementation and monitoring of the mitigation area shall provide an "as-built" mitigation plan with the first monitoring plan submittal. Any changes to the plant species composition shown on the mitigation plan due to availability shall be noted on the "as-built" mitigation plan. If the mitigation area is not progressing as anticipated, proposed corrective actions shall be provided in the annual monitoring report.

☐ Provide a note on the plan describing any deviations from requirements as outlined in the Guidelines. Describe any special site conditions, such as presence of noxious and/or invasive species, previous disturbance, etc.

Resources:

Chapter 16.30 of the Floodplain and Erosion Hazard Management Ordinance No. 2005-FC2
http://municipalcodes.lexisnexis.com/codes/pima/_DATA/TITLE16/

Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines
http://rfcd.pima.gov/riparian/mitigat/mitstand.pdf

Pima County Mapguide to view Regulated Riparian Habitat
http://www.dot.pima.gov/gis/maps/mapguide/

Chapter 18.07.080 of the Zoning Code for information on modified development standards
http://municipalcodes.lexisnexis.com/codes/pima/_DATA/TITLE18/

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appendix B
approved plant list

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Plant Selection

Successful riparian habitat mitigation requires sufficient diversity of plant species and structure to provide food and cover for a variety of wildlife. A mix of annual and perennial plant species will provide structural diversity required for a naturalistic habitat. When selecting plant species for your Mitigation Plan, consider using plants native to the site. Plant species naturally occurring on your site are well-adapted to the site's soils, elevation, and water availability.

Use of Native Top Soil

Salvaging topsoil can provide an abundant source of native seed, organic matter and beneficial soil organisms.

If the property owner decides to salvage topsoil for redistribution on the site, the following procedure is recommended:

- Only use topsoil from undisturbed, native plant communities. If noxious and/or invasive plant species are present, it is not recommended the topsoil be salvaged.
- Topsoil should be salvaged to a depth of 4 to 6 inches and stockpiled no higher than 3 feet in height.
- Topsoil shall be stored for as short a duration as possible to ensure survival of seeds and soil organisms.

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Approved Class H Seed Mix

Approved Class H seed mixes shall be selected from the Approved Plant List and contain at least 12 plant species appropriate for the site elevation, soil type and watershed location. Of the 12 species, 4 shall be shrubs, 4 shall be annuals/perennials/vines, and 4 shall be grasses. These quantities are to serve as guidance in developing seed mixes appropriate for individual sites. Applicants may also contact local seed vendors (see page B-5) for additional seed mixes. To help prevent the spread of noxious and/or invasive plant species, ask vendors if the seed mix is certified "weed-free".

Below is an example seed mix for a property located in the Sabino Creek Watershed.

Baccharis salicifolia
Seep Willow
Anisacanthus thurberi
Desert Honeysuckle
Aristida ternipes
Spidergrass
Brickellia coulteri
Brickelbush
Epilobium canum ssp. latifolium
Hummingbird Trumpet
Garryea wrightii
Wright's Silktassel
Hilaria belangeri var. belangeri
Curly-mesquite
Ipomoea coccinea var. hederifolia
Scarlet creeper
Leptochloa dubia
Green Sprangletop
Muhlenbergia rigens
Deergrass
Penstemon pseudospectabilis
Desert Penstemon
Rhus trilobata

Note: Onsite seed collection is encouraged. Seeds collected onsite may be used within the approved seed mix, given appropriate seed application rates are verified through a seed vendor and noted on the Mitigation Plan.

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Approved Xeroriparian Seed Mix

Approved Xeroriparian seed mixes shall be selected from the Approved Plant List and contain at least 12 plant species appropriate for the site elevation, soil type, and watershed location. Of the 12 species, 4 shall be shrub species, 4 shall be annual/perennial/vine species, and 4 shall be grasses. These quantities are to serve as guidance in developing seed mixes appropriate for individual sites. Applicants may also contact local seed vendors (see page B-5) for additional seed mixes. To help prevent the spread of noxious and/or invasive plant species, ask vendors if the seed mix is certified "weed –free".

Below is an example seed mix for a property located in the Black/Brawley Wash Watershed.

Ambrosia ambrosioides
Canyon Ragweed
Aristida ternipes
Spidergrass
Atriplex canescens
Four-Winged Saltbush
Atriplex lentiformis
Quailbush
Cucurbita digitata
Fingerleaf Gourd
Hilaria belangeri var. belangeri
Curly-mesquite
Hymenoclea monogyra
Burrobrush
Larrea tridentata var. tridentate
Creosote Bush
Lesquerella gordonii var. gordonii
Gordon's Bladderpod
Machaeranthera tanacetifolia
Purple Aster
Muhlenbergia rigens
Deergrass
Vulpia octoflora
Sixweeks Fescue

Note: Onsite seed collection is encouraged. Seeds collected onsite may be used within the approved seed mix, given appropriate seed application rates are verified through a seed vendor and noted on the Mitigation Plan.

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Seed Vendors

Plant species selected for your Mitigation Plan shall be native to Pima County. The following is a partial list of local seed vendors that sell native plant seed and seed mixes. This list is for information only and is in no way exhaustive. It is not required that you purchase seed from these vendors.

The approved seed mix can be purchased from one of the following vendors:

- Curtis & Curtis — (505) 762-4759
  Clovis, New Mexico
- Desert Seed Source — (602) 226-4886
  Tempe, Arizona
- Double O Enterprises — (480) 831-5564
  Chandler, Arizona
- Granite Seed — (800) 992-5040
  Lehi, Utah — (801) 768-4422
- Native Seeds/SEARCH — (520) 622-5561
  Tucson, Arizona
- Southwestern Native Seeds — Contact through mail only
  P.O. Box 50503
  Tucson, Arizona 85224
- Western Native Seed — (719) 942-3935
  Coaldale, Colorado
- Wildland Restoration — (520) 882-0969
  Tucson, Arizona
- Wild Seed — (602) 276-3536
  Tempe, Arizona

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Where can I buy native plants?

Plants selected for your Mitigation Plan shall be native to Pima County. The following is a partial list of local nurseries that sell native plants. This list is for information only and is in no way exhaustive. It is not required that you purchase your plants from these vendors. The Arizona Native Plant Society website has an extensive list of native plant and seed sources in addition to the ones listed on pages B-5 and B-7. This list is available online at:

http://www.aznps.com/sources.html

When purchasing plants from the nursery, verify plant species nativity by checking the scientific name to ensure the plant species noted matches plant species on your Mitigation Plan. Many of the non-native plants look similar to native species. For example, hybrid mesquites look similar when young, but have a very different growth habit and do not provide the same value for wildlife as native mesquites. In addition, native mesquites are one of the most difficult species to identify correctly. Plant identification sheets have been included in this appendix (pages B-9 thru B-11) to assist applicants in distinguishing between native and non-native Mesquite species.

Note: Onsite seed collection and propagation is encouraged including the establishment of an onsite plant nursery. The onsite nursery will act as a supplement to required mitigation and will not act as a replacement for onsite plant requirements.

Where can I buy native plants?

Native Plant Nursery Vendors

PLANT NURSERY

Civano Nursery Inc. (520) 546-9200	5301 S. Houghton Rd. Tucson, Arizona 85747
Coronado Heights Nursery (520) 882-0969	2944 N. Castro Lane Tucson, Arizona 85705
Desert Survivors Nursery (520) 791-9309	1020 W. Star Pass Blvd. Tucson, Arizona 85731
Harlow Gardens (520) 298-3303	5620 E. Pima Road Tucson, Arizona 85712
Mesquite Valley Growers (520) 721-8600	8005 E. Speedway Blvd. Tucson, Arizona 85710
Mountain States Nursery 1-800-840-8509	10020 W. Glendale Ave. Glendale, Arizona 85307
Plants for the Southwest (520) 628-8773	50 E. Blacklidge Drive Tucson, Arizona 85705
Silverbell Nursery (520) 622-3894	2730 N. Silverbell Rd. Tucson, Arizona 85745
Sonoran Desert Nursery (520) 791-2334	901 E. 12th Street Tucson, Arizona 85719

SPECIALTY NURSERY

B & B Cactus Farm (520) 721-4687	11550 E. Speedway Blvd. Tucson, Arizona 85748

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Where can I find more information on plants?

For more information on these and other native plants, the following resources may be helpful.

Native Plants for the Southwestern Landscapes
Judy Milke, 1993, University of Texas Press

Landscape Plants for Dry Regions
Warren Jones & Charles Sacamano. 2000 Fischer Books.

A Field Guide to the Plants of Arizona
Anne O. Epple & Lewis E. Epple. 1995. LewAnne Publishing Company

Pruning, Planting and Care: Johnson's Guide to Gardening Plants for the Arid West.
Eric A. Johnson, et.al. 1997. Ironwood Press.

The Arizona Native Plant Society
The Arizona Native Plant Society has an extensive list of native plant and seed sources.
http://www.aznps.com

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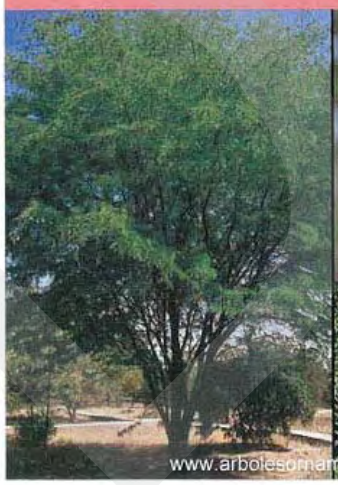
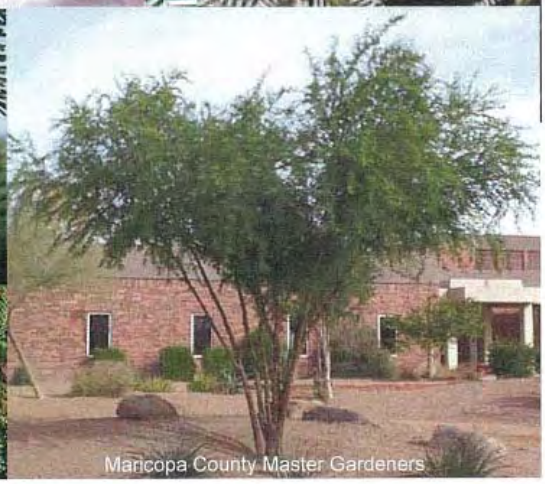
How to distinguish between the native mesquite species:

	velvet mesquite	screwbean mesquite	honey mesquite
Number of minor leaflets	15 - 20 pairs	6 - 9 pairs	10 - 16 pairs
Hairy leaflets?	yes		no
Leaflet spacing	close	intermediate	wide
Pods	straight or slightly curved	tightly coiled	flattened, straight, or curved

Native mesquites are easily confused with non-native South American mesquites (P. chilensis, P. alba) and hybrids! Indicators of non-native mesquites:

- Thornless or extremely long thorns
- More upright form
- Bright green, more widely-spaced leaflets that are not fuzzy





Velvet Mesquite (*Prosopis velutina*)

RANGE: Central and southern Arizona, extreme southwestern New Mexico, and adjacent northern Mexico below 5,000 feet.

FORM: Large shrub or small tree with spreading crown. May be single-stemmed and up to 50 feet tall or grow as an erect, multi-stemmed shrub.

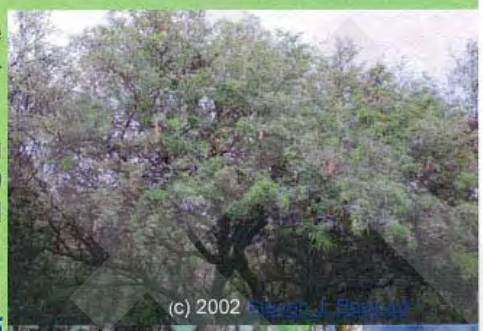
LEAVES: Alternate and bi-pinnately compound; usually about 6 inches long. Each leaflet has ***15 to 20 pairs of minor leaflets,*** less than one half inch long. ***Finely fuzzy surface***; dull green above, and paler below. Deciduous in the winter.

FLOWERS: 2—3 inch ***catkins of pale yellow flowers***; late spring to early summer.

FRUITS: ***Straight or slightly curved tan pods*** 3—7 inches long; solitary or clustered, ripen mid to late summer and drop in the fall.

TWIGS: Light brown and velvety, slightly zig-zagged with ***paired slender spines at the base of each leaf.*** Bark on young stems can be greenish.

BARK: ***Dark brown, rough and shreddy, sometimes gnarled and twisted.*** Newer bark can be reddish brown.



Screwbean Mesquite (*Prosopis pubescens*)

RANGE: Riparian areas of the Sonoran and Chihuahuan deserts.

FORM: Single or multistemmed small tree or shrub; sometimes forms thickets. Several crooked and arching stems form a broad round crown.

LEAVES: Deciduous, alternate, and bipinnately compound, 1 to 2 inches long, usually with only two major leaflets. ***Each leaflet with 6 to 9 pairs of narrow minor leaflets*** (1/2 to 1 inch long). Entire margins and a ***fuzzy surface***, green to gray-green above, paler below.

FLOWERS: Pale yellow pendulous yellow spikes in groups of 2 to 6, appearing late spring to early summer.

FRUIT: : ***A very unique, tightly coiled pod, 1 to 2 inches long, light brown, ripening in mid to late summer.***

TWIG: Paired whitish spines (up to 1 inch long) at the base of each leaf; knobby spur branches may also be present.

Alphabetical listing of trees, shrubs and grasses, etc. by Scientific Name.
For a version on 8.5" x 11" paper, please see District web site (or separate appendix)

Watershed								Botanical Name	Common name	Important Riparian Habitat Areas			Life Form	Water Requirements	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon			Hydroriparian	Mesoriparian	Xeroriparian						
								TREES										
	X	X		X	X			*Acacia constricta*	Whitethorn acacia		X	X	Perennial shrub/small tree	Low-Moderate	Perennial; 2500'-5000', occurs in a variety of settings including washes, slopes, shallow caliche-lined soils and grasslands; to 15' tall	Deciduous; very small yellow-orange flowers in spherical clusters present May-September, followed by seedpods; pairs of whitish spines on branches; nitrogen-fixer	Midstory shrubby tree occurring in a variety of situations; often associated with velvet mesquite, desert hackberry, wolfberry, and various cacti	Nectar: eaten by insects and nectar-eating birds including verdin; Seeds: eaten by a wide variety of birds and other wildlife; Foliage: eaten by deer and jackrabbits; host plant for larval butterflies; Provides cover and nest sites for birds
X	X	X	X	X	X	X	X	*Acacia greggii*	Catclaw acacia		X	X	Perennial Tree	Low	Long-lived perennial; below 5000', occurs within and along slopes, canyons, riparian bottomlands, and desert washes; shrub or small tree to 20' tall	Small yellow flowers on cylindrical spikes bloom April–October; seedpods produced in summer to fall; semi-deciduous in winter and extreme drought; has small but sharp "cat-claw-like" thorns; nitrogen-fixer	Under- to mid-story shrub on slopes, along washes; occasionally a tree where moisture plentiful; associated with common xeroriparian species such as velvet mesquite, desert hackberry, and graythorn.	Seeds: eaten by birds and other wildlife; Nectar: attracts butterflies and other insects including ants, which in turn attract horned lizards; Shelter for a wide variety of wildlife
X	X	X				X		*Celtis laevigata (Celtis reticulata)*	Netleaf/Canyon hackberry	X	X		Perennial Tree	Moderate	Long-lived perennial; 1500'-6000'; occurs in moist riverbeds, and along intermittent streams, and canyons; to 35' tall	Deciduous; very small greenish flower blooms March-April; small reddish fruits available June to November	Midstory to overstory tree associated with Mexican elderberry, velvet ash, Fremont cottonwood, velvet mesquite, western soapberry, and Arizona walnut	Berries: eaten by a wild variety of wildlife; Provides cover and nest sites for birds including raptors
X	X	X					X	*Chilopsis linearis*	Desert willow		X	X	Perennial shrub/small tree	Low-Moderate	Perennial, moderate lifespan; 1500' – 5000', occurs in desert flats, and along washes and streams; to 25'	Deciduous; showy lavender pea-shaped blooms Apr–Aug/Sep	Midstory to overstory tree in variety of upland and riparian situations; commonly associated with desert wash communities including velvet mesquite, Mexican elderberry, and desert hackberry.	Nectar: consumed by hummingbirds, insects including bees (bumble bees, carpenter bees, and others), and nectar-eating birds; Insects attracted by nectar provide food for insect-eating birds; Leaves: host plant for larvae of pollinating moths; Shelter and nesting for birds and other wildlife
X	X		X				X	*Fraxinus velutina*	Arizona ash, Velvet ash	X	X		Perennial Tree	Moderate-High	Perennial; 2000'– 7000'; within and along streams, moist canyons and washes; to 30' tall	Deciduous; Blooms March-April; very small yellow flowers appear before leaves	Overstory tree in riparian bottomlands; associated with Arizona walnut, netleaf hackberry, and Mexican elderberry.	Seeds: eaten by a wide variety of wildlife
	X					X		*Juglans major*	Arizona black walnut	X	X		Perennial Tree	High	Long-lived perennial; 3000'-7000'; occurs in streams and moist canyons from desert to oak or pine forestlands; to 50' tall	Deciduous; small greenish blooms before or during spring or summer leaf growth; produces large edible nut	Mid-or overstory tree in moist areas; associated with velvet ash, Mexican elderberry, Acacia spp.; understory often canyon hackberry	Nuts: eaten by a wide variety of wildlife; Provides shelter including nesting cavities for birds and other wildlife
		X			X			*Olneya tesota*	Desert Ironwood			X	Perennial Tree	Low	Long-lived perennial; below 2500', occurs on foothills and desert slopes where cold air doesn't settle; 26'to 30' tall	Purple, pink or white pea-like flowers bloom May–June; seedpods produced June-July; pairs of spines emerge from stems at base of leaves; nitrogen-fixer	Mid-sized desert tree; associated with saguaro, desert hackberry, wolfberry, graythorn, and desert lavender	Seeds: eaten by numerous wildlife species; Flowers: provide food for nectar-eating birds; Leaves and twigs: valuable browse for bighorn sheep and mule deer; Retains leaves during summer drought and provides important breeding and year-round thermal shelter; Considered a keystone species due to the abundance of wildlife that rely on this tree

Alphabetical listing of trees, shrubs and grasses, etc. by Scientific Name.
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San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon			Hydroriparian	Mesoriparian	Xeroriparian						
X	X	X	X	X			X	*Parkinsonia florida* (*Cercidium floridum*)	Blue paloverde		X	X	Perennial Tree	Low-Moderate	Perennial, moderate age; 500'–4000', occurs in washes, valleys, and floodplains, grasslands; to 30' tall	Bright yellow flowers bloom April–May; seedpods appear May-June; winter and drought deciduous; some spines on branches and stems; needs higher moisture levels than foothills paloverde; nitrogen-fixer	Mid to overstory associate within a wide variety of habitats including desert, grassland and xeroriparian understory; often associated with velvet mesquite and desert hackberry	Seeds: eaten by a variety of wildlife; Nectar: used by bees and other insects and nectar-eating birds; Fallen flowers: eaten by desert tortoise and other wildlife species; Branches: provide nesting sites for numerous bird species and nighttime roosts for many wildlife species; Host plant for mistletoe which is a key food source for phainopepla;
	X	X			X		X	*Parkinsonia microphylla* (*Cercidium microphyllum*)	Foothills Palo Verde, yellow palo verde			X	Perennial Tree	Low	Long-lived perennial; 500-4000'; occurs throughout Sonoran desertscrub habitats and along washes and streams; slow to medium growth rate, depending on water availability; shrub or tree to 26' tall	Large yellow flowers bloom Mar-May; seedpods mature June-July; tolerates drier conditions than blue paloverde; nitrogen-fixer	Mid to overstory associate within a wide variety of habitats including desert, grassland and xeroriparian understory; often associated with saguaro and other cacti, creosotebush, desert ironwood, and mesquite.	Seeds: eaten by birds and mammals; Flowers: provide pollen and nectar for insects including solitary bees, and also eaten by wildlife; Branches: used for nesting and roosting sites; Host for mistletoe providing food for phainopepla.and other birds
	X				X	X	X	*Platanus wrightii*	Arizona sycamore	X	X		Perennial Tree	Moderate	Perennial; 2000'-6000', occurs within and along streams and rocky canyons; to 80' tall	Deciduous; inconspicuous flowers bloom March-April; flowers followed by cylindrical fruits	Overstory tree in canyons near streams; associated with Arizona walnut, Fremont cottonwood, and Goodding's willow	Seeds: eaten by wildlife; Leaves, stems, wood: utilized by beaver;Provides habitat for wildlife including sites for cavity-nesting birds
X		X					X	*Populus fremontii ssp. Fremontii*	Fremont cottonwood	X	X		Perennial Tree	High	Long-lived perennial; 150' – 6000'; occurs along streams, rivers, and cienegas with surface water or near-surface groundwater; to 100' tall	Deciduous; very small, green-yellow flowers bloom early spring (often late February in Tucson area)	Overstory tree in moist areas along streams and rivers, or elsewhere where water table is near surface; associated with Arizona sycamore, Arizona ash, Goodding's willow, sacaton, grasslands, and canyon grape	Twigs and foliage: eaten by deer, beaver, and other mammals; Buds and catkins: eaten by birds; Insects attracted by fragrant buds provide additional forage for wildlife; Large size: offers abundant sheltering, resting, nesting and foraging habitat for numerous wildlife species
		X	X	X				*Prosopis pubescens*	Screwbean mesquite		X	X	Perennial Tree	Moderate	Perennial, moderate lifespan; below 4000', occurs in floodplains and bottomlands; to 15'–20' tall	Deciduous; small, yellow flowers in clusters bloom May-August; seedpods in summer to fall; branches have spines; nitrogen-fixer	Medium-sized tree; fixes nitrogen in soil; associates with velvet mesquite, wolfberry, graythorn, and four-winged saltbush	Seeds and pods: eaten by a wide variety of wildlife; Host plant for mistletoe, which is an important food source for phainopepla and other birds;
X	X	X	X	X	X	X		*Prosopis velutina*	Velvet mesquite		X	X	Perennial tree	Low	Long-lived perennial; 1000'-5000'; occurs in riparian floodplains; along washes, on scrubland slopes, and scattered in grasslands; generally to 30' tall, but larger in old-growth bosques in bottomlands	Deciduous; clusters of yellow flowers bloom April-May, and again in August; seedpods are produced June-September; nitrogen-fixer	Mid- to over-story tree associated with wide variety of desert and riparian plants including saltbush, wolfberry, desert hackberry, graythorn, desert lavender, and a wide variety of grasses and forbs	Seeds, pods, bark, twigs and leaves: eaten by a wide variety of wildlife including birds, bighorn sheep, deer, antelope, coyote, and rodents; Flowers: attract 60 species of native bees, plus wasps and butterflies; Nectar and larval plant for butterflies; Nesting sites: utilized by white winged doves, mourning doves, and many other birds; Host plant for mistletoe, which is an important food source for phainopepla and other birds; Insects on plant gleaned by birds
	X							*Quercus emoryi*	Emory oak		X	X			Perennial; 4,000 – 7,000', occurs on dry slopes, and along moist canyons in grasslands; shrub or small tree to 50'	Evergreen; small inconspicuous flowers appear in spring; acorns produced in summer	Midstory to overstory tree in variety of mid- to high-elevation settings; often along drainages in grassland settings.	Leaves and stems: browse for deer; Acorns: eaten by a variety of wildlife; Perennial cover valued by a wide variety of wildlife

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X	X	X					X	*Salix gooddingii*	Goodding's willow	X	X		Perennial Tree	High	Perennial; below 7000', occurs along streams, rivers, and moist bottomlands with surface water or near-surface groundwater; to 45' tall	Deciduous; tiny flowers in bunches bloom in spring and then release seeds that float in cottony fluff	Mid to overstory tree, often draping branches to the ground, associated with Fremont cottonwood, velvet ash, and canyon grape	Twigs and foliage: eaten by deer, beaver, and other mammals; Buds and catkins: eaten by birds, sites for insect gleaning birds; Dense cover: provides thermal shelter and cover from predators, and sheltered nest sites
	X					X		*Sambucus nigra ssp. Cerulea (Sambucus mexicana)*	Mexican elderberry, blue elderberry		X		Perennial shrub/small tree	Moderate	Perennial; 1000' – 4000', occurs along streams, rivers, and bottomlands, and scattered across moist grasslands; shrub to small tree to 30' tall	Drought deciduous; yellow-white cluster of small blooms appears March-June; small, abundant berries May-October	Mid-sized tree, occasionally large, associated with Goodding's willow, velvet mesquite, netleaf hackberry, graythorn, climbing milkweed, and old man's beard	Berries: eaten by a wide variety of wildlife; Foliage: eaten by deer, livestock, and other mammals
	X					X		*Sapindus saponaria* var. *drummondii*	Western soapberry		X	X	Perennial Tree	Low	Perennial; 2,400' – 6,000'; occurs in canyons, streams, desert grasslands, and oak woodlands; 20' to 50' tall	Deciduous; small white flower appears May – August, followed by yellowish berries	Multi-trunked tree occurring in riparian communities; common codominants include Arizona black walnut and velvet ash	Leaves and twigs: generally not palatable for wildlife due to the presence of poisonous saponids; Nectar: eaten by butterflies Clonal growth provides dense cover for a numerous wildlife species
								SHRUBS										
		X					X	*Ambrosia deltoidea*	Triangle-leaf bursage			X	Perennial shrub or subshrub	Low	Perennial, ,1000-3000', low-growing, less than 2' tall. Often in nearly pure stands on bajadas, plains, and mesas	Evergreen; inconspicuous pale yello green flowers, fruit a small bur. Flowers February to July	Low-growing subshrub prefers coarse, rapidly draining soils. Often associated with foothill palo verde and saguaro	Flowers probably provide nectar and pollen for insects. Plant provides cover for small vertebrates.
	X	X			X	X	X	*Anisacanthus thurberi (Drejera thurberi)*	Desert honeysuckle		X		Perennial Shrub	Moderate	Perennial; 2500-5500', colonizes sandy washes, canyons, and riparian bottomlands; upright shrub to 6' tall	Showy red to orange flowers appear mostly in spring, but during other times when adequate moisture is present	Understory shrub, sometimes forming large clumps; often found alongside desert washes with velvet mesquite, ironwood, paloverde, chuperosa, and desert willow	Nectar and pollen: eaten by hummingbirds and solitary bees; Leaves and twigs: browsed by bighorn sheep, cattle, and other mammals; Host plant for several butterfly species
	X				X			*Asclepias tuberosa*	Butterfly milkweed		X		Perennial subshrub	Moderate	Perennial; 4,000 – 8,000', dry grasslands, meadows; Bushy to 3' high	Low to mid-sized herb with bright orange or yellow flower blooming May – September	Low to mid-sized meadow herb	
	X	X		X				*Atriplex canescens*	Four-winged saltbush			X	Perennial shrub	Low	Perennial; 2000'-8000'; occurs in valleys and along washes, and in sandy soil from creosote valleys to pinyon flats; shrub to 8' tall	Evergreen; inconspicuous pale flowers bloom July - August; prominent winged seeds present April-September; alkaline tolerant	Mid-sized to large shrub; associated with variety of low to mid-elevation plant communities including triange bursage, burrobrush and grasses and forsbs	Seeds: eaten by birds and small mammals; Insects attracted to flowers are gleaned by birds; Leaves and twigs: valuable forage for mammals including deer; Plant provides good cover and nesting sites
		X		X				*Atriplex lentiformis*	Quailbush			X	Perennial Shrub	Low	Perennial; below 4000'; inhabits a range of dry to moist soils in desert flats, floodplains and drainages; dense shrub, to 8' tall and 12' wide	Semi-deciduous; small green flower blooms February-April; alkaline tolerant	Mid- to large-sized shrub in open areas or under- to mid-story in other areas; frequent associates include velvet mesquite, four-winged saltbush, and saltgrass	Seeds: eaten by quail and other birds; Flowers: provide pollen and nectar for bees; Twigs and foliage: browsed by deer, pronghorn and bighorn sheep; Cover plant for wildlife including quail
X	X		X	X	X	X	X	*Baccharis salicifolia*	Seep willow	X	X		Perennial Shrub	Moderate-High	Perennial; 2000'-5500; occurs along streams and moist washes, and in riparian bottomlands; tall shrub or small tree to 12' tall	White flowers on ends of branches bloom March-Dec; seeds in summer to fall	Associated with, and contributes to growth of, willows and Fremont cottonwoods	Nectar: eaten by butterflies, wasps and beneficial bees

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X								*Barkleyanthus salicifolius (Senecio salignus)*	Senecio, willow ragwort		X		Perennial Shrub	Moderatae	Perennial; 2000-4000'; occurs along moist washes and streams, and disturbed areas; shrub to 3' tall	Bright yellow flowers in dense clusters from February-April; frost-sensitive	Occurs in desertscrub and grassland habitats; common associates include cacti and a wide variety of grasses and forbs	Flowers: provide pollen and nectar for butterflies and other insects; Foliage: browsed by deer and other mammals
	X	X	X			X	X	*Calliandra eriophylla*	Fairy duster			X	Perennial Shrub	Low	Perennial; below 5000'; occurs on hillsides, desert flats, washes, and grasslands; shrub to 4' tall	Semi-deciduous; puffy, pink flower clusters appear any time of year, but mostly October-May	Small to medium sized cold-hardy shrub; associated with bricklebush, Trixis, limberbush, and a wide variety of grasses and forbs	Foliage: browse for mammals; Flowers: provide nectar eaten by butterflies, hummingbirds, and bees; Seeds: eaten by birds and other wildlife; Provides dense cover often lacking in the lower strata
X	X	X	X	X	X	X		*Celtis ehrenbergiana (Celtis pallida)*	Desert hackberry, spiny hackberry	X	X	X	Perennial shrub	Low	Long-lived perennial; 1500 – 3500'; occurs in uplands along washes and canyons, and in open desert and riparian bottomlands; shrub 10'-20' tall	Deciduous or semi-evergreen shrub; flowers are small and whitish, appearing in summer; bright orange berries present from June-October; dense and thorny	Large shrub in open desert or midstory in riparian bottomlands; associated with velvet mesquite, graythorn, wolfberry, catclaw acacia, and prickly pear and other cactus	Berries: valuable forage for a wide variety of wildlife; Foliage: browsed by deer, attracts insects, which are eaten by birds; Provides dense cover and nesting habitat for birds and small mammals
X					X	X	X	*Cephalanthus occidentalis*	Buttonbush, Common buttonbush	X			Perennial shrub	High	Long-lived perennial, 1,000-5000'; inhabits wet soils adjacent to streams and open waters; shrub or small tree to 10'.	Deciduous shrub with warts on stems; flowers are white balls to 1.5 inches in diameter that appear between June and September; fruit a rough button to 3/4" in diameter;	Mid-story shrub, usually in saturated soils adjacent to streams or other water bodies. Associated with three-leafed sumac and silktassel.	Waterfowl are the principle users of the seeds and the plants are browsed by deer. Insects come to the blooms for nectar.
	X					X	X	*Condalia warnockii*	Warnock condalia, Warnock's snakeweed		X	X	Perennial shrub	Low	Long-lived perennial, 2500-5000' occurs in uplands on bajdas and mesas and in canyons to 10' tall	Evergreen, tiny flowers in August to October, also spring. Fruits are red-blackish and up to 1/4 inch in diameter	Associated with mesquite and palo verde, graythorn and wolfberry	provides excellent cover for nesting birds such as Pyrrhuloxia
		X			X	X	X	*Dodonaea viscosa*	Hopbush			X	Perennial Shrub	Moderate	Perennial; 2000'- 5000', found along washes, canyons, rocky slopes; and floodplains; shrub to 12' tall	Evergreen; small yellowish flowers bloom February-October, followed by winged fruits	Mid- to large-sized deep green shrub scattered in open areas; often associated with ocotillo and jojoba	Seeds: eaten by some birds; Provides dense shelter for wildlife
X	X	X	X			X	X	*Encelia farinosa*	Brittlebush			X	Perennial Shrub	Low	Perennial; occurs on hillsides, washes, roadsides and other flat areas below 3000'; Shrub to 3' tall	Silvery-gray leaves may drop in spring droughts; showy yellow flowers November-May in frost free areas	Sub-shrub with showy, yellow "daisy-like" flowers; often associated with creosotebush, paloverde, and various cacti and grasses	Flowers: pollinated by nectar-eating butterflies, moths, and small bees; Seeds: eaten by birds, rodents, and other wildlife; Leaves and twigs: eaten by bighorn sheep and other mammals
	X	X			X	X	X	*Ericameria laricifolia (Haplopappus laricifolius)*	Turpentine bush			X	Perennial Shrub	Low	Perennial; 3000'- 6000', occurs in canyons, and on rocky slopes and desert flats; to 3' tall	Small and numerous yellow to golden flowers bloom August-December	Small, deep green shrub found in open areas or understory in oak woodland; has strong-smelling	Flowers: provide nectar and pollen for bees and other insects
		X			X	X	X	*Eriogonum fasciculatum var. Foliolosum/polifolium*	Flat-top buckwheat, Eastern Mohave buckwheat			X	Perennial Shrub	Moderate	Perennial; 1000'-4500'; grows on hillsides and other scrub-dominated uplands; to 3' tall	Very small white to pink persistent flowers in clusters that dry to an orangish-white color	Sub-shrub often associated with odora and fairy duster	Seeds: eaten by birds and other wildlife; Flowers: produce nectar eaten by butterflies and bees; Foliage: browsed and gleaned by mammals and some birds
	X				X	X	X	*Garrya wrightii*	Wright's silktassel		X		Perennial Shrub	Moderate	Evergreen perennial, 3000'-8000', occurs as scattered individuals in many different plant communities; generally to 8' tall, rarely reaching 15'	Inconspicuous tasseled flower bloom March – August; prefers partial summer shade in Tucson area	Mid-sized to large cold-hardy shrub; generally an understory component of pinyon-juniper woodlands and interior chaparral dominated by evergreen oaks and birchleaf mountain-mahogany	Foliage: browsed by deer, and other mammals; Provides good thermal and visual cover

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	X						X	*Gossypium thurberi (Thurberia thespesioides)*	Native cotton, Thurber's cotton		X	X	Perennial shrub	Moderate	Perennial; 2500-5000'; occurs in canyons, wash bottoms, and on rocky slopes; shrub to 7' tall	White to pinkish flowers bloom May-September; seed capsule with fuzzy seeds with short cottony hairs	Occurs on rocky hillsides or in washes or canyons; frequent associates include desert honeysuckle, catclaw acacia, and burrobrush.	Leaves: host plant and larval food for the splendid royal moth
X	X		X	X	X	X	X	*Hymenoclea monogyra (Ambrosia monogyra)*	Burrobrush, single whorl burrobrush			X	Perennial Shrub	Moderate	Perennial; 1000' – 4000'; occurs in valleys, flats, and strands with sandy soil; lanky shrub 3'- 6' tall	Small inconspicuous flowers appear in fall, followed by winged fruits	Understory to midstory shrub growing in sandy or disturbed soils; often associated with desert broom, seep willow, and other plants that are tolerant of frequent disturbance	Offers cover and nesting sites for wildlife in otherwise sparsely vegetated landscapes
		X				X	X	*Hyptis emoryi*	Desert lavender			X	Perennial Shrub	Low	Perennial; below 5000'; occurs within desert washes, on dry rocky slopes, and in canyons; medium shrub to 15' tall	Violet to blue flowers in clusters that may bloom any time of the year; very drought tolerant	Attractive medium to large shrub; often a component of creosotebush scrub communities	Flowers: important to bees, butterflies, and hummingbirds; Seeds: eaten by variety of wildlife
						X	X	*Justicia candicans*	Red justicia, Arizona water-willow		X	X	Perennial Shrub	Moderate	Perennial; 1500'- 3000', occurs within and along washes or slopes; to 3' tall	Drought deciduous; attractive red, sometimes yellow, flowers bloom spring and fall	Semi-frost hardy small shrub; associated white-thorn acacia and a wide variety of grasses and forbs	Flowers: hummingbirds use nectar Foliage: browsed by javelina
X	X	X	X	X		X	X	*Larrea tridentata var. tridentata*	Creosote bush			X	Perennial Shrub	Low	Long-lived perennial; below 4500'; inhabits dry plains and desert valleys; shrub to 10' tall	Small yellow flowers bloom Mar-April and November–December, followed by small, fuzzy white fruit	Medium to large shrub; associated species include saguaro, night-blooming cereus, paperflower, desert zinnia, and Christmas cholla; sometimes dominates extensive areas on bajadas and valley floors	Flowers: extremely important for native insects (22 species of native bees feed only on its flowers and it supports 17 species of gall forming insects); Seeds: eaten by a variety of birds and other wildlife; Provides valuable shelter in harsh landscapes
	X	X		X		X		*Lycium andersonii var. andersonii*	Anderson Wolfberry, water jacket		X	X	Perennial shrub	Low	Perennial; below 5500'; occurs in desert flats and along desert washes; 3 – 6' tall	Drought deciduous; lavender flowers bloom February-April; fruits present late spring to summer	Alone or as understory in some areas; frequently associated with graythorn, velvet mesquite, catclaw acacia, and desert hackberry	Fruits: eaten by birds and other wildlife
X		X						*Lycium fremontii*	Fremont Wolfberry, Fremont's desert-thorn		X	X	Perennial shrub	Low	Perennial; below 2500', occurs in desert valleys, and within and along washes, slopes, riparian bottomlands; shrub to 9' tall	Drought deciduous; small, lavender flowers blooms year round, but primarily Jan-Mar; can produce fruit year-round	Open areas or as understory shrub in mesoriparian to xeroriparian areas; associated with saltbush, velvet mesquite, graythorn, desert hackberry, and canyon ragweed	Flowers: provides nectar and pollen for a wide variety of insects; Fruits: eaten by birds and other wildlife
		X						*Mahonia haematocarpa (Berberis haematocarpa)*	Red mahonia, red barberry		X		Perennial Shrub	Low-Moderate	Perennial; 3000'- 5000', occurs within desert grasslands and oak woodlands; shrub to 6' tall	Cold-tolerant evergreen; yellow flowers in loose clusters bloom February-May, followed by red berries	Medium shrub in full sun or as understory in oak woodlands; associated with oak, *Ceanothus* , juniper, sugar bush, soap tree	Flowers: provide nectar and pollen for ;bees; Berries: eaten by birds and other wildlife; Foliage: browsed by deer, elk, bighorn, rabbits, and ringtail
X			X					*Parthenium incanum*	Mariola			X	Perennial Shrub	Low	Perennial; 3000'- 6000', occurs on dry slopes in the Sonoran desertscrub-Chihuhuan desertscrub transition zone; to 2' tall	White flowers with small petals bloom April-October	Small aromatic shrub occurring on well-drained rocky hillsides; often occurring with creosotebush, desert zinnia, snakeweed, brittlebush, and a variety of cacti; very drought-tolerant.	Provides cover for small mammals and birds

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	X				X	X	X	*Rhus glabra*	Smooth sumac		X		Perennial Shrub	Moderate	Perennial; 5000'- 7000', flats and forests with rich soil; to 20' tall	Small white flowers in attractive terminal clusters bloom June-August, followed by clusters of red berries	Large shrub standing alone or in forest settings; requires good soil	Foliage: browsed by deer
			X					*Rhus microphylla*	Littleleaf sumac		X	X	Perennial sub-shrub	Moderate	Perennial; generally 3,000 - 6,500 feet; occurs on dry desert foothills, and in canyons and along washes and valleys; shrub to 15' tall	Greenish-white flowers occur in dense compound spikes; hairy, red-orange fruit	Small to medium shrub in desert grasslands and scrublands; common associates include velvet mesquite, creosotebush, catclaw acacia, soaptree yucca, sideoats grama, and bush muhly	Fruit: eaten by birds and rodents; Leaves and twigs: browsed by deer and small mammals
					X	X	X	*Rhus ovata*	Sugar bush, sugar sumac		X		Perennial Shtub	Moderate	Perennial shrub or small tree; 3000'-5000'; occurs in desert canyons, mountain and on slopes with chaparral; to 15' tall	Small cream-colored flowers appear February-March, followed by sticky, reddish fruit	Evergreen, cold-hardy, medium to large shrub stands alone or grows among chaparral or scrub-oak; associated with *Ceanothus* , canyon hackberry, catclaw acacia, velvet mesquite, and scrub oak woodland associations	Fruit: eaten by a wide variety of birds and other wildlife; Evergreen foliage provides year-round shelter
	X				X	X	X	*Rhus trilobata*	Three-leafed sumac, skunkbush sumac		X		Perennial Shrubq	Moderate	Perennial; 2500'- 7500', occurs in canyons, and on mountain slopes; to 10' tall	Yellow flowers in dense clusters bloom March-June; red fruits mature in summer	Deciduous, attractive shrub often as understory component of pinyon pine or oak woodlands	Berries: eaten by small mammals and birds; Foliage: eaten by and small mammals; Bark: eaten by small mammals
					X	X	X	*Ribes aureum var. aureum*	Wax currant, golden currant	X			Perennial Shrub	Moderate-High	Perennial; 2600-8000'; occurs in mid- to high-elevation grasslands, and mixed deciduous and coniferous woodlands; to 10'tall	Deciduous; fragrant yellow flowers in spring and berries in summer; small to medium, lanky shrub	Occurs in grasslands, coniferous forests and woodlands, and riparian and mountain shrub communities	Berries: eaten by variety of wildlife; Foliage: browsed by large mammals
	X	X					X	*Simmondsia chinensis*	Jojoba			X	Perennial shrub	Low	Perennial; 1000'-5000'; occurs on desertscrub habitats and along washes, slopes, and rocky hillsides; shrub to 7' tall	Evergreen; inconspicuous greenish flower, male and female flowers occur on separate plants and bloom variable from December-July; nuts appear from May- July	Small to medium shrub scattered across upland desert areas; often associated with velvet mequite, paloverde, hopbush, creosotebush, brittlebush and various cacti	Nuts: eaten by birds and a wide variety of mammals including javelina; Foliage: eaten by deer, bighorn sheep and other mammals
X					X	X	X	*Tecoma stans*	Yellow bells, yellow trumpetbush			X	Perennial shrub	Low	Perennial; 3,000-5,500'; occurs on rocky or gravelly slopes along desert washes; shrub with upright form to 12' tall.	Deciduous; elongated, serrated leaves. Bright yellow trumpet-shaped flowers May through October.	Medium shrub of rocky slopes associated with plants of the Sonoran and Chihuahaun deserts. Often occurs with foothill paloverde and saguaro on hillsides.	Browsed by bighorn sheep and probably mule deer. Carpenter bees pirate nectar from blossoms by cutting into the base of the flower.
	X	X	X		X	X	X	*Trixis californica*	Trixis, American threefold			X	Perrenial shrub	Low	Perennial up to 5000', probably long-lived up to 3' tall	Bright yellow flowers up to 3/4-inch in diameter	Rocky slopes in the Arizona Upland Subdivision of the Sonoran Desert	Browsed to some extent by cattle
	X	X						*Vauquelinia californica ssp. Californica/sonorensis*	Arizona rosewood			X			Perennial; 2500' – 5000', occurs on mid-elevation canyons and mountains, oak woodlands; shrub or small tree to 25' tall	Slow-growing evergreen; small white flowers in clusters bloom May – June, followed by woody fruits that persist through winter	Shrub or small tree associated in canyons and on slopes with shrub live oak, (*Quercus turbinella*) and as scattered individuals in grama grasslands with scattered velvet mesquite.	Dense perennial foliage: provide valuable cover for wildlife

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X	X	X	X		X	X		*Ziziphus obtusifolia var. canescens*	Graythorn, lotebush			X	Perennial shrub	Low	Perennial; 1000'-5000'; found scattered in desert uplands, and along washes, riparian bottomlands, and mesquite bosque; to 10' tall	Deciduous; tiny whitish-green blooms appear May–September; fruits August to January	Mid-sized shrub; often associated with wolfberry, desert hackberry, catclaw acacia, desert honeysuckle, and velvet mesquite	Berries: eaten by birds, especially white-winged dove and Gambel's quail; Flowers: nectar and pollen eaten by honeybees, native bees, tarantula hawks, and other insects; Insects attracted to plant are gleaned by birds; Dense and thorny character provides valuable shelter and nesting sites
								VINES										
	X	X	X					*Clematis drummondii*	Old man's beard, Virgin's bower, Drummond's Clematis		X	X	Perennial vine	Moderate	Perennial; below 4000'; occurs in moist open areas and along the edges of riparian woodlands; woody, climbing vine can reach heights of trellises or trees	White flowers bloom March-September, and later yield fluffy, white plumed seeds	Vine often seen climbing shrubs and trees in riparian bottomlands or thick vegetation where some moisture available; common associates include netleaf hackberry, velvet ash, and seep willow	Serves as a larval host plant for butterflies
X	X	X	X	X	X	X	X	*Cucurbita digitata*	Fingerleaf gourd			X	Perennial vine	Low-Moderate	Perennial vine; below 5000'; occurs from low desert valleys to mid-elevation grasslands	Deciduous; large yellow blooms June - October; gourds mature in fall	Associated with fourwing saltbush, and a wide variety of grasses and forbs	Vines, leaves, root and seeds: eaten by wildlife including javelina; Flowers: provide pollen for pollinators including bees
		X	X	X				*Cucurbita palmata (Cucurbita californica)*	Coyote melon, Coyote gourd			X	Perennial vine	Moderate	Annual ground-hugging vine with trailing stems from a large root; usually below 3,000' on sandy plains, mesas, or rocky slopes; often in arroyo bottoms.	Has incised palmate leaves and large funnel-shaped yellow-orange flowers that appear between May and August. Produces round white-striped gourds.	Ground-hugging vine; may be associated with datura, clumping grassses, small shrubs or cacti.	Flowers visited by bees. Plant stems are a reservoir for the squash vine borer, which is an economically important pest species of cucurbits.
							X	*Ipomoea hederifolia (Ipomoea coccinea* var. *hederifolia)*	Scarlet creeper	X	X	X	Annual vine	Moderate	Perennial vine; 2500 - 6000'; occurs along desert washes, canyons and rivers; 2-10' long	Tubular red flowers from May-October;	Common associates include Fremont cottonwood, Goodding's willow, mesquite, and seep willow	Nectar: major food source for hummingbirds;
X	X		X	X	X	X	X	*Maurandya antirrhiniflora*	Snapdragon vine, roving sailor	X	X	X	Perennial vine	Moderate	Perennial herbaceous climbing vine with dark green arrow-shaped leaves; often associated with rocky slopes or wash areas where it	Reddish pink or lilac blooms with whitish throat with pink lines appear from April through October. Fruit is a dehiscent round capsule.	Common associates include wolfberry, hackberry, and burrowbrush.	Flowers probably provide nectar and pollen for insects.
X	X							*Vitis arizonica*	Arizona wild grape, Canyon grape		X		Perennial vine	Moderate	Perennial vine; 2000' - 7500'; occurs in canyons and along washes and rivers, to 30' long	Deciduous; greenish flower in clusters from April-July; fruit present July-August	Associated with riparian plants such as netleaf hackberry, Fremont cottonwood, and velvet ash	Berries: eaten by a wide variety of wildlife; Vines and leaves: browsed by mammals including javelina and used by birds for nesting material; Flowers: provide nectar and pollen for
								CACTI & SUCCULENTS										
	X	X	X					*Cylindropuntia arbuscula,* (*Opuntia arbuscula*)	Arizona Pencil cholla			X	Perennial cactus	Low	Perennial; 1000' – 4000'; occurs in open areas on rocky slopes and bajadas; to 9' tall	Blooms from May-June; fruit present in fall and may persist through winter	Associated with desertscrub vegetation including other cholla species, saguaro cactus, triangle bursage, mesquite, and paloverde	Fruits: eaten by deer, javelina, small mammals and birds; Seeds: eaten by birds including mourning dove and Gamble's quail; Flowers: provide nectar and pollen for bees; Provides sheltered sites for small mammal burrows
	X	X	X	X				*Cylindropuntia leptocaulis,* (*Opuntia leptocaulis*)	Christmas cholla, desert Christmas cactus			X	Perennial cactus	Low	Perennial; 1000' – 5000'; occurs in open areas on rocky slopes and bajadas; to 4' tall	Small yellowish-greenish blooms from May-June; bright red fruit present in fall and may persist through winter	Associated with desertscrub vegetation including other cholla species, saguaro cactus, triangle bursage, mesquite, and paloverde	Fruits and seeds: eaten by birds and mammals including deer and javelina; Nectar and pollen: eaten by bees and nectar-eating birds; Provides protective nest sites for cactus wren, curve billed thrasher, and other birds

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X	X	X	X	X	X	X	X	*Ferocactus wislizeni (Echinocactus wislizeni)*	Candy barrel cactus			X	Perennial Cactus	Low	Long-lived, to 11' tall, but mostly less than 6' tall. Up to 4500'	Flowers July-September, very persistent, waxy, yellow fruit	Mexquite and mixed palo verde-cactus, variable soils	Pollen and nectar utilized by a variety of insects; fruit used by ground squirrels.
	X	X			X	X	X	*Nolina microcarpa*	Beargrass, sacahuista			X	Perennial Lily	Low	Perennial; 3000-6000'; occurs in open areas on rocky slopes and bajadas; to 3' tall, flowering stalk to 8'	Evergreen; small creamy white flowers form showy plumes on stalks that bloom in May-June; coarse leaves are somewhat abrasive	Not a true grass but resembles a coarse bunchgrass; usually in the open rather than in understory; often found with Arizona rosewood, turpentine bush, ocotillo; sotol, manzanita, and oak	Plant: larval plant for Melinus hairstreak butterfly; Flowers: provide nectar and pollen for bees and butterflies; Foliage: sometimes browsed when other food scarce
	X	X			X	X	X	*Opuntia phaeacantha*	prickly pear			X	Perennial cactus	Low	Perennial; to 6500'; occurs in desertscrub habitats on bajadas and alongside canyons and washes; generally to 3' tall	Large rose-like flowers appear April June, with bright red fruits maturing July-August; some fruits persist through most of winter	Occurs in open desertscrub and grassland habitats; common associates include mesquite, paloverde, other cacti, creosotebush, triangle bursage, and fluffgrass.	Fruits: eaten by deer, javelina, small mammals and birds; Seeds: eaten by birds including mourning dove and Gamble's quail; Flowers: provide nectar and pollen for bees; Provides sheltered sites for small mammal burrows
	X				X			*Yucca elata*	Soaptree yucca			X	Perennial shrub	Low	Perennial; 1500' – 6000'; occurs in open areas on rocky slopes and bajada; to 15' tall	Evergreen; dense cluster of yellowish-white flowers on tall stalk bloom May –June; fruits mature in summer	Occurs in open desertscrub and grassland habitats; common associates include ocotillo; sotol, oak, and a wide variety of grasses and forbs	Flower stalks: browsed by mammals including mule deer and javelina; Seeds: eaten by birds and other wildlife; Larval plant for butterflies; Pollinated by symbiotic yucca moth
								PERENNIAL FORBS/SUB-SHRUBS										
	X			X				*Allionia incarnata*	Trailing windmills, trailing four-o'clock			X	Perennial forb	Low	Perennial forb; to 6500'; occurs in open areas including sandy washes and valley bottoms; trailing plant to 6" high and 24 " wide	Vibrant rose-pink flowers present April-October	Often associated with desert strand species including clammyweed, datura, slimpod senna, and burrobrush. Also found along in disturbed roadside areas and in four-wing saltbush associations.	Provides temporary cover and moist microsites for insects and small mammals
X	X	X	X	X	X	X	X	*Ambrosia ambrosioides*	Canyon ragweed		X	X	Perennial Subshrub	Moderate	Medium to large perennial shrub; occurs in washes and strand areas below 4,500'. Plants get to about 6' in height.	Indistinct yellowish-green flowers in a terminal spike appear between February and May. Fruit has a cocklebur form.	Found in association with mesquite, paloverde, burrobrush, datura, seepwillow, and brickellia.	There is little use this plant as forage; leaves are consumed by leaf beetles; wind pollinated, does not provide a nectar source for insects.
						X		*Anemopsis californica*	Yerba Mansa	X	X		Perennial forb	High	Perennial forb; 2000-5000'; colonizes moist alkaline soils in meadows and alongside streams and cienegas; to 20" tall	Large white flowers borne on tall stalks present from May-Aug; highly aromatic leaves; plants spread by stolons and can form extensive groundcover	Often occurs in mesquite bosques; associated with other saline-tolerant plants including saltgrass and alkali sacaton	Provides temporary cover and moist microsites for insects and small mammals
	X						X	*Aquilegia chrysantha*	Columbine, yellow	X	X		Perennial forb	High	Perennial forb; 3000'-11000', occurs in shady, moist canyons and forest associations; to 4' tall	Showy yellow flower appears April-September	Associated with grasses, forbs and other wildflowers in rich soils along streams or other moist areas	Flowers: provide nectar and pollen for insects and hummingbirds; Seeds: eaten by birds and small mammals
X	X		X					*Baileya multiradiata*	Desert marigold			X	Perennial forb	Low	Annual or short lived perennial; below 5000'; occurs on sandy and gravelly slopes and desert flats, and along roadsides in sunny open areas; to 2' tall	Bright yellow flowers at ends of leafless stems appear March-October when moisture available	Associated with desert broom, desert globemallow, lupine, and fluffgrass	Seeds: eaten by birds including Inca dove, and ants; Insects on plant gleaned by birds

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X	X		X	X	X	X	X	*Brickellia coulteri*	Brickelbush, Coulter's brickelbush		X	X	Perennial Subshrub	Moderate	Perennial shrub; 2,000-4,000'; along washes, canyons, and dry rocky slopes.	Plant is sticky, with brittle stems; produces an inconspicuous, slender flowerhead of yellow-green rayless flowers.	Associated with mesquite, desert hackberry, grasses; often associated with plants on tops of banks.	Seeds consumed by Gambel's Quail and probably other birds.
X	X	X	X	X		X	X	*Dichelostemma capitatum* (*Dichelostemma pulchellum*)	Bluedicks		X	X	Perennial forb	Low	Perennial (bulb); below 5000', occurs on mesas, open slopes, and plains; to 30" tall	Beautiful lavender flower at the top of a slender stem, blooms February-May	Prefers gravelly soils; in our area, often found in association with grasses and low stature shrubs including acacia, mariola, and creosotebush.	Bulbs: highly valuable forage for small and large mammals
X		X			X	X	X	*Dicliptera resupinata*	Arizona foldwing		X	X	Perennial forb	Low	Perennial forb or subshrub to 2' in height; on rocky slopes, in canyons, and along wash embankments between 3,000 and 6,000'.	Densely branching, erect to spreading form; lanceolate leaves; red-violet blooms subtended by clasping bracts occur between May and October.	Associated with mesquite bosque, graythorn, wolfberry, and desert hackberry.	Flowers probably provide nectar for insects and hummingbirds.
X	X	X			X	X	X	*Epilobium canum ssp. latifolium* (*Zauschneria californica*)	Hummingbird trumpet		X	X	Perennial forb	Moderate	Perennial; suffrutescent; to about 20" height; damp places and on rocky slopes and in canyons from 2,500-7.000'.	Long-tubular scarlet to red flowers from June to December.	Associated with streamside or hillside vegetation including deergrass, agaves, and juniper and oaks.	Provides nectar for hummingbirds.
	X	X				X		*Glandularia gooddingii (Verbena gooddingii)*	Goodding's verbena, southwest mock vervain			X	Perennial forb	Low	Annual or short-lived perennial forb; below 5000'; occurs in open canyons and along slopes add washes with sandy soils; to 2' tall and 4' wide	Purple clusters of flowers bloom from Feb-Oct; easily propogated through cuttings and self-seeding	Occurs in open areas with clammyweed, desert marigold, Arizona blazing star, windmills, and datura.b	Flowers: nectar and pollen attract butterflies and moths; Good groundcover that provides temporary shelter and moist, resting microsites for insects, birds, and small mammals
					X	X	X	*Lobelia cardinalis*	Cardinalflower	X			Perennial forb	Moderate-High	Perennial forb; 3000'-7500'; occurs with streamsides and cienegas; to 5' tall	Tubular bright red flower bloom June-October	Associated with other streamside plants including giant sacaton, deergrass, Fremont cottonwood, and Gooding's willow	Flowers: provide nectar for hummingbirds and insects
X			X	X	X	X	X	*Machaeranthera tanacetifolia (Aster tanacetifolius)*	Tanseyleaf tansyaster, purple aster			X	Perennial forb	Low	Perennial forb; 1000'-8000'; occurs in disturbed soils along washes, fields, paths, and roadsides; to 16" tall	Handsome "daisy-like" bluish-purple rays surrounding yellow disk flowers, blooms June – October	Usually open areas with other species that pioneer disturbed and sandy soils including windmills, clammyweed, and desert marigold	Provides temporary cover and moist microsites for insects and small mammals
	X	X			X			*Penstemon parryi*	Penstemon, Parry, beardtongue			X	Perennial forb	Low	Perennial forb; 1500-5000'; occurs in well-drained soils on grassy slopes, alongside canyons and along roadsides; to 4' tall	Tubular pink flower appear March-July	Associated with a wide variety of desert-adapted shrubs, grasses and forbs; frequent associates include velvet mesquite, paloverde, lupine, desert globemallow, and Goodding's verbena	Flowers:provide nectar and pollen for insects and hummingbirds
X		X	X	X	X	X	X	*Penstemon pseudospectabilis*	Desert Penstemon		X		Perennial forb	Moderate	Perennial forb; 2000'-7000'; occurs on arid slopes, and along canyons and desert washes; to 4' tall	Tubular red flower appears February-May	Associated with a wide variety of desert-adapted shrubs, grasses and forbs; frequent associates include, velvet mesquite, soaptree yucca, and spidergrass	Flowers: provide nectar and pollen for insect and hummingbirds
	X		X		X			*Rumex hymenosepalus*	Canaigre dock		X	X	Perennial forb	Moderate	Perennial forb; to 6000'; occurs in sandy soils in valley floors and along washes; clustered leaves to 12' with flowering stem to 4' tall	Small green flowers appear on spikes from March-April; followed by clustered pinkish, winged fruits; roots form a stout tuber	Occurs in sandy soils along with paloverde, velvet mesquite, four-wing saltbush, and Mexican elderberry	Seeds, leaves, tubers: eaten by a wide variety of wildlife

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				X				*Ruellia nudiflora var. nudiflora*	Violet wild petunia	X	X		Perennial forb	Moderate	Perennial forb; 2500-4000'; occurs in moist woodlands along streams and washes; to 24' tall	Large purple flowers present May-Oct	Associated with mesquite, graythorn, desert hackberry, wolfberry, and scarlet creeper	Provides temporary cover and moist microsites for insects and small mammals
	X					X		*Senna hirsuta* var. *glaberima (Cassia leptocarpa var. glaberrima)*	Slimpod senna, woolly senna		X	X	Perennial forb	Moderate	Perennial forb; 2500- 5500'; occurs in sandy washes and disturbed areas such as roadsides; to 3' tall	Bright yellow flower clusters present July-Sept; followed by long, slender pods	Associated with desert strand species including clammyweed, datura, windmills, *Hymenoclea monogyra*	Pollen: collected by insects including bumblebees and butterflies; Seeds and pods: eaten by a wide variety of wildlife
X	X	X	X	X				*Sphaeralcea ambigua ssp. Ambigua*	Desert globemallow, apricot globemallow			X	Perennial forb	Low	Perennial; below 3500'; occurs in sandy flats and washes, and along roadsides; to 3' tall	Attractive flowers vary in color from white to orange, salmon,lavender, or pinkish; flowers appear throughout year when moisture available; woody stem	Frequently associated with prickly pear, creosotebush, and other a variety of other Sonoran desertscrub plants that grow in the open and along roadsides	Flowers: provide nectar and pollen for insects including native bees, and eaten by desert tortoise, birds, and other wildlife; Leaves and twigs: provide browse for bighorn sheep and other mammals; Larval food plant for butterflies
X	X	X	X	X	X	X	X	*Zinnia acerosa (Zinnia pumila)*	Desert zinnia			X	Perennial Subshrub	Low	Perennial; 2000' – 5000', occurs in dry valleys and on rocky slopes; to 10" tall	Evergreen; white to pale yellow flowers bloom March-October when moisture is adequate	Frequently ssociated with prickly pear, creosotebush, triangle bursage, fluffgrass, and other Sonoran desertscrub plants that grow in open, exposed sites	Flower petals: eaten by quail, finches, sparrows, and other birds; Seeds: eaten by harvester ants, which in turn attract horned lizards; Insects on plant gleaned by birds
								ANNUAL WILDFLOWERS										
	X		X					*Bowlesia incana*	Bowlesia, hoary bowlesia		X	X	Annual forb	Low	Annual forb; to 3000'; occurs along sandy washes and woodlands; trailing stems to 20" long	Tiny, seldom-noticed flowers appear March-April; shade-tolerant	Abundant after winter rains along with other spring ephemerals forming a carpet under velvet mesquite, paloverde, catclaw acacia, and wolfberry. Associated with other spring ephemerals and annual grasses.	Provides temporary cover and moist microsites for insects and small mammals
	X					X		*Datura wrightii*	Datura, sacred, jimsonweed, sacred thorn-apple		X	X	Annual or Perennial forb	Low	Annual or perennial forb; 700-6000'; occurs in open disturbed areas including strands and valley bottoms; to 5' tall and 7' wide	Large white tubular flowers present May –Oct, followed by big spiny fruits	Often associated with desert strand species including clammyweed, slimpod senna, and burrobrush. Also present in riparian buffers, disturbed roadside areas, and saltbush associations	Nectar and pollen: utilized by bees, moths and other insects; Birds forage on insects attracted by flowers
X			X	X	X	X	X	*Eriastrum diffusum*	Miniature woollystar			X	Annual forb	Low	Annual to 4 1/2"; 1,000-5,500'; sandy areas of deserts and mesas.	Pale bluish to white tubular flowers to 1/2" long on bristle-tipped heads appear between March and June.	Associated with subshrubs, cacti, and forbs in Sonoran desertscrub and semidesert grassland habitats.	Provides nectar for insects.
	X	X		X				*Eschscholzia californica ssp. Mexicana (Eschscholtzia mexicana)*	Mexican Gold Poppy, California poppy			X	Annual forb	Low	Annual forb; below 4,500'; occurs in dr , gravelly or sandy places, often alongside desert washes; to 16 " tall	Bright orange flowers appear from mid-Feb to May; useful as a quick soil stabilizer following disturbance	Abundant after winter rains along with Gordon's bladderpod, lupine, *Phacelia* spp., and owl's clover	Provides temporary cover and moist microsites for insects and small mammals
X	X	X	X	X	X	X	X	*Kallstroemia grandiflora*	Arizona poppy		X	X	Annual forb	Low	Summer annual; spreading to 3'; open plains, deserts, wash strand areas, and desert slopes.	Flowers bright orange with a red center appear between July and October. Leaves and stems hairy.	Late summer bloomer responding to summer rains. Common along roadsides; occurs with tansyaster (*Machaeranthera* sp.), mesquite, and grasses.	Fowers visited by insects.

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Watershed								Botanical Name	Common name	Important Riparian Habitat Areas			Life Form	Water Requirements	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon			Hydroriparian	Mesoriparian	Xeroriparian						
	X			X	X	X		*Lesquerella gordonii var. gordonii*	Gordon's bladderpod		X	X	Annual or Perennial forb	Moderate	Annual forb; 100-5000'; occurs in sandy open places; to 16" tall	Profuse yellow flowers appear from Feb-May; round pea-sized pods follow flowers; useful as a quick soil stabilizer following disturbance	Abundant after winter rains along with Mexican gold poppy, lupine, *Phacelia* spp., and owl's clover	Pods eaten by large and small mammals, birds, and other wildlife
X	X		X	X	X	X	X	*Lupinus sparsiflorus ssp. mohavensis*	Coulter's lupine		X	X	Annual forb	Moderate	Annual forb to 16" height; below 4,500' on slopes and mesas on sandy soils.	Pale blue to violet flowers from January to May. Improves soil quality through nitrogen infusion.	Abundant after winter rains along with other spring ephemerals including Mexican gold poppy, Gordon's bladderpod, *Cryptantha* spp., bowlesia and purplemat	Flowers: provide nectar: eaten by bees and butterflies.
X			X	X	X	X	X	*Nama demissum var. demissum*	Purplemat		X	X	Annual forb	Moderate	Annual forb to 8"; desert flats and washes; below 3,500'.	Red-purple flowers between February and May; may carpet the desert when rains are abundant.	Occurs with other spring annuals including Mexican gold poppy, lupines, *Cryptantha* spp., and owl clover.	Flower are visited by insects.
	X				X			*Phacelia distans*	Blue-eyed scorpionweed, distant phacelia		X	X	Annual or Perennial forb	Moderate	Annual forb; to 5000'; occurs in dry, gravelly or sandy places, often alongside desert washes; to 12" tall	Deep blue, bell-shaped flowers unfurl from a coiled spike from Feb-April; useful as a quick soil stabilizer following disturbance	Abundant after winter rains along with other spring ephemerals including Mexican gold poppy, Gordon's bladderpod, *Cryptantha* spp., bowlesia and purplemat	Nectar and pollen: eaten by insects Provides temporary cover for small mammals
X								*Platystemon californicus*	Creamcups	X	X	X			Annual forb; 1500-4500'; occurs in open areas with moist, gravelly soil, primarily along streams and washes and moist meadows; to 15" tall	Cream-colored "poppy-like" flowers present March-May; does not tolerate heavy shade	Associated with a wide variety of forbs and grasses in open moist habitats such as grassland meadows and streamside edges. Associated plants include Fremont cottonwood, seep willow and various grasses and forbs	Provides temporary cover and moist microsites for insects and small mammals
	X					X		*Polansia dodecandra*	Western Clammyweed		X	X	Annual forb	Moderate	Annual forb; 1000-6500'; occurs in wash channels and other sandy areas subject to frequent disturbance; to 30" tall	Clusters of white to pinkish flowers borne on tall stalks from May-Oct; strongly scented leaves and stems	Often associated with desert strand species including datura, slimpod senna, windmills, and burrobrush.	Flowers: provide nectar: eaten by bees and butterflies
	X		X					*Salvia columbariae var. columbariage*	Chia		X	X	Annual forb	Low	Annual forb; to 3000'; occurs in open, exposed areas along sandy washes, dry slopes, woodland hillsides and gravelly disturbed sites such as roadsides; to 60" high if sufficient moisture is present	Whorls of tubular blue flowers on tall stems appear from March - May; seeds follow flowers in summer; requires full sun; readily self-sowing	Occurs in open areas subject to frequent disturbance with other annuals including Mexican gold poppy, Gordon's bladderpod, *Cryptantha* spp., and annual grasses	Seeds: valuable high-protein food source for a wide variety of wildlife; Flowers: provide nectar: eaten by bees and butterflies
								GRASSES										
	X			X			X	*Aristida ternipes*	Spidergrass		X	X	Perennial grass	Low	Tufted perennial grass; 2,500 – 5,500'; occurs on rocky and sandy slopes and often along roadsides and other frequently disturbed areas; to 3' tall	Long drooping panicles lend a delicate feature to the landscape; flowers mostly Aug – Nov but sometimes in the spring	Associated with Sonoran desertscrub plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses	Leaves and seeds: browsed by large and small mammals; Provides nesting materials for birds and small mammals
	X	X					X	*Bothriochloa barbinodis (Andropogon barbinoides)*	Cane beardgrass			X	Perennial bunchgrass	Moderate	Tufted perennial; 1,000-6000'; occurs on rocky and sandy slopes and in floodplains, desert uplands, and disturbed roadside areas; to 5 feet tall	Spikelet with dense long hairs blooms Apr-Oct; attractive "fluffy" appearance; extremely drought-resistant	Associated plants include velvet mesquite, paloverde, creosotebush, triangle bursage, cacti, and a wide variety of forbs and other grasses	Leaves: considered good forage for grazing mammals when green; Seeds: eaten by mammals and birds; Serves as nesting materials and cover for birds and small mammals

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Watershed								Botanical Name	Common name	Important Riparian Habitat Areas			Life Form	Water Requirements	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon			Hydroriparian	Mesoriparian	Xeroriparian						
X	X		X	X	X			*Bouteloua aristidoides*	Needle grama		X	X	Annual tufted grass	Low	Low, tufted, annual grass; to 6000'; occurs on dry mesas, and in and along washes and disturbed areas; to 6 inches tall	One-sided raceme of flowers appearing in spring, summer, or fall, depending upon rainfall; useful as a quick soil stabilizer following disturbance	Associated with Sonoran desertscrub and xeroriparian plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses	Leaves and seeds: utilized by birds and small mammals
X	X	X			X			*Bouteloua curtipendula*	Sideoats grama			X	Perennial tufted grass	Low	Tufted perennial grass; to 7,000', occurs on rocky slopes, grasslands, and in woodlands and forest openings; 1-2' tall	Raceme of hanging spikelets bloom from summer to early fall	Associated plants include oak, juniper, velvet mesquite, fairy duster, creosotebush, triangle bursage, cacti, and a variety of forbs and other grasses	Seeds: eaten by birds and small mammals; Leaves: considered excellent forage for grazing mammals when green
	X	X			X			*Bouteloua rothrockii*	Rothrock grama			X	Perennial tufted grass	Low	Short-lived perennial grass; 2,300-5,500'; occurs in scattered clumps on dry rocky hillsides and sandy mesas; 10-36"tall	One-sided raceme of flowers arranged on curving spikelets bloom in warm season; very hardy and drought-resistant	Associated with Sonoran desertscrub and xeroriparian plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses.	Leaves: considered valuable forage for grazing mammals due to drought resistance, though not as good as other grama species; Seeds: eaten by birds and small mammals; Provides cover and nesting materials for birds and small mammals
X	X	X	X	X	X	X	X	*Dasyochloa pulchella (Erioneuronpulchellum, Tridens pulchellus)*	Fluffgrass, low woolly grass			X	Perennial Grass	Low	Low densely-tufted perennial grass; under 5500'; occurs on dry, rocky slopes and desert flats; in scattered clumps less than 6" tall	Short spikelets bloom spring, summer and fall; abundant in overgrazed lands	Associated with Sonoran desertscrub plant communities; often with paloverde, velvet mesquite, cacti, desert zinnia, and various forbs and other grasses.	Seeds: eaten by mammals and birds; Leaves: not utilized by large grazers but utilized by small mammals and desert tortoise; Serves as nesting materials for birds and small mammals
X						X		*Distichlis stricta*	Desert saltgrass	X	X	X	Perennial turfgrass	Moderate	Low-growing perennial; up to 7000'; occurs on alkaline and saline soil; 8-15" tall	Warm season flowers in dense spikes; spreads by stolons and forms dense turfgrass that is a good native alternative to the invasive Bermudagrass	Occurs near riparian areas and at the edges of mesquite bosques; associated with other saline-tolerant plants including yerba mansa and alkali sacaton	Leaves and seeds: browsed by large and small mammals but considered poor forage for cattle; Provides nesting materials for birds and small mammals
X			X	X	X	X	X	*Hilaria belangeri var. belangeri (Anthephora belangeri)*	Curly-mesquite			X	Perennial tufted grass	Moderate	Tufted perennial to about 12"; occurs on rocky slopes, dry hillsides, and sandy plains from 1,500-6,000 feet.	Flowers mostly from August to November. Most palatable of the *Hilarias* for forage.	Associated with gramas (*Bouteloua* spp.), three-awn (*Aristida* spp.), tanglehead, bush muhly, and other grasses.	Leaves: considered excellent forage for livestock and deer. Provides nesting materials for birds and small mammals;
						X	X	*Leptochloa dubia*	Green sprangletop		X	X	Annual grass	Moderate	Tufted perennial; 2500'-6000'; coarse soils from bottomlands to uplands and hills, most common in higher elevations; 2-3' tall	Large drooping flower spikes in spring and summer; bluish green leaves	Associated with Sonoran desertscrub and grassland plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses	Leaves and seeds: valuable forage for by large and small mammals; Provides nesting materials for birds and small mammals; Sometimes harvested as hay
	X	X		X				*Muhlenbergia porteri*	Bush muhly		X	X	Perennial tufted grass	Moderate	Tufted perennial grass; 2000-6000'; occurs on dry mesas and rocky slopes;; 2'– 4' tall and 3' wide	Flowers in numerous delicate panicles blooming Aug–Oct; shade-tolerant	Associated plants include velvet mesquite, paloverde, creosotebush, triangle bursage, cacti, and a variety of forbs and other grasses; often seen growing under the protection of shrubs	Leaves: excellent forage for livestock, deer and pronghorn; Seeds: eaten by mammals and birds; Serves as nesting materials and cover for birds and small mammals
	X	X	X	X		X	X	*Muhlenbergia rigens*	Deergrass		X	X	Perennial bunchgrass	Moderate	Perennial bunchgrass; 2000-7500', occurs on woodland slopes, and in canyons and along water courses; 2-5' tall	Tall, dense, compressed spikelets bloom in the warm season; attractive drooping leaves provide a good alternative to the invasive fountaingrass	Associated plant include Fremont cottonwood, velvet mesquite, oak, velvet ash, and a wide variety of shrubs, forbs and other grasses	Leaves: considered good forage for grazing mammals when green, but poor when dry; Seeds: eaten by mammals and birds; Serves as nesting materials and cover for birds and small mammals

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San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon			Hydroriparian	Mesoriparian	Xeroriparian						
	X		X					*Panicum obtusum*	Vine mesquite	X	X		Perennial tufted grass	Moderate	Perennial bunchgrass; 1000'-6000'; occurs along streams, roadsides, and moist lowlands; to 30" tall	Flowers May - Oct; bluish-green leaves; spreads by stolons forming dense stands that are useful in erosion control	Occurs in hydro- and mesoriparian plant communities; frequent associates include Fremont cottonwood, Goodding's willow, velvet ash, netleaf hackberry, and seep willow	Seeds: eaten by a wide variety of wildlife including birds; Leaves: considered good forage for grazing mammals when green; Provides nesting materials for birds and small mammals
X	X	X						*Setaria macrostachya*	Plains bristlegrass, large-spike bristlegrass	X	X	X	Perennial bunchgrass	Moderate	Tufted perennial grass; 2000 – 7000'; occurs on slopes and along washes, often at the edge of tree canopies or disturbed roadsides; 1 - 4' tall	Dense spike-like panicle of flowers with stiff hairs blooms May–Oct; provides a good alternative to the invasive fountaingrass	Associated plants velvet mesquite, paloverde, giant sacaton, graythorn, and a variety of forbs and other grasses	Leaves: considered relatively poor forage for grazing mammals; Seeds and foliage: eaten by birds and small mammals; Provides cover and nesting materials for small mammals
	X	X				X		*Sporobolus airoides*	Alkali sacaton	X	X	X	Perennial bunchgrass	Moderate	Dense, tall perennial bunchgrass; 2500' – 6500'; occurs in and along sandy valleys and washes, and riparian bottomlands; 2 - 4' tall	Large spreading panicle of flowers bloom May - Oct; tolerant of alkaline and saline soils	Associated with other riparian and saline-tolerant plants including Fremont cottonwood, velvet mesquite, desert saltgrass, and yerba mansa	Leaves: though tough are considered valuable browse, especially where alternatives are lacking; Seeds: eaten by mammals and birds; Provides cover in otherwise open landscapes
	X	X	X					*Sporobolus cryptandrus*	Sand dropseed, spike dropseed		X	X	Perennial bunchgrass	Moderate	Perennial bunchgrass; 150-7000', occurs on upland slopes and within floodplains with sandy soil; to 3' tall	Slender, erect panicle of flowers bloom July – October; highly adaptable to a wide range of environmental conditions and thus valuable for erosion control	Associated plants include velvet mesquite, four-winged saltbush, giant sacaton, alkali sacaton, and desert saltgrass	Seeds: eaten by numerous birds including wild turkey, and small mammals; Leaves: considered good forage for grazing mammals when green
X								*Sporobolus wrightii*	Giant sacaton, big sacaton	X	X		Perennial bunchgrass	Moderate	Perennial bunchgrass; 2000'–5000'; occurs in riparian floodplains and along slopes and sandy washes; 3 – 6.5' tall	Large spreading panicle of tiny flowers bloom May - October	Associated with other riparian plants including Fremont cottonwood, Goodding's willow, velvet mesquite, graythorn, buttonbush, and deergrass	Leaves: considered good forage for grazing mammals when green; Seeds: eaten by mammals and birds; Provides nesting materials and cover for birds and small mammals
			X	X				*Vulpia octoflora (Festuca octoflora)*	Sixweeks fescue		X	X	Annual grass	Low	Short-lived annual grass; up to 5,500'; widespread on rocky slopes; generally to 12", occasionally to 20" tall	Lush spring growth after summer rains; useful as a quick soil stabilizer following disturbance	Associated with Sonoran desertscrub and xeroriparian plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses including desert strand species	Leaves and seeds: browsed by large and small mammals

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
								TREES					
	X	X		X	X			*Acacia constricta* (Whitethorn acacia)		X	X	Perennial shrub/small tree	Low-Moderate
X	X	X	X	X	X	X	X	*Acacia greggii* (Catclaw acacia)		X	X	Perennial Tree	Low
X	X	X				X		*Celtis laevigata (Celtis reticulata)* (Netleaf/Canyon hackberry)	X	X		Perennial Tree	Moderate
X	X	X					X	*Chilopsis linearis* (Desert willow)		X	X	Perennial shrub/small tree	Low-Moderate
X	X		X				X	*Fraxinus velutina* (Arizona ash, Velvet ash)	X	X		Perennial Tree	Moderate-High
	X					X		*Juglans major* (Arizona Black Walnut)	X	X		Perennial Tree	High

Draft

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
TREES				
Acacia constricta (Whitethorn acacia)	Perennial; 2500'-5000', occurs in a variety of settings including washes, slopes, shallow caliche-lined soils and grasslands; to 15' tall	Deciduous; very small yellow-orange flowers in spherical clusters present May-September, followed by seedpods; pairs of whitish spines on branches; nitrogen-fixer	Midstory shrubby tree occurring in a variety of situations; often associated with velvet mesquite, desert hackberry, wolfberry, and various cacti	Nectar: eaten by insects and nectar-eating birds including verdin; Seeds: eaten by a wide variety of birds and other wildlife; Foliage: eaten by deer and jackrabbits; host plant for larval butterflies; Provides cover and nest sites for birds
Acacia greggii (Catclaw acacia)	Long-lived perennial; below 5000', occurs within and along slopes, canyons, riparian bottomlands, and desert washes; shrub or small tree to 20' tall	Small yellow flowers on cylindrical spikes bloom April–October; seedpods produced in summer to fall; semi-deciduous in winter and extreme drought; has small but sharp "cat-claw-like" thorns; nitrogen-fixer	Under- to mid-story shrub on slopes, along washes; occasionally a tree where moisture plentiful; associated with common xeroriparian species such as velvet mesquite, desert hackberry, and graythorn.	Seeds: eaten by birds and other wildlife; Nectar: attracts butterflies and other insects including ants, which in turn attract horned lizards; Shelter for a wide variety of wildlife
Celtis laevigata (Celtis reticulata) (Netleaf/Canyon hackberry)	Long-lived perennial; 1500'-6000'; occurs in moist riverbeds, and along intermittent streams, and canyons; to 35' tall	Deciduous; very small greenish flower blooms March-April; small reddish fruits available June to November	Midstory to overstory tree associated with Mexican elderberry, velvet ash, Fremont cottonwood, velvet mesquite, western soapberry, and Arizona walnut	Berries: eaten by a wild variety of wildlife; Provides cover and nest sites for birds including raptors
Chilopsis linearis (Desert willow)	Perennial, moderate lifespan; 1500' – 5000', occurs in desert flats, and along washes and streams; to 25'	Deciduous; showy lavender pea-shaped blooms Apr–Aug/Sep	Midstory to overstory tree in variety of upland and riparian situations; commonly associated with desert wash communities including velvet mesquite, Mexican elderberry, and desert hackberry.	Nectar: consumed by hummingbirds, insects including bees (bumble bees, carpenter bees, and others), and nectar-eating birds; Insects attracted by nectar provide food for insect-eating birds; Leaves: host plant for larvae of pollinating moths; Shelter and nesting for birds and other wildlife
Fraxinus velutina (Arizona ash, Velvet ash)	Perennial; 2000'– 7000'; within and along streams, moist canyons and washes; to 30' tall	Deciduous; Blooms March-April; very small yellow flowers appear before leaves	Overstory tree in riparian bottomlands; associated with Arizona walnut, netleaf hackberry, and Mexican elderberry.	Seeds: eaten by a wide variety of wildlife
Juglans major (Arizona Black Walnut)	Long-lived perennial; 3000'-7000'; occurs in streams and moist canyons from desert to oak or pine forestlands; to 50' tall	Deciduous; small greenish blooms before or during spring or summer leaf growth; produces large edible nut	Mid-or overstory tree in moist areas; associated with velvet ash, Mexican elderberry, Acacia spp.; understory often canyon hackberry	Nuts: eaten by a wide variety of wildlife; Provides shelter including nesting cavities for birds and other wildlife

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	**Santa Cruz River**	**Western Pima County**	**Pantano/Rillito/Lower Canyon del Oro Wash**	**Black/Brawley Wash**	**Upper Canyon del Oro Wash**	**Tanque Verde/Agua Caliente/Rincon Creek**	**Sabino Canyon**		**Hydroriparian**	**Mesoriparian**	**Xeroriparian**		
		X			X			*Olneya tesota* (Desert Ironwood)			X	Perennial Tree	Low
X	X	X	X	X			X	*Parkinsonia florida (Cercidium floridum)* (Blue paloverde)		X	X	Perennial Tree	Low-Moderate
	X	X			X		X	*Parkinsonia microphylla* (*Cercidium microphyllum)* (Foothills Palo Verde, yellow palo verde)			X	Perennial Tree	Low
	X				X	X	X	*Platanus wrightii* (Arizona sycamore)	X	X		Perennial Tree	Moderate
X		X					X	*Populus fremontii ssp. fremontii* (Fremont cottonwood)	X	X		Perennial Tree	High
		X	X	X				*Prosopis pubescens* (Screwbean mesquite)		X	X	Perennial Tree	Moderate

Draft

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Olneya tesota (Desert Ironwood)	Long-lived perennial; below 2500', occurs on foothills and desert slopes where cold air doesn't settle; 26'to 30' tall	Purple, pink or white pea-like flowers bloom May–June; seedpods produced June-July; pairs of spines emerge from stems at base of leaves; nitrogen-fixer	Mid-sized desert tree; associated with saguaro, desert hackberry, wolfberry, graythorn, and desert lavender	Seeds: eaten by numerous wildlife species; Flowers: provide food for nectar-eating birds; Leaves and twigs: valuable browse for bighorn sheep and mule deer; Retains leaves during summer drought and provides important breeding and year-round thermal shelter; Considered a keystone species due to the abundance of wildlife that rely on this tree
Parkinsonia florida (Cercidium floridum) (Blue paloverde)	Perennial, moderate age; 500'–4000', occurs in washes, valleys, and floodplains, grasslands; to 30' tall	Bright yellow flowers bloom April–May; seedpods appear May-June; winter and drought deciduous; some spines on branches and stems; needs higher moisture levels than foothills paloverde; nitrogen-fixer	Mid to overstory associate within a wide variety of habitats including desert, grassland and xeroriparian understory; often associated with velvet mesquite and desert hackberry	Seeds: eaten by a variety of wildlife; Nectar: used by bees and other insects and nectar-eating birds; Fallen flowers: eaten by desert tortoise and other wildlife species; Branches: provide nesting sites for numerous bird species and nighttime roosts for many wildlife species; Host plant for mistletoe which is a key food source for phainopepla;
Parkinsonia microphylla (Cercidium microphyllum) (Foothills Palo Verde, yellow palo verde)	Long-lived perennial; 500-4000'; occurs throughout Sonoran desertscrub habitats and along washes and streams; slow to medium growth rate, depending on water availability; shrub or tree to 26' tall	Large yellow flowers bloom Mar-May; seedpods mature June-July; tolerates drier conditions than blue paloverde; nitrogen-fixer	Mid to overstory associate within a wide variety of habitats including desert, grassland and xeroriparian understory; often associated with saguaro and other cacti, creosotebush, desert ironwood, and mesquite.	Seeds: eaten by birds and mammals; Flowers: provide pollen and nectar for insects including solitary bees, and also eaten by wildlife; Branches: used for nesting and roosting sites; Host for mistletoe providing food for phainopepla.and other birds
Platanus wrightii (Arizona sycamore)	Perennial; 2000'-6000', occurs within and along streams and rocky canyons; to 80' tall	Deciduous; inconspicuous flowers bloom March-April; flowers followed by cylindrical fruits	Overstory tree in canyons near streams; associated with Arizona walnut, Fremont cottonwood, and Goodding's willow	Seeds: eaten by wildlife; Leaves, stems, wood: utilized by beaver;Provides habitat for wildlife including sites for cavity-nesting birds
Populus fremontii ssp. fremontii (Fremont cottonwood)	Long-lived perennial; 150' – 6000'; occurs along streams, rivers, and cienegas with surface water or near-surface groundwater; to 100' tall	Deciduous; very small, green-yellow flowers bloom early spring (often late February in Tucson area)	Overstory tree in moist areas along streams and rivers, or elsewhere where water table is near surface; associated with Arizona sycamore, Arizona ash, Goodding's willow, sacaton, grasslands, and canyon grape	Twigs and foliage: eaten by deer, beaver, and other mammals; Buds and catkins: eaten by birds; Insects attracted by fragrant buds provide additional forage for wildlife; Large size: offers abundant sheltering, resting, nesting and foraging habitat for numerous wildlife species
Prosopis pubescens (Screwbean mesquite)	Perennial, moderate lifespan; below 4000', occurs in floodplains and bottomlands; to 15'–20' tall	Deciduous; small, yellow flowers in clusters bloom May-August; seedpods in summer to fall; branches have spines; nitrogen-fixer	Medium-sized tree; fixes nitrogen in soil; associates with velvet mesquite, wolfberry, graythorn, and four-winged saltbush	Seeds and pods: eaten by a wide variety of wildlife; Host plant for mistletoe, which is an important food source for phainopepla and other birds;

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
X	X	X	X	X	X	X		*Prosopis velutina* (Velvet mequite)		X	X	Perennial tree	Low
	X							*Quercus emoryi* (Emory oak)		X			X
X	X	X					X	*Salix gooddingii* (Goodding's willow)	X	X		Perennial Tree	High
	X					X		*Sambucus nigra ssp.cerulea (Sambucus mexicana)* (Mexican elderberry, blue elderberry)		X		Perennial shrub/small tree	Moderate
	X					X		*Sapindus saponaria var. drummondii* (Western soapberry)		X	X	Perennial Tree	Low
								SHRUBS					
		X					X	*Ambrosia deltoidea* (Triangle-leaf bursage)			X	Perennial shrub or subshrub	Low
	X	X			X	X	X	*Anisacanthus thurberi (Drejera thurberi)* (Desert honeysuckle)		X		Perennial Shrub	Moderate

Draft

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Prosopis velutina (Velvet mequite)	Long-lived perennial; 1000'-5000'; occurs in riparian floodplains; along washes, on scrubland slopes, and scattered in grasslands; generally to 30' tall, but larger in old-growth bosques in bottomlands	Deciduous; clusters of yellow flowers bloom April-May, and again in August; seedpods are produced June-September; nitrogen-fixer	Mid- to over-story tree associated with wide variety of desert and riparian plants including saltbush, wolfberry, desert hackberry, graythorn, desert lavender, and a wide variety of grasses and forbs	Seeds, pods, bark, twigs and leaves: eaten by a wide variety of wildlife including birds, bighorn sheep, deer, antelope, coyote, and rodents; Flowers: attract 60 species of native bees, plus wasps and butterflies; Nectar and larval plant for butterflies; Nesting sites: utilized by white winged doves, mourning doves, and many other birds; Host plant for mistletoe, which is an important food source for phainopepla and other birds; Insects on plant gleaned by birds
Quercus emoryi (Emory oak)	Perennial; 4,000 – 7,000', occurs on dry slopes, and along moist canyons in grasslands; shrub or small tree to 50'	Evergreen; small inconspicuous flowers appear in spring; acorns produced in summer	Midstory to overstory tree in variety of mid- to high-elevation settings; often along drainages in grassland settings.	Leaves and stems: browse for deer; Acorns: eaten by a variety of wildlife; Perennial cover valued by a wide variety of wildlife
Salix gooddingii (Goodding's willow)	Perennial; below 7000', occurs along streams, rivers, and moist bottomlands with surface water or near-surface groundwater; to 45' tall	Deciduous; tiny flowers in bunches bloom in spring and then release seeds that float in cottony fluff	Mid to overstory tree, often draping branches to the ground, associated with Fremont cottonwood, velvet ash, and canyon grape	Twigs and foliage: eaten by deer, beaver, and other mammals; Buds and catkins: eaten by birds, sites for insect gleaning birds; Dense cover: provides thermal shelter and cover from predators, and sheltered nest sites
Sambucus nigra ssp.cerulea (Sambucus mexicana) (Mexican elderberry, blue elderberry)	Perennial; 1000' – 4000', occurs along streams, rivers, and bottomlands, and scattered across moist grasslands; shrub to small tree to 30' tall	Drought deciduous; yellow-white cluster of small blooms appears March-June; small, abundant berries May-October	Mid-sized tree, occasionally large, associated with Goodding's willow, velvet mesquite, netleaf hackberry, graythorn, climbing milkweed, and old man's beard	Berries: eaten by a wide variety of wildlife; Foliage: eaten by deer, livestock, and other mammals
Sapindus saponaria var. drummondii (Western soapberry)	Perennial; 2,400' – 6,000'; occurs in canyons, streams, desert grasslands, and oak woodlands; 20' to 50' tall	Deciduous; small white flower appears May – August, followed by yellowish berries	Multi-trunked tree occurring in riparian communities; common codominants include Arizona black walnut and velvet ash	Leaves and twigs: generally not palatable for wildlife due to the presence of poisonous saponids; Nectar: eaten by butterflies Clonal growth provides dense cover for a numerous wildlife species
SHRUBS				
Ambrosia deltoidea (Triangle-leaf bursage)	Perennial, ,1000-3000', low-growing, less than 2' tall. Often in nearly pure stands on bajadas, plains, and mesas	Evergreen; inconspicuous pale yello-green flowers, fruit a small bur. Flowers February to July	Low-growing subshrub prefers coarse, rapidly draining soils. Often associated with foothill palo verde and saguaro	Flowers probably provide nectar and pollen for insects. Plant provides cover for small vertebrates.
Anisacanthus thurberi (Drejera thurberi) (Desert honeysuckle)	Perennial; 2500-5500', colonizes sandy washes, canyons, and riparian bottomlands; upright shrub to 6' tall	Showy red to orange flowers appear mostly in spring, but during other times when adequate moisture is present	Understory shrub, sometimes forming large clumps; often found alongside desert washes with velvet mesquite, ironwood, paloverde, chuperosa, and desert willow	Nectar and pollen: eaten by hummingbirds and solitary bees; Leaves and twigs: browsed by bighorn sheep, cattle, and other mammals; Host plant for several butterfly species

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
	X				X			*Asclepias tuberosa* (Butterfly milkweed)		X		Perennial subshrub	Moderate
	X	X		X				*Atriplex canescens* (Four-winged saltbush)			X	Perennial shrub	Low
		X		X				*Atriplex lentiformis* (Quailbush)			X	Perennial Shrub	Low
X	X		X	X	X	X	X	*Baccharis salicifolia* (Seep willow)	X	X		Perennial Shrub	Moderate-High
X								*Barkleyanthus salicifolius (Senecio salignus)* (Senecio, willow ragwort)		X		Perennial Shrub	Moderatae
	X	X	X			X	X	*Calliandra eriophylla* (Fairy duster)			X	Perennial Shrub	Low
X	X	X	X	X	X	X		*Celtis ehrenbergiana (Celtis pallida)* (Desert hackberry, spiny hackberry)	X	X		Perennial shrub	Low
X					X	X	X	*Cephalanthus occidentalis* (Buttonbush, Common buttonbush)	X			Perennial shrub	High

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Asclepias tuberosa (Butterfly milkweed)	Perennial; 4,000 – 8,000', dry grasslands, meadows; Bushy to 3' high	Low to mid-sized herb with bright orange or yellow flower blooming May – September	Low to mid-sized meadow herb	
Atriplex canescens (Four-winged saltbush)	Perennial; 2000'-8000'; occurs in valleys and along washes, and in sandy soil from creosote valleys to pinyon flats; shrub to 8' tall	Evergreen; inconspicuous pale flowers bloom July - August; prominent winged seeds present April-September; alkaline tolerant	Mid-sized to large shrub; associated with variety of low to mid-elevation plant communities including triange bursage, burrobrush and grasses and forsbs	Seeds: eaten by birds and small mammals; Insects attracted to flowers are gleaned by birds; Leaves and twigs: valuable forage for mammals including deer; Plant provides good cover and nesting sites
Atriplex lentiformis (Quailbush)	Perennial; below 4000'; inhabits a range of dry to moist soils in desert flats, floodplains and drainages; dense shrub, to 8' tall and 12' wide	Semi-deciduous; small green flower blooms February-April; alkaline tolerant	Mid- to large-sized shrub in open areas or under- to mid-story in other areas; frequent associates include velvet mesquite, four-winged saltbush, and saltgrass	Seeds: eaten by quail and other birds; Flowers: provide pollen and nectar for bees; Twigs and foliage: browsed by deer, pronghorn and bighorn sheep; Cover plant for wildlife including quail
Baccharis salicifolia (Seep willow)	Perennial; 2000'-5500; occurs along streams and moist washes, and in riparian bottomlands; tall shrub or small tree to 12' tall	White flowers on ends of branches bloom March-Dec; seeds in summer to fall	Associated with, and contributes to growth of, willows and Fremont cottonwoods	Nectar: eaten by butterflies, wasps and beneficial bees
Barkleyanthus salicifolius (Senecio salignus) (Senecio, willow ragwort)	Perennial; 2000-4000'; occurs along moist washes and streams, and disturbed areas; shrub to 3' tall	Bright yellow flowers in dense clusters from February-April; frost-sensitive	Occurs in desertscrub and grassland habitats; common associates include cacti and a wide variety of grasses and forbs	Flowers: provide pollen and nectar for butterflies and other insects; Foliage: browsed by deer and other mammals
Calliandra eriophylla (Fairy duster)	Perennial; below 5000'; occurs on hillsides, desert flats, washes, and grasslands; shrub to 4' tall	Semi-deciduous; puffy, pink flower clusters appear any time of year, but mostly October-May	Small to medium sized cold-hardy shrub; associated with bricklebush, Trixis, limberbush, and a wide variety of grasses and forbs	Foliage: browse for mammals; Flowers: provide nectar eaten by butterflies, hummingbirds, and bees; Seeds: eaten by birds and other wildlife; Provides dense cover often lacking in the lower strata
Celtis ehrenbergiana (Celtis pallida) (Desert hackberry, spiny hackberry)	Long-lived perennial; 1500 – 3500'; occurs in uplands along washes and canyons, and in open desert and riparian bottomlands; shrub 10'-20' tall	Deciduous or semi-evergreen shrub; flowers are small and whitish, appearing in summer; bright orange berries present from June-October; dense and thorny	Large shrub in open desert or midstory in riparian bottomlands; associated with velvet mesquite, graythorn, wolfberry, catclaw acacia, and prickly pear and other cactus	Berries: valuable forage for a wide variety of wildlife; Foliage: browsed by deer, attracts insects, which are eaten by birds; Provides dense cover and nesting habitat for birds and small mammals
Cephalanthus occidentalis (Buttonbush, Common buttonbush)	Long-lived perennial, 1,000-5000'; inhabits wet soils adjacent to streams and open waters; shrub or small tree to 10'.	Deciduous shrub with warts on stems; flowers are white balls to 1.5 inches in diameter that appear between June and September; fruit a rough button to 3/4" in diameter;	Mid-story shrub, usually in saturated soils adjacent to streams or other water bodies. Associated with three-leafed sumac and silktassel.	Waterfowl are the principle users of the seeds and the plants are browsed by deer. Insects come to the blooms for nectar.

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
	X					X	X	*Condalia warnockii* (Warnock condalia, Warnock's snakeweed)			X	Perennial shrub	Low
		X			X	X	X	*Dodonaea viscosa* (Hopbush)			X	Perennial Shrub	Moderate
X	X	X	X			X	X	*Encelia farinosa* (Brittlebush)			X	Perennial Shrub	Low
	X	X			X	X	X	*Ericameria laricifolia (Haplopappus laricifolius)* (Turpentine bush)			X	Perennial Shrub	Low
		X			X	X	X	*Eriogonum fasciculatum var. foliolosum/polifolium* (Flat-top buckwheat, Eastern Mohave buckwheat)			X	Perennial Shrub	Moderate
	X				X	X	X	*Garrya wrightii* (Wright's silktassel)		X		Perennial Shrub	Moderate
	X						X	*Gossypium thurberi (Thurberia thespesioides)* (Native cotton, Thurber's cotton)		X	X	Perennial shrub	Moderate
X	X		X	X	X	X	X	*Hymenoclea monogyra (Ambrosia monogyra)* (Burrobrush, single whorl burrobrush)			X	Perennial Shrub	Moderate
		X				X	X	*Hyptis emoryi* (Desert lavender)			X	Perennial Shrub	Low

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Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Condalia warnockii (Warnock condalia, Warnock's snakeweed)	Long-lived perennial, 2500-5000' occurs in uplands on bajdas and mesas and in canyons to 10' tall	Evergreen, tiny flowers in August to October, also spring. Fruits are red-blackish and up to 1/4 inch in diameter	Associated with mesquite and palo verde, graythorn and wolfberry	provides excellent cover for nesting birds such as Pyrrhuloxia
Dodonaea viscosa (Hopbush)	Perennial; 2000'- 5000', found along washes, canyons, rocky slopes; and floodplains; shrub to 12' tall	Evergreen; small yellowish flowers bloom February-October, followed by winged fruits	Mid- to large-sized deep green shrub scattered in open areas; often associated with ocotillo and jojoba	Seeds: eaten by some birds; Provides dense shelter for wildlife
Encelia farinosa (Brittlebush)	Perennial; occurs on hillsides, washes, roadsides and other flat areas below 3000'; Shrub to 3' tall	Silvery-gray leaves may drop in spring droughts; showy yellow flowers November-May in frost free areas	Sub-shrub with showy, yellow "daisy-like" flowers; often associated with creosotebush, paloverde, and various cacti and grasses	Flowers: pollinated by nectar-eating butterflies, moths, and small bees; Seeds: eaten by birds, rodents, and other wildlife; Leaves and twigs: eaten by bighorn sheep and other mammals
Ericameria laricifolia (Haplopappus laricifolius) (Turpentine bush)	Perennial; 3000'- 6000', occurs in canyons, and on rocky slopes and desert flats; to 3' tall	Small and numerous yellow to golden flowers bloom August-December	Small, deep green shrub found in open areas or understory in oak woodland; has strong-smelling foliage	Flowers: provide nectar and pollen for bees and other insects
Eriogonum fasciculatum var. foliolosum/polifolium (Flat-top buckwheat, Eastern Mohave buckwheat)	Perennial; 1000'-4500'; grows on hillsides and other scrub-dominated uplands; to 3' tall	Very small white to pink persistent flowers in clusters that dry to an orangish-white color	Sub-shrub often associated with odora and fairy duster	Seeds: eaten by birds and other wildlife; Flowers: produce nectar eaten by butterflies and bees; Foliage: browsed and gleaned by mammals and some birds
Garrya wrightii (Wright's silktassel)	Evergreen perennial, 3000'-8000', occurs as scattered individuals in many different plant communities; generally to 8' tall, rarely reaching 15'	Inconspicuous tasseled flower bloom March – August; prefers partial summer shade in Tucson area	Mid-sized to large cold-hardy shrub; generally an understory component of pinyon-juniper woodlands and interior chaparral dominated by evergreen oaks and birchleaf mountain-mahogany	Foliage: browsed by deer, and other mammals; Provides good thermal and visual cover
Gossypium thurberi (Thurberia thespesioides) (Native cotton, Thurber's cotton)	Perennial; 2500-5000'; occurs in canyons, wash bottoms, and on rocky slopes; shrub to 7' tall	White to pinkish flowers bloom May-September; seed capsule with fuzzy seeds with short cottony hairs	Occurs on rocky hillsides or in washes or canyons; frequent associates include desert honeysuckle, catclaw acacia, and burrobrush.	Leaves: host plant and larval food for the splendid royal moth
Hymenoclea monogyra (Ambrosia monogyra) (Burrobrush, single whorl burrobrush)	Perennial; 1000' – 4000'; occurs in valleys, flats, and strands with sandy soil; lanky shrub 3'- 6' tall	Small inconspicuous flowers appear in fall, followed by winged fruits	Understory to midstory shrub growing in sandy or disturbed soils; often associated with desert broom, seep willow, and other plants that are tolerant of frequent disturbance	Offers cover and nesting sites for wildlife in otherwise sparsely vegetated landscapes
Hyptis emoryi (Desert lavender)	Perennial; below 5000'; occurs within desert washes, on dry rocky slopes, and in canyons; medium shrub to 15' tall	Violet to blue flowers in clusters that may bloom any time of the year; very drought tolerant	Attractive medium to large shrub; often a component of creosotebush scrub communities	Flowers: important to bees, butterflies, and hummingbirds; Seeds: eaten by variety of wildlife

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	**Santa Cruz River**	**Western Pima County**	**Pantano/Rillito/Lower Canyon del Oro Wash**	**Black/Brawley Wash**	**Upper Canyon del Oro Wash**	**Tanque Verde/Agua Caliente/Rincon Creek**	**Sabino Canyon**		**Hydroriparian**	**Mesoriparian**	**Xeroriparian**		
						X	X	*Justicia candicans* (Red justica, Arizona water-willow)		X	X	Perennial Shrub	Moderate
X	X	X	X	X		X	X	*Larrea tridentata var. tridentata* (Creosote bush)			X	Perennial Shrub	Low
	X	X		X		X		*Lycium andersonii var. andersonii* (Anderson's Wolfberry), water jacket		X	X	Perennial shrub	Low
X		X						*Lycium fremontii* (Fremont Wolfberry, Fremont's desert-thorn)		X	X	Perennial shrub	Low
		X						*Mahonia haematocarpa (Berberis haematocarpa)* (Red mahonia, red barberry)		X		Perennial Shrub	Low-Moderate
X			X					*Parthenium incanum* (Mariola)			X	Perennial Shrub	Low
	X				X	X	X	*Rhus glabra* (Smooth sumac)		X		Perennial Shrub	Moderate
			X					*Rhus microphylla* (Littleleaf sumac)		X	X	Perennial sub-shrub	Moderate

Draft

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Justicia candicans (Red justica, Arizona water-willow)	Perennial; 1500’- 3000’, occurs within and along washes or slopes; to 3’ tall	Drought deciduous; attractive red, sometimes yellow, flowers bloom spring and fall	Semi-frost hardy small shrub; associated white-thorn acacia and a wide variety of grasses and forbs	Flowers: hummingbirds use nectar Foliage: browsed by javelina
Larrea tridentata var. tridentata (Creosote bush)	Long-lived perennial; below 4500'; inhabits dry plains and desert valleys; shrub to 10' tall	Small yellow flowers bloom Mar-April and November–December, followed by small, fuzzy white fruit	Medium to large shrub; associated species include saguaro, night-blooming cereus, paperflower, desert zinnia, and Christmas cholla; sometimes dominates extensive areas on bajadas and valley floors	Flowers: extremely important for native insects (22 species of native bees feed only on its flowers and it supports 17 species of gall forming insects); Seeds: eaten by a variety of birds and other wildlife; Provides valuable shelter in harsh landscapes
Lycium andersonii var. andersonii (Anderson's Wolfberry), water jacket	Perennial; below 5500’; occurs in desert flats and along desert washes; 3 – 6’ tall	Drought deciduous; lavender flowers bloom February-April; fruits present late spring to summer	Alone or as understory in some areas; frequently associated with graythorn, velvet mesquite, catclaw acacia, and desert hackberry	Fruits: eaten by birds and other wildlife
Lycium fremontii (Fremont Wolfberry, Fremont's desert-thorn)	Perennial; below 2500', occurs in desert valleys, and within and along washes, slopes, riparian bottomlands; shrub to 9' tall	Drought deciduous; small, lavender flowers blooms year round, but primarily Jan-Mar; can produce fruit year-round	Open areas or as understory shrub in mesoriparian to xeroriparian areas; associated with saltbush, velvet mesquite, graythorn, desert hackberry, and canyon ragweed	Flowers: provides nectar and pollen for a wide variety of insects; Fruits: eaten by birds and other wildlife
Mahonia haematocarpa (Berberis haematocarpa) (Red mahonia, red barberry)	Perennial; 3000’- 5000’, occurs within desert grasslands and oak woodlands; shrub to 6’ tall	Cold-tolerant evergreen; yellow flowers in loose clusters bloom February-May, followed by red berries	Medium shrub in full sun or as understory in oak woodlands; associated with oak, *Ceanothus* , juniper, sugar bush, soap tree yucca, and canyon hackberry	Flowers: provide nectar and pollen for ;bees; Berries: eaten by birds and other wildlife; Foliage: browsed by deer, elk, bighorn, rabbits, and ringtail
Parthenium incanum (Mariola)	Perennial; 3000’- 6000’, occurs on dry slopes in the Sonoran desertscrub-Chihuhuan desertscrub transition zone; to 2’ tall	White flowers with small petals bloom April-October	Small aromatic shrub occurring on well-drained rocky hillsides; often occurring with creosotebush, desert zinnia, snakeweed, brittlebush, and a variety of cacti; very drought-tolerant.	Provides cover for small mammals and birds
Rhus glabra (Smooth sumac)	Perennial; 5000’- 7000’, flats and forests with rich soil; to 20’ tall	Small white flowers in attractive terminal clusters bloom June-August, followed by clusters of red berries	Large shrub standing alone or in forest settings; requires good soil	Foliage: browsed by deer
Rhus microphylla (Littleleaf sumac)	Perennial; generally 3,000 - 6,500 feet; occurs on dry desert foothills, and in canyons and along washes and valleys; shrub to 15’ tall	Greenish-white flowers occur in dense compound spikes; hairy, red-orange fruit	Small to medium shrub in desert grasslands and scrublands; common associates include velvet mesquite, creosotebush, catclaw acacia, soaptree yucca, sideoats grama, and bush muhly	Fruit: eaten by birds and rodents; Leaves and twigs: browsed by deer and small mammals

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	**Santa Cruz River**	**Western Pima County**	**Pantano/Rillito/Lower Canyon del Oro Wash**	**Black/Brawley Wash**	**Upper Canyon del Oro Wash**	**Tanque Verde/Agua Caliente/Rincon Creek**	**Sabino Canyon**		**Hydroriparian**	**Mesoriparian**	**Xeroriparian**		
					X	X	X	*Rhus ovata* (Sugar bush, sugar sumac)		X		Perennial Shtub	Moderate
	X				X	X	X	*Rhus trilobata* (Three-leafed sumac, skunkbush sumac)		X		Perennial Shrub	Moderate
					X	X	X	*Ribes aureum var. aureum* (Wax currant, golden currant)	X			Perennial Shrub	Moderate-High
	X	X					X	*Simmondsia chinensis* (Jojoba)			X	Perennial shrub	Low
X					X	X	X	*Tecoma stans* (Yellow bells, yellow trumpetbush)			X	Perennial shrub	Low
	X	X	X		X	X	X	*Trixis californica* (Trixis, American threefold)			X	Perennial shrub	Low
	X	X						*Vauquelinia californica ssp. Californica/sonorensis* (Arizona rosewood)			X		
X	X	X	X		X	X		*Ziziphus obtusifolia var. canescens* (Graythorn, lotebush)			X	Perennial shrub	Low

Draft

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Rhus ovata (Sugar bush, sugar sumac)	Perennial shrub or small tree; 3000’- 5000’; occurs in desert canyons, mountain and on slopes with chaparral; to 15’ tall	Small cream-colored flowers appear February-March, followed by sticky, reddish fruit	Evergreen, cold-hardy, medium to large shrub stands alone or grows among chaparral or scrub-oak; associated with *Ceanothus* , canyon hackberry, catclaw acacia, velvet mesquite, and scrub oak woodland associations	Fruit: eaten by a wide variety of birds and other wildlife; Evergreen foliage provides year-round shelter
Rhus trilobata (Three-leafed sumac, skunkbush sumac)	Perennial; 2500’- 7500’, occurs in canyons, and on mountain slopes; to 10’ tall	Yellow flowers in dense clusters bloom March-June; red fruits mature in summer	Deciduous, attractive shrub often as understory component of pinyon pine or oak woodlands	Berries: eaten by small mammals and birds; Foliage: eaten by and small mammals; Bark: eaten by small mammals
Ribes aureum var. aureum (Wax currant, golden currant)	Perennial; 2600-8000’; occurs in mid- to high-elevation grasslands, and mixed deciduous and coniferous woodlands; to 10’tall	Deciduous; fragrant yellow flowers in spring and berries in summer; small to medium, lanky shrub	Occurs in grasslands, coniferous forests and woodlands, and riparian and mountain shrub communities	Berries: eaten by variety of wildlife; Foliage: browsed by large mammals
Simmondsia chinensis (Jojoba)	Perennial; 1000’-5000’; occurs on desertscrub habitats and along washes, slopes, and rocky hillsides; shrub to 7' tall	Evergreen; inconspicuous greenish flower, male and female flowers occur on separate plants and bloom variable from December-July; nuts appear from May- July	Small to medium shrub scattered across upland desert areas; often associated with velvet mequite, paloverde, hopbush, creosotebush, brittlebush and various cacti	Nuts: eaten by birds and a wide variety of mammals including javelina; Foliage: eaten by deer, bighorn sheep and other mammals
Tecoma stans (Yellow bells, yellow trumpetbush)	Perennial; 3,000-5,500'; occurs on rocky or gravelly slopes along desert washes; shrub with upright form to 12' tall.	Deciduous; elongated, serrated leaves. Bright yellow trumpet-shaped flowers May through October.	Medium shrub of rocky slopes associated with plants of the Sonoran and Chihuahaun deserts. Often occurs with foothill paloverde and saguaro on hillsides.	Browsed by bighorn sheep and probably mule deer. Carpenter bees pirate nectar from blossoms by cutting into the base of the flower.
Trixis californica (Trixis, American threefold)	Perennial up to 5000', probably long-lived up to 3' tall	Bright yellow flowers up to 3/4-inch in diameter	Rocky slopes in the Arizona Upland Subdivision of the Sonoran Desert	Browsed to some extent by cattle
Vauquelinia californica ssp. Californica/sonorensis (Arizona rosewood)	Perennial; 2500’ – 5000’, occurs on mid-elevation canyons and mountains, oak woodlands; shrub or small tree to 25’ tall	Slow-growing evergreen; small white flowers in clusters bloom May – June, followed by woody fruits that persist through winter	Shrub or small tree associated in canyons and on slopes with shrub live oak, (*Quercus turbinella*) and as scattered individuals in grama grasslands with scattered velvet mesquite.	Dense perennial foliage: provide valuable cover for wildlife
Ziziphus obtusifolia var. canescens (Graythorn, lotebush)	Perennial; 1000’-5000’; found scattered in desert uplands, and along washes, riparian bottomlands, and mesquite bosque; to 10’ tall	Deciduous; tiny whitish-green blooms appear May–September; fruits August to January	Mid-sized shrub; often associated with wolfberry, desert hackberry, catclaw acacia, desert honeysuckle, and velvet mesquite	Berries: eaten by birds, especially white-winged dove and Gambel's quail; Flowers: nectar and pollen eaten by honeybees, native bees, tarantula hawks, and other insects; Insects attracted to plant are gleaned by birds; Dense and thorny character provides valuable shelter and nesting sites

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
								VINES					
	X	X	X					*Clematis drummondii* (Old man's beard, Virgin's bower, Drummond's Clematis)		X	X	Perennial vine	Moderate
X	X	X	X	X	X	X	X	*Cucurbita digitata* (Fingerleaf gourd)			X	Perennial vine	Low-Moderate
		X	X	X				*Cucurbita palmata (Cucurbita californica)* (Coyote melon, Coyote gourd)			X	Perennial vine	Moderate
							X	*Ipomoea hederifolia (Ipomoea coccinea* var. *hederifolia)* (Scarlet creeper)	X	X	X	Annual vine	Moderate
X	X		X	X	X	X	X	*Maurandya antirrhiniflora* (Snapdragon vine, roving sailor)	X	X	X	Perennial vine	Moderate
X	X							*Vitis arizonica* Arizona wild grape, Canyon grape		X		Perennial vine	Moderate
								CACTI & SUCCULENTS					
	X	X	X					*Cylindropuntia arbuscula (Opuntia arbuscula)* (Arizona Pencil cholla)			X	Perennial cactus	Low

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
VINES				
Clematis drummondii (Old man's beard, Virgin's bower, Drummond's Clematis)	Perennial; below 4000'; occurs in moist open areas and along the edges of riparian woodlands; woody, climbing vine can reach heights of trellises or trees	White flowers bloom March-September, and later yield fluffy, white plumed seeds	Vine often seen climbing shrubs and trees in riparian bottomlands or thick vegetation where some moisture available; common associates include netleaf hackberry, velvet ash, and seep willow	Serves as a larval host plant for butterflies
Cucurbita digitata (Fingerleaf gourd)	Perennial vine; below 5000'; occurs from low desert valleys to mid-elevation grasslands	Deciduous; large yellow blooms June - October; gourds mature in fall	Associated with fourwing saltbush, and a wide variety of grasses and forbs	Vines, leaves, root and seeds: eaten by wildlife including javelina; Flowers: provide pollen for pollinators including bees
Cucurbita palmata (Cucurbita californica) (Coyote melon, Coyote gourd)	Annual ground-hugging vine with trailing stems from a large root; usually below 3,000' on sandy plains, mesas, or rocky slopes; often in arroyo bottoms.	Has incised palmate leaves and large funnel-shaped yellow-orange flowers that appear between May and August. Produces round white-striped gourds.	Ground-hugging vine; may be associated with datura, clumping grassses, small shrubs or cacti.	Flowers visited by bees. Plant stems are a reservoir for the squash vine borer, which is an economically important pest species of cucurbits.
Ipomoea hederifolia (Ipomoea coccinea var. *hederifolia)* (Scarlet creeper)	Perennial vine; 2500 - 6000'; occurs along desert washes, canyons and rivers; 2-10' long	Tubular red flowers from May-October;	Common associates include Fremont cottonwood, Goodding's willow, mesquite, and seep willow	Nectar: major food source for hummingbirds;
Maurandya antirrhiniflora (Snapdragon vine, roving sailor)	Perennial herbaceous climbing vine with dark green arrow-shaped leaves; often associated with rocky slopes or wash areas where it climbs over vegetation to 8' height. Occurs from 1,500 to 6,000'.	Reddish pink or lilac blooms with whitish throat with pink lines appear from April through October. Fruit is a dehiscent round capsule.	Common associates include wolfberry, hackberry, and burrowbrush.	Flowers probably provide nectar and pollen for insects.
Vitis arizonica Arizona wild grape, Canyon grape	Perennial vine; 2000' - 7500'; occurs in canyons and along washes and rivers, to 30' long	Deciduous; greenish flower in clusters from April-July; fruit present July-August	Associated with riparian plants such as netleaf hackberry, Fremont cottonwood, and velvet ash	Berries: eaten by a wide variety of wildlife; Vines and leaves: browsed by mammals including javelina and used by birds for nesting material; Flowers: provide nectar and pollen for bees
CACTI & SUCCULENTS				
Cylindropuntia arbuscula (Opuntia arbuscula) (Arizona Pencil cholla)	Perennial; 1000' – 4000'; occurs in open areas on rocky slopes and bajadas; to 9' tall	Blooms from May-June; fruit present in fall and may persist through winter	Associated with desertscrub vegetation including other cholla species, saguaro cactus, triangle bursage, mesquite, and paloverde	Fruits: eaten by deer, javelina, small mammals and birds; Seeds: eaten by birds including mourning dove and Gamble's quail; Flowers: provide nectar and pollen for bees; Provides sheltered sites for small mammal burrows

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
	X	X	X	X				*Cylindropuntia leptocaulis (Opuntia leptocaulis)* (Christmas cholla, desert Christmas cactus)			X	Perennial cactus	Low
X	X	X	X	X	X	X	X	*Ferocactus wislizeni (Echinocactus wislizeni)* (Candy barrel cactus)			X	Perennial Cactus	Low
	X	X			X	X	X	*Nolina microcarpa* (Beargrass, sacahuista)			X	Perennial Lily	Low
	X	X			X	X	X	*Opuntia phaeacantha* (Prickly Pear)			X	Perennial cactus	Low
	X				X			*Yucca elata* (Soaptree Yucca)			X	Perennial shrub	Low
								PERENNIAL FORBS/SUB-SHRUBS					
	X			X				*Allionia incarnata* (Trailing windmills, trailing four-o'clock)			X	Perennial forb	Low
X	X	X	X	X	X	X	X	*Ambrosia ambrosioides* (Triangle-leaf bursage)		X	X	Perennial Subshrub	Moderate
						X		*Anemopsis californica* (Yerba Mansa)	X	X		Perennial forb	High

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Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Cylindropuntia leptocaulis (Opuntia leptocaulis) (Christmas cholla, desert Christmas cactus)	Perennial; 1000' – 5000'; occurs in open areas on rocky slopes and bajadas; to 4' tall	Small yellowish-greenish blooms from May-June; bright red fruit present in fall and may persist through winter	Associated with desertscrub vegetation including other cholla species, saguaro cactus, triangle bursage, mesquite, and paloverde	Fruits and seeds: eaten by birds and mammals including deer and javelina; Nectar and pollen: eaten by bees and nectar-eating birds; Provides protective nest sites for cactus wren, curve billed thrasher, and other birds
Ferocactus wislizeni (Echinocactus wislizeni) (Candy barrel cactus)	Long-lived, to 11' tall, but mostly less than 6' tall. Up to 4500'	Flowers July-September, very persistent, waxy, yellow fruit	Mexquite and mixed palo verde-cactus, variable soils	Pollen and nectar utilized by a variety of insects
Nolina microcarpa (Beargrass, sacahuista)	Perennial; 3000-6000'; occurs in open areas on rocky slopes and bajadas; to 3' tall, flowering stalk to 8'	Evergreen; small creamy white flowers form showy plumes on stalks that bloom in May-June; coarse leaves are somewhat abrasive	Not a true grass but resembles a coarse bunchgrass; usually in the open rather than in understory; often found with Arizona rosewood, turpentine bush, ocotillo; sotol, manzanita, and oak	Plant: larval plant for Melinus hairstreak butterfly; Flowers: provide nectar and pollen for bees and butterflies; Foliage: sometimes browsed when other food scarce
Opuntia phaeacantha (Prickly Pear)	Perennial; to 6500'; occurs in desertscrub habitats on bajadas and alongside canyons and washes; generally to 3' tall	Large rose-like flowers appear April-June, with bright red fruits maturing July-August; some fruits persist through most of winter	Occurs in open desertscrub and grassland habitats; common associates include mesquite, paloverde, other cacti, creosotebush, triangle bursage, and fluffgrass.	Fruits: eaten by deer, javelina, small mammals and birds; Seeds: eaten by birds including mourning dove and Gamble's quail; Flowers: provide nectar and pollen for bees; Provides sheltered sites for small mammal burrows
Yucca elata (Soaptree Yucca)	Perennial; 1500' – 6000'; occurs in open areas on rocky slopes and bajada; to 15' tall	Evergreen; dense cluster of yellowish-white flowers on tall stalk bloom May –June; fruits mature in summer	Occurs in open desertscrub and grassland habitats; common associates include ocotillo; sotol, oak, and a wide variety of grasses and forbs	Flower stalks: browsed by mammals including mule deer and javelina; Seeds: eaten by birds and other wildlife; Larval plant for butterflies; Pollinated by symbiotic yucca moth
PERENNIAL FORBS/SUB-SHRUBS				
Allionia incarnata (Trailing windmills, trailing four-o'clock)	Perennial forb; to 6500'; occurs in open areas including sandy washes and valley bottoms; trailing plant to 6" high and 24 " wide	Vibrant rose-pink flowers present April-October	Often associated with desert strand species including clammyweed, datura, slimpod senna, and burrobrush. Also found along in disturbed roadside areas and in four- wing saltbush associations.	Provides temporary cover and moist microsites for insects and small mammals
Ambrosia ambrosioides (Triangle-leaf bursage)	Medium to large perennial shrub; occurs in washes and strand areas below 4,500'. Plants get to about 6' in height.	Indistinct yellowish-green flowers in a terminal spike appear between February and May. Fruit has a cocklebur form.	Found in association with mesquite, paloverde, burrobrush, datura, seepwillow, and brickellia.	There is little use this plant as forage; leaves are consumed by leaf beetles; wind pollinated, does not provide a nectar source for insects.
Anemopsis californica (Yerba Mansa)	Perennial forb; 2000-5000'; colonizes moist alkaline soils in meadows and alongside streams and cienegas; to 20" tall	Large white flowers borne on tall stalks present from May-Aug; highly aromatic leaves; plants spread by stolons and can form extensive groundcover	Often occurs in mesquite bosques; associated with other saline-tolerant plants including saltgrass and alkali sacaton	Provides temporary cover and moist microsites for insects and small mammals

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
	X						X	*Aquilegia chrysantha* (Yellow Columbine)	X	X		Perennial forb	High
X	X		X					*Baileya multiradiata* (Desert marigold)			X	Perennial forb	Low
X	X		X	X	X	X	X	*Brickellia coulteri* (Brickelbush, Coulter's brickelbush)		X	X	Perennial Subshrub	Moderate
X	X	X	X	X		X	X	*Dichelostemma capitatum* (*Dichelostemma pulchellum*) (Bluedicks)		X	X	Perennial forb	Low
X		X			X	X	X	*Dicliptera resupinata* (Arizona foldwing)		X	X	Perennial forb	Low
X	X	X			X	X	X	*Epilobium canum ssp.latifolium* (*Zauschneria californica*) (Hummingbird Trumpet)		X	X	Perennial forb	Moderate
	X	X				X		*Glandularia gooddingii (Verbena gooddingii*) (Goodding's verbena, southwest mock vervain)			X	Perennial forb	Low
					X	X	X	*Lobelia cardinalis* (Cardinalflower)	X			Perennial forb	Moderate-High
X			X	X	X	X	X	*Machaeranthera tanacetifolia (Aster tanacetifolius)* (Tanseyleaf tansyaster, purple aster)			X	Perennial forb	Low

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Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Aquilegia chrysantha (Yellow Columbine)	Perennial forb; 3000'-11000', occurs in shady, moist canyons and forest associations; to 4' tall	Showy yellow flower appears April-September	Associated with grasses, forbs and other wildflowers in rich soils along streams or other moist areas	Flowers: provide nectar and pollen for insects and hummingbirds; Seeds: eaten by birds and small mammals
Baileya multiradiata (Desert marigold)	Annual or short lived perennial; below 5000'; occurs on sandy and gravelly slopes and desert flats, and along roadsides in sunny open areas; to 2' tall	Bright yellow flowers at ends of leafless stems appear March October when moisture available	Associated with desert broom, desert globemallow, lupine, and fluffgrass	Seeds: eaten by birds including Inca dove, and ants; Insects on plant gleaned by birds
Brickellia coulteri (Brickelbush, Coulter's brickelbush)	Perennial shrub; 2,000-4,000'; along washes, canyons, and dry rocky slopes.	Plant is sticky, with brittle stems; produces an inconspicuous, slender flowerhead of yellow-green rayless flowers.	Associated with mesquite, desert hackberry, grasses; often associated with plants on tops of banks.	Seeds consumed by Gambel's Quail and probably other birds.
Dichelostemma capitatum (*Dichelostemma pulchellum*) (Bluedicks)	Perennial (bulb); below 5000', occurs on mesas, open slopes, and plains; to 30" tall	Beautiful lavender flower at the top of a slender stem, blooms February-May	Prefers gravelly soils; in our area, often found in association with grasses and low stature shrubs including acacia, mariola, and creosotebush.	Bulbs: highly valuable forage for small and large mammals
Dicliptera resupinata (Arizona foldwing)	Perennial forb or subshrub to 2' in height; on rocky slopes, in canyons, and along wash embankments between 3,000 and 6,000'.	Densely branching, erect to spreading form; lanceolate leaves; red-violet blooms subtended by clasping bracts occur between May and October.	Associated with mesquite bosque, graythorn, wolfberry, and desert hackberry.	Flowers probably provide nectar for insects and hummingbirds.
Epilobium canum ssp.latifolium (*Zauschneria californica*) (Hummingbird Trumpet)	Perennial; suffrutescent; to about 20" height; damp places and on rocky slopes and in canyons from 2,500-7.000'.	Long-tubular scarlet to red flowers from June to December.	Associated with streamside or hillside vegetation including deergrass, agaves, and juniper and oaks.	Provides nectar for hummingbirds.
Glandularia gooddingii (Verbena gooddingii) (Goodding's verbena, southwest mock vervain)	Annual or short-lived perennial forb; below 5000'; occurs in open canyons and along slopes add washes with sandy soils; to 2' tall and 4' wide	Purple clusters of flowers bloom from Feb-Oct; easily propogated through cuttings and self-seeding	Occurs in open areas with clammyweed, desert marigold, Arizona blazing star, windmills, and datura.b	Flowers: nectar and pollen attract butterflies and moths; Good groundcover that provides temporary shelter and moist, resting microsites for insects, birds, and small mammals
Lobelia cardinalis (Cardinalflower)	Perennial forb; 3000'-7500'; occurs with streamsides and cienegas; to 5' tall	Tubular bright red flower bloom June-October	Associated with other streamside plants including giant sacaton, deergrass, Fremont cottonwood, and Gooding's willow	Flowers: provide nectar for hummingbirds and insects
Machaeranthera tanacetifolia (Aster tanacetifolius) (Tanseyleaf tansyaster, purple aster)	Perennial forb; 1000'-8000'; occurs in disturbed soils along washes, fields, paths, and roadsides; to 16" tall	Handsome "daisy-like" bluish-purple rays surrounding yellow disk flowers, blooms June – October	Usually open areas with other species that pioneer disturbed and sandy soils including windmills, clammyweed, and desert marigold	Provides temporary cover and moist microsites for insects and small mammals

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	**Santa Cruz River**	**Western Pima County**	**Pantano/Rillito/Lower Canyon del Oro Wash**	**Black/Brawley Wash**	**Upper Canyon del Oro Wash**	**Tanque Verde/Agua Caliente/Rincon Creek**	**Sabino Canyon**		**Hydroriparian**	**Mesoriparian**	**Xeroriparian**		
	X	X			X			*Penstemon parryi* (Penstemon, Parry, Beardtongue)			X	Perennial forb	Low
X		X	X	X	X	X	X	*Penstemon pseudospectabilis* (Desert Penstemon)		X		Perennial forb	Moderate
	X		X		X			*Ruellia nudiflora var. nudiflora* (Violet wild petunia)	X	X		Perennial forb	Moderate
				X				*Rumex hymenosepalus* (Canaigre dock)		X	X	Perennial forb	Moderate
	X					X		*Senna hirsuta* var. *glaberima (Cassia leptocarpa var. glaberrima)* (Slimpod senna, woolly senna)		X	X	Perennial forb	Moderate
X	X	X	X	X				*Sphaeralcea ambigua ssp. ambigua* (Desert globemallow, apricot globemallow)			X	Perennial forb	Low
X	X	X	X	X	X	X	X	*Zinnia acerosa (Zinnia pumila)* (Desert Zinnia)			X	Perennial Subshrub	Low

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Penstemon parryi (Penstemon, Parry, Beardtongue)	Perennial forb; 1500-5000'; occurs in well-drained soils on grassy slopes, alongside canyons and along roadsides; to 4' tall	Tubular pink flower appear March-July	Associated with a wide variety of desert-adapted shrubs, grasses and forbs; frequent associates include velvet mesquite, paloverde, lupine, desert globemallow, and Goodding's verbena	Flowers:provide nectar and pollen for insects and hummingbirds
Penstemon pseudospectabilis (Desert Penstemon)	Perennial forb; 2000'-7000'; occurs on arid slopes, and along canyons and desert washes; to 4' tall	Tubular red flower appears February-May	Associated with a wide variety of desert-adapted shrubs, grasses and forbs; frequent associates include, velvet mesquite, soaptree yucca, and spidergrass	Flowers: provide nectar and pollen for insect and hummingbirds
Ruellia nudiflora var. nudiflora (Violet wild petunia)	Perennial forb; 2500-4000'; occurs in moist woodlands along streams and washes; to 24' tall	Large purple flowers present May-Oct	Associated with mesquite, graythorn, desert hackberry, wolfberry, and scarlet creeper	Provides temporary cover and moist microsites for insects and small mammals
Rumex hymenosepalus (Canaigre dock)	Perennial forb; to 6000'; occurs in sandy soils in valley floors and along washes; clustered leaves to 12' with flowering stem to 4' tall	Small green flowers appear on spikes from March-April; followed by clustered pinkish, winged fruits; roots form a stout tuber	Occurs in sandy soils along with paloverde, velvet mesquite, four-wing saltbush, and Mexican elderberry	Seeds, leaves, tubers: eaten by a wide variety of wildlife
Senna hirsuta var. *glaberima (Cassia leptocarpa var. glaberrima)* (Slimpod senna, woolly senna)	Perennial forb; 2500- 5500'; occurs in sandy washes and disturbed areas such as roadsides; to 3' tall	Bright yellow flower clusters present July-Sept; followed by long, slender pods	Associated with desert strand species including clammyweed, datura, windmills, *Hymenoclea monogyra*	Pollen: collected by insects including bumblebees and butterflies; Seeds and pods: eaten by a wide variety of wildlife
Sphaeralcea ambigua ssp. ambigua (Desert globemallow, apricot globemallow)	Perennial; below 3500'; occurs in sandy flats and washes, and along roadsides; to 3' tall	Attractive flowers vary in color from white to orange, salmon,lavender, or pinkish; flowers appear throughout year when moisture available; woody stem	Frequently associated with prickly pear, creosotebush, and other a variety of other Sonoran desertscrub plants that grow in the open and along roadsides	Flowers: provide nectar and pollen for insects including native bees, and eaten by desert tortoise, birds, and other wildlife; Leaves and twigs: provide browse for bighorn sheep and other mammals; Larval food plant for butterflies
Zinnia acerosa (Zinnia pumila) (Desert Zinnia)	Perennial; 2000' – 5000', occurs in dry valleys and on rocky slopes; to 10" tall	Evergreen; white to pale yellow flowers bloom March-October when moisture is adequate	Frequently ssociated with prickly pear, creosotebush, triangle bursage, fluffgrass, and other Sonoran desertscrub plants that grow in open, exposed sites	Flower petals: eaten by quail, finches, sparrows, and other birds; Seeds: eaten by harvester ants, which in turn attract horned lizards; Insects on plant gleaned by birds

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
								ANNUAL WILDFLOWERS					
	X		X					*Bowlesia incana* (Bowlesia, hoary bowlesia)		X	X	Annual forb	Low
	X					X		*Datura wrightii* (Datura, sacred, jimsonweed, sacred thorn-apple)		X	X	Annual or Perennial forb	Low
X			X	X	X	X	X	*Eriastrum diffusum* (Miniature woollystar)			X	Annual forb	Low
	X	X		X				*Eschscholzia californica ssp. Mexicana (Eschscholtzia mexicana)* (Mexican Gold Poppy, California poppy)			X	Annual forb	Low
X	X	X	X	X	X	X	X	*Kallstroemia grandiflora*		X	X	Annual forb	Low
	X			X	X	X		*Lesquerella gordonii var. gordonii* (Gordon's bladderpod)		X	X	Annual or Perennial forb	Moderate

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
ANNUAL WILDFLOWERS				
Bowlesia incana (Bowlesia, hoary bowlesia)	Annual forb; to 3000'; occurs along sandy washes and woodlands; trailing stems to 20" long	Tiny, seldom-noticed flowers appear March-April; shade-tolerant	Abundant after winter rains along with other spring ephemerals forming a carpet under velvet mesquite, paloverde, catclaw acacia, and wolfberry. Associated with other spring ephemerals and annual grasses.	Provides temporary cover and moist microsites for insects and small mammals
Datura wrightii (Datura, sacred, jimsonweed, sacred thorn-apple)	Annual or perennial forb; 700-6000'; occurs in open disturbed areas including strands and valley bottoms; to 5' tall and 7' wide	Large white tubular flowers present May –Oct, followed by big spiny fruits	Often associated with desert strand species including clammyweed, slimpod senna, and burrobrush. Also present in riparian buffers, disturbed roadside areas, and saltbush associations	Nectar and pollen: utilized by bees, moths and other insects; Birds forage on insects attracted by flowers
Eriastrum diffusum (Miniature woollystar)	Annual to 4 1/2"; 1,000-5,500'; sandy areas of deserts and mesas.	Pale bluish to white tubular flowers to 1/2" long on bristle-tipped heads appear between March and June.	Associated with subshrubs, cacti, and forbs in Sonoran desertscrub and semidesert grassland habitats.	Provides nectar for insects.
Eschscholzia californica ssp. Mexicana (Eschscholtzia mexicana) (Mexican Gold Poppy, California poppy)	Annual forb; below 4,500'; occurs in dr , gravelly or sandy places, often alongside desert washes; to 16 " tall	Bright orange flowers appear from mid-Feb to May; useful as a quick soil stabilizer following disturbance	Abundant after winter rains along with Gordon's bladderpod, lupine, *Phacelia* spp., and owl's clover	Provides temporary cover and moist microsites for insects and small mammals
Kallstroemia grandiflora	Summer annual; spreading to 3'; open plains, deserts, wash strand areas, and desert slopes.	Flowers bright orange with a red center appear between July and October. Leaves and stems hairy.	Late summer bloomer responding to summer rains. Common along roadsides; occurs with tansyaster (*Machaeranthera* sp.), mesquite, and grasses.	Fowers visited by insects.
Lesquerella gordonii var. gordonii (Gordon's bladderpod)	Annual forb; 100-5000'; occurs in sandy open places; to 16" tall	Profuse yellow flowers appear from Feb-May; round pea-sized pods follow flowers; useful as a quick soil stabilizer following disturbance	Abundant after winter rains along with Mexican gold poppy, lupine, *Phacelia* spp., and owl's clover	Pods eaten by large and small mammals, birds, and other wildlife

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
X	X		X	X	X	X	X	*Lupinus sparsiflorus ssp. Mohavensis* (Coulter's lupine)		X	X	Annual forb	Moderate
X			X	X	X	X	X	*Nama demissum var. demissum* (Purplemat)		X	X	Annual forb	Moderate
	X				X			*Phacelia distans* (Blue-eyed scorpionweed, distant phacelia)		X	X	Annual or Perennial forb	Moderate
X								*Platystemon californicus* (Creamcups)	X	X	X		
	X					X		*Polansia dodecandra* (Western Clammyweed)		X	X	Annual forb	Moderate
	X		X					*Salvia columbariae var. columbariae* (Chia)		X	X	Annual forb	Low

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Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Lupinus sparsiflorus ssp. Mohavensis (Coulter's lupine)	Annual forb to 16" height; below 4,500' on slopes and mesas on sandy soils.	Pale blue to violet flowers from January to May. Improves soil quality through nitrogen infusion.	Abundant after winter rains along with other spring ephemerals including Mexican gold poppy, Gordon's bladderpod, *Cryptantha* spp., bowlesia and purplemat	Flowers: provide nectar: eaten by bees and butterflies.
Nama demissum var. demissum (Purplemat)	Annual forb to 8"; desert flats and washes; below 3,500'.	Red-purple flowers between February and May; may carpet the desert when rains are abundant.	Occurs with other spring annuals including Mexican gold poppy, lupines, *Cryptantha* spp., and owl clover.	Flower are visited by insects.
Phacelia distans (Blue-eyed scorpionweed, distant phacelia)	Annual forb; to 5000'; occurs in dry, gravelly or sandy places, often alongside desert washes; to 12" tall	Deep blue, bell-shaped flowers unfurl from a coiled spike from Feb-April; useful as a quick soil stabilizer following disturbance	Abundant after winter rains along with other spring ephemerals including Mexican gold poppy, Gordon's bladderpod, *Cryptantha* spp., bowlesia and purplemat	Nectar and pollen: eaten by insects Provides temporary cover for small mammals
Platystemon californicus (Creamcups)	Annual forb; 1500-4500'; occurs in open areas with moist, gravelly soil, primarily along streams and washes and moist meadows; to 15" tall	Cream-colored "poppy-like" flowers present March-May; does not tolerate heavy shade	Associated with a wide variety of forbs and grasses in open moist habitats such as grassland meadows and streamside edges. Associated plants include Fremont cottonwood, seep willow and various grasses and forbs	Provides temporary cover and moist microsites for insects and small mammals
Polansia dodecandra (Western Clammyweed)	Annual forb; 1000-6500'; occurs in wash channels and other sandy areas subject to frequent disturbance; to 30" tall	Clusters of white to pinkish flowers borne on tall stalks from May-Oct; strongly scented leaves and stems	Often associated with desert strand species including datura, slimpod senna, windmills, and burrobrush.	Flowers: provide nectar: eaten by bees and butterflies
Salvia columbariae var. columbariae (Chia)	Annual forb; to 3000'; occurs in open, exposed areas along sandy washes, dry slopes, woodland hillsides and gravelly disturbed sites such as roadsides; to 60" high if sufficient moisture is present	Whorls of tubular blue flowers on tall stems appear from March - May; seeds follow flowers in summer; requires full sun; readily self-sowing	Occurs in open areas subject to frequent disturbance with other annuals including Mexican gold poppy, Gordon's bladderpod, *Cryptantha* spp., and annual grasses	Seeds: valuable high-protein food source for a wide variety of wildlife; Flowers: provide nectar: eaten by bees and butterflies

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
								GRASSES					
	X			X			X	*Aristida ternipes* (Spidergrass)		X	X	Perennial grass	Low
	X	X					X	*Bothriochloa barbinodis (Andropogon barbinoides)* (Cane beardgrass)			X	Perennial bunchgrass	Moderate
X	X		X	X	X			*Bouteloua aristidoides* (Needle grama)		X	X	Annual tufted grass	Low
X	X	X			X			*Bouteloua curtipendula* (Sideoats grama)			X	Perennial tufted grass	Low
	X	X			X			*Bouteloua rothrockii* (Rothrock Grama)			X	Perennial tufted grass	Low
X	X	X	X	X	X	X	X	*Distichlis stricta* (Desert saltgrass)	X	X	X	Perennial turfgrass	Moderate
X						X		*Dasyochloa pulchella (Erioneuron pulchellus, Tridens pulchellus)* (Fluffgrass, low woolly grass)			X	Perennial Grass	Low
X			X	X	X	X	X	*Hilaria belangeri var. belangeri (Anthephora belangeri)* (Curly-mequite)			X	Perennial tufted grass	Moderate

Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
GRASSES				
Aristida ternipes (Spidergrass)	Tufted perennial grass; 2,500 – 5,500'; occurs on rocky and sandy slopes and often along roadsides and other frequently disturbed areas; to 3' tall	Long drooping panicles lend a delicate feature to the landscape; flowers mostly Aug – Nov but sometimes in the spring	Associated with Sonoran desertscrub plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses	Leaves and seeds: browsed by large and small mammals; Provides nesting materials for birds and small mammals
Bothriochloa barbinodis (Andropogon barbinoides) (Cane beardgrass)	Tufted perennial; 1,000-6000'; occurs on rocky and sandy slopes and in floodplains, desert uplands, and disturbed roadside areas; to 5 feet tall	Spikelet with dense long hairs blooms Apr-Oct; attractive "fluffy" appearance; extremely drought-resistant	Associated plants include velvet mesquite, paloverde, creosotebush, triangle bursage, cacti, and a wide variety of forbs and other grasses	Leaves: considered good forage for grazing mammals when green; Seeds: eaten by mammals and birds; Serves as nesting materials and cover for birds and small mammals
Bouteloua aristidoides (Needle grama)	Low, tufted, annual grass; to 6000'; occurs on dry mesas, and in and along washes and disturbed areas; to 6 inches tall	One-sided raceme of flowers appearing in spring, summer, or fall, depending upon rainfall; useful as a quick soil stabilizer following disturbance	Associated with Sonoran desertscrub and xeroriparian plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses	Leaves and seeds: utilized by birds and small mammals
Bouteloua curtipendula (Sideoats grama)	Tufted perennial grass; to 7,000', occurs on rocky slopes, grasslands, and in woodlands and forest openings; 1-2' tall	Raceme of hanging spikelets bloom from summer to early fall	Associated plants include oak, juniper, velvet mesquite, fairy duster, creosotebush, triangle bursage, cacti, and a variety of forbs and other grasses	Seeds: eaten by birds and small mammals; Leaves: considered excellent forage for grazing mammals when green
Bouteloua rothrockii (Rothrock Grama)	Short-lived perennial grass; 2,300-5,500'; occurs in scattered clumps on dry rocky hillsides and sandy mesas; 10-36"tall	One-sided raceme of flowers arranged on curving spikelets bloom in warm season; very hardy and drought-resistant	Associated with Sonoran desertscrub and xeroriparian plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses.	Leaves: considered valuable forage for grazing mammals due to drought resistance, though not as good as other grama species; Seeds: eaten by birds and small mammals; Provides cover and nesting materials for birds and small mammals
Distichlis stricta (Desert saltgrass)	Low-growing perennial; up to 7000'; occurs on alkaline and saline soil; 8-15" tall	Warm season flowers in dense spikes; spreads by stolons and forms dense turfgrass that is a good native alternative to the invasive Bermudagrass	Occurs near riparian areas and at the edges of mesquite bosques; associated with other saline-tolerant plants including yerba mansa and alkali sacaton	Leaves and seeds: browsed by large and small mammals but considered poor forage for cattle; Provides nesting materials for birds and small mammals
Dasyochloa pulchella (Erioneuron pulchellus, Tridens pulchellus) (Fluffgrass, low woolly grass)	Low densely-tufted perennial grass; under 5500'; occurs on dry, rocky slopes and desert flats; in scattered clumps less than 6" tall	Short spikelets bloom spring, summer and fall; abundant in overgrazed lands	Associated with Sonoran desertscrub plant communities; often with paloverde, velvet mesquite, cacti, desert zinnia, and various forbs and other grasses.	Seeds: eaten by mammals and birds; Leaves: not utilized by large grazers but utilized by small mammals and desert tortoise; Serves as nesting materials for birds and small mammals
Hilaria belangeri var. belangeri (Anthephora belangeri) (Curly-mequite)	Tufted perennial to about 12"; occurs on rocky slopes, dry hillsides, and sandy plains from 1,500-6,000 feet.	Flowers mostly from August to November. Most palatable of the *Hilarias* for forage.	Associated with gramas (*Bouteloua* spp.), three-awn (*Aristida* spp.), tanglehead, bush muhly, and other grasses.	Leaves: considered excellent forage for livestock and deer. Provides nesting materials for birds and small mammals;

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	Santa Cruz River	Western Pima County	Pantano/Rillito/Lower Canyon del Oro Wash	Black/Brawley Wash	Upper Canyon del Oro Wash	Tanque Verde/Agua Caliente/Rincon Creek	Sabino Canyon		Hydroriparian	Mesoriparian	Xeroriparian		
						X	X	*Leptochloa dubia* (Green sprangletop)		X	X	Annual grass	Moderate
	X	X		X				*Muhlenbergia porteri* (Bush muhly)		X	X	Perennial tufted grass	Moderate
	X	X	X	X		X	X	*Muhlenbergia rigens* (Deergrass)		X	X	Perennial bunchgrass	Moderate
	X		X					*Panicum obtusum* (Vine mesquite)	X	X		Perennial tufted grass	Moderate
X	X	X						*Setaria macrostachya* (Plains bristlegrass, large-spike bristlegrass)	X	X	X	Perennial bunchgrass	Moderate
	X	X				X		*Sporobolus airoides* (Alkali sacaton)	X	X	X	Perennial bunchgrass	Moderate
	X	X	X					*Sporobolus cryptandrus* (Sand dropseed, Spike dropseed)		X	X	Perennial bunchgrass	Moderate

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Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Leptochloa dubia (Green sprangletop)	Tufted perennial; 2500'-6000'; coarse soils from bottomlands to uplands and hills, most common in higher elevations; 2-3' tall	Large drooping flower spikes in spring and summer; bluish green leaves	Associated with Sonoran desertscrub and grassland plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses	Leaves and seeds: valuable forage for by large and small mammals; Provides nesting materials for birds and small mammals; Sometimes harvested as hay
Muhlenbergia porteri (Bush muhly)	Tufted perennial grass; 2000-6000'; occurs on dry mesas and rocky slopes;; 2'– 4' tall and 3' wide	Flowers in numerous delicate panicles blooming Aug–Oct; shade-tolerant	Associated plants include velvet mesquite, paloverde, creosotebush, triangle bursage, cacti, and a variety of forbs and other grasses; often seen growing under the protection of shrubs	Leaves: excellent forage for livestock, deer and pronghorn; Seeds: eaten by mammals and birds; Serves as nesting materials and cover for birds and small mammals
Muhlenbergia rigens (Deergrass)	Perennial bunchgrass; 2000-7500', occurs on woodland slopes, and in canyons and along water courses; 2-5' tall	Tall, dense, compressed spikelets bloom in the warm season; attractive drooping leaves provide a good alternative to the invasive fountaingrass	Associated plant include Fremont cottonwood, velvet mesquite, oak, velvet ash, and a wide variety of shrubs, forbs and other grasses	Leaves: considered good forage for grazing mammals when green, but poor when dry; Seeds: eaten by mammals and birds; Serves as nesting materials and cover for birds and small mammals
Panicum obtusum (Vine mesquite)	Perennial bunchgrass; 1000'-6000'; occurs along streams, roadsides, and moist lowlands; to 30" tall	Flowers May - Oct; bluish-green leaves; spreads by stolons forming dense stands that are useful in erosion control	Occurs in hydro- and mesoriparian plant communities; frequent associates include Fremont cottonwood, Goodding's willow, velvet ash, netleaf hackberry, and seep willow	Seeds: eaten by a wide variety of wildlife including birds; Leaves: considered good forage for grazing mammals when green; Provides nesting materials for birds and small mammals
Setaria macrostachya (Plains bristlegrass, large-spike bristlegrass)	Tufted perennial grass; 2000 – 7000'; occurs on slopes and along washes, often at the edge of tree canopies or disturbed roadsides; 1 - 4' tall	Dense spike-like panicle of flowers with stiff hairs blooms May–Oct; provides a good alternative to the invasive fountaingrass	Associated plants velvet mesquite, paloverde, giant sacaton, graythorn, and a variety of forbs and other grasses	Leaves: considered relatively poor forage for grazing mammals; Seeds and foliage: eaten by birds and small mammals; Provides cover and nesting materials for small mammals
Sporobolus airoides (Alkali sacaton)	Dense, tall perennial bunchgrass; 2500' – 6500'; occurs in and along sandy valleys and washes, and riparian bottomlands; 2 - 4' tall	Large spreading panicle of flowers bloom May - Oct; tolerant of alkaline and saline soils	Associated with other riparian and saline-tolerant plants including Fremont cottonwood, velvet mesquite, desert saltgrass, and yerba mansa	Leaves: though tough are considered valuable browse, especially where alternatives are lacking; Seeds: eaten by mammals and birds; Provides cover in otherwise open landscapes
Sporobolus cryptandrus (Sand dropseed, Spike dropseed)	Perennial bunchgrass; 150-7000', occurs on upland slopes and within floodplains with sandy soil; to 3' tall	Slender, erect panicle of flowers bloom July – October; highly adaptable to a wide range of environmental conditions and thus valuable for erosion control	Associated plants include velvet mesquite, four-winged saltbush, giant sacaton, alkali sacaton, and desert saltgrass	Seeds: eaten by numerous birds including wild turkey, and small mammals; Leaves: considered good forage for grazing mammals when green

Watershed								Botanical Name (Common Name)	Riparian Classification			Life Form	Water Requirements
San Pedro River	**Santa Cruz River**	**Western Pima County**	**Pantano/Rillito/Lower Canyon del Oro Wash**	**Black/Brawley Wash**	**Upper Canyon del Oro Wash**	**Tanque Verde/Agua Caliente/Rincon Creek**	**Sabino Canyon**		**Hydroriparian**	**Mesoriparian**	**Xeroriparian**		
X								*Sporobolus wrightii* (Giant sacaton, big sacaton)	X	X		Perennial bunchgrass	Moderate
			X	X				*Vulpia octoflora (Festuca octoflora)* (Sixweek fescue)		X	X	Annual grass	Low

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Botanical Name (Common Name)	Lifespan, elevation, size	Seasonality; flower, fruit, berries, other	Plant guild relationships	Animal relationships
Sporobolus wrightii (Giant sacaton, big sacaton)	Perennial bunchgrass; 2000'–5000'; occurs in riparian floodplains and along slopes and sandy washes; 3 – 6.5' tall	Large spreading panicle of tiny flowers bloom May - October	Associated with other riparian plants including Fremont cottonwood, Goodding's willow, velvet mesquite, graythorn, buttonbush, and deergrass	Leaves: considered good forage for grazing mammals when green; Seeds: eaten by mammals and birds; Provides nesting materials and cover for birds and small mammals
Vulpia octoflora (Festuca octoflora) (Sixweek fescue)	Short-lived annual grass; up to 5,500'; widespread on rocky slopes; generally to 12", occasionally to 20" tall	Lush spring growth after summer rains; useful as a quick soil stabilizer following disturbance	Associated with Sonoran desertscrub and xeroriparian plant communities, often with paloverde, velvet mesquite, cacti, and various forbs and other grasses including desert strand species	Leaves and seeds: browsed by large and small mammals

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APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

SAN PEDRO RIVER

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
	Populus fremontii ssp. fremontii	Fremont cottonwood	Perennial Tree	High
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Cephalanthus occidentalis	Buttonbush, Common buttonbush	Perennial Shrub	High
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
ANNUAL WILDFLOWERS				
	Platystemon californicus	Creamcups	Annual Forb	Moderate
GRASSES				
	Distichlis stricta	Desert saltgrass	Perennial Turfgrass	Moderate
	Setaria macrostachya	Plains bristlegrass, Large-spike bristlegrass	Perennial Bunchgrass	Moderate
	Sporobolus wrightii	Giant sacaton, Big sacaton	Perennial Bunchgrass	Moderate
MESORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Chilopsis linearis	Desert willow	Perennial Shrub/Small tree	Low-Moderate
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
	Parkinsonia florida (Cercidium floridum)	Blue paloverde	Perennial Tree	Low-Moderate
	Populus fremontii ssp. fremontii	Fremont cottonwood	Perennial Tree	High
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Barkleyanthus salicifolius(Senecio salignus)	Senecio, Willow ragwort	Perennial Shrub	Moderatae
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, Spiny hackberry	Perennial Shrub	Low
	Lycium fremontii	Fremont Wolfberry, Fremont desert-thorn	Perennial Shrub	Low
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
	Vitus arizonica	Arizona wild grape, Canyon grape	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (Dichelostemma pulchellum)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium (Zauschneria californica)	Hummingbird trumpet	Perennial Forb	Moderate
	Penstemon pseudospectabilis	Desert Penstemon	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lupinus sparsiflorus	Coulter's lupine	Annual Forb	Moderate
	Nama demissum	Purplemat	Annual Forb	Moderate
	Platystemon californicus	Cream cups	Annual Forb	Moderate
GRASSES				
	Bouteloua aristidoides	Needle grama	Annual Tuftedgrass	Low
	Distichlis stricta	Desert saltgrass	Perennial Turfgrass	Moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	Moderate
	Sporobolus wrightii	Giant sacaton	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

SAN PEDRO RIVER

	Botanical Name	Common Name	Life Form	Water Requirements
XERORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Chilopsis linearis	Desert willow	Perennial Shrub/Small Tree	Low-Moderate
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, Spiny hackberry	Perennial Shrub	Low
	Encelia farinosa	Brittlebush	Perennial Shrub	Low
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, Single whorl burrobrush	Perennial Shrub	Moderate
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	Low
	Lycium fremontii	Fremont Wolfberry, Fremont's desert-thorn	Perennial Shrub	Low
	Parthenium incanum	Mariola	Perennial Shrub	Low
	Tecoma stans	Yellow bells, yello trumpetbush	Perennial Shrub	Low
	Ziziphus obtusifolia var. canescens	Graythorn, Lotebush	Perennial Shrub	Low
VINES				
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	Low-Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Baileya multiradiata	Desert marigold	Perennial Forb	Low
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (*Dichelostemma pulchellum*)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp.latifolium (*Zauschneria californica*)	Hummingbird trumpet	Perennial Forb	Moderate
	Machaeranthera tanacetifolia (Aster tanacetifolius)	Tanseyleaf tansyaster, purple aster	Perennial Forb	Low
	Sphaeralcea ambigua ssp. Ambigua	Desert globemallow, apricot globemallow	Perennial Forb	Low
	Zinnia acerosa (Ainnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Eriastrum diffusum	Miniature woollystar	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Platystemon californicus	Creamcups	Annual Forb	Moderate
GRASSES				
	Bouteloua aristidoides	Needle grama	Annual Tuftedgrass	Low
	Bouteloua curtipendula	Sideoats grama	Annual Tuftedgrass	Low
	Dasyochloa pulchella (Erioneuron pulchellum, Tridens pulchellus)	Fluffgrass, low wooly grass	Perennial Grass	Low
	Distichlis stricta	Desert saltgrass	Annual Tuftedgrass	Moderate
	Hilaria belangeri var. belangeri (Anthephora belangeri)	Curly-mesquite	Annual Tuftedgrass	Moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

SANTA CRUZ RIVER

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
	Juglans major	Arizona black walnut	Perennial Tree	High
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana	Desert Hackberry	Perennial shrub	low
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Aquilegia chrysantha	Yellow Columbine	Perennial Forb	High
GRASSES				
	Panicum obtusum	Vine mesquite	Perennial Tufted Grass	Moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	Moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate
MESORIPARIAN				
TREES				
	Acacia constricta	Whitethorn Acacia	Perennial shrub/small tree	low-moderate
	Acacia greggii	Catclaw Acacia	Perennial tree	low
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Chilopsis linearis	Desert Willow	Perennial shrub/small tree	low-moderate
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	moderate-high
	Juglans major	Arizona black walnut	Perennial Tree	high
	Parkinsonia florida	Blue Palo Verde	Perennial tree	low-moderate
	Platanus wrightii	Arizona sycamore	Perennial Tree	moderate
	Prosopis velutina	Velvet Mesquite	Perennial tree	low
	Quercus emoryi	Emory Oak	Perennial tree	low
	Salix gooddingii	Goodding's willow	Perennial Tree	high
	Sambucus nigra ssp.cerulea (Sambucus mexicana)	Mexican elderberry, blue elderberry	Perennial Shrub/Small Tree	moderate
	Sapindus saponaria var. *drummondii*	Western soapberry	Perennial Tree	low
SHRUBS				
	Anisacanthus thurberi (Drejera thurberi)	Desert honeysuckle	Perennial Shrub	moderate
	Asclepias tuberosa	Butterfly milkweed	Perennial Sub-Shrub	moderate
	Baccharis salicifolia	Seep willow	Perennial Shrub	moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	low
	Garrya wrightii	Wright's silktassel	Perennial Shrub	moderate
	Gossypium thurberi (Thurberia thespesioides)	Native cotton, Thurber's cotton	Perennial Shrub	moderate
	Rhus glabra	Smooth sumac	Perennial Shrub	moderate
	Rhus trilobata	Three-leafed sumac, skunkbush sumac	Perennial Shrub	moderate
VINES				
	Clematis drummondii	Old Man's Beard	Perennial vine	moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	moderate
	Vitus arizonica	Arizona wild grape, Canyon grape	Perennial Vine	moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	moderate
	Aquilegia chrysantha	Yellow Columbine	Perennial Forb	high
	Brickellia coulteri	Brickelbush	Perennial subshrub	moderate
	Dichelostemma capitatum (*Dichelostemma pulchellum*)	Bluedicks	Perennial Forb	low
	Epilobium canum ssp. latifolium (Zauschneria californica)	Hummingbird trumpet	Perennial Forb	moderate
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacke	Perennial Shrub	low
	Rumex hymenosepalus	Canaigre dock	Perennial Forb	moderate
	Senna hirsuta var. glaberima (Cassia leptocarpa var. glaberrima)	Slimpod senna, woolly senna	Perennial Forb	moderate
ANNUAL WILDFLOWERS				
	Bowlesia incana	Bowlesia, hoary bowlesia	Annual Forb	low
	Datura wrightii	Datura, sacred, jimsonweed, sacred thorn-apple	Annual or Perennial Forb	low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	low
	Lesquerella gordonni	Gordon's bladderpod	Annual or Perennial forb	moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	moderate
	Phacelia distans	Blue-eyed scorpionweed, distant phacelia	Annual or Perennial Forb	moderate
	Polansia dodecandra	Western Clammyweed	Annual Forb	moderate
	Salvia columbariae var. columbariae	Chia	Annual Forb	low
GRASSES				
	Aristida ternipes	Spidergrass	Perennial Grass	low
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	low
	Leptochloa dubia	Green sprangletop	Annual Grass	moderate
	Muhlenbergia porteri	Bush Muhly	Perennial tufted grass	moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	moderate
	Panicum obtusum	Vine mesquite	Perennial Tufted Grass	moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	moderate
	Sporobolus cryptandrus	Sand dropseed, spike dropseed	Perennial Bunchgrass	moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

SANTA CRUZ RIVER				
	Botanical Name	**Common Name**	**Life Form**	**Water Requirements**
XERORIPARIAN				
TREES				
	Acacia constricta	Whitethorn Acacia	Perennial shrub/small tree	low-moderate
	Acacia greggii	Catclaw Acacia	Perennial tree	low
	Chilopsis linearis	Desert Willow	Perennial shrub/small tree	low-moderate
	Parkinsonia florida	Blue Palo Verde	Perennial tree	low-moderate
	Parkinsonia microphylla	Foothills Palo Verde	Perennial tree	low
	Prosopis velutina	Velvet Mesquite	Perennial tree	low
	Quercus emoryi	Emory Oak	Perennial tree	low
	Sapindus saponaria var. *drummondii*	Western soapberry	Perennial Tree	low
SHRUBS				
	Atriplex canescens	Four-winged Saltbush	Perennial shrub	low
	Calliandra eriophylla	Fairy duster	Perennial Shrub	low
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	low
	Condalia warnockii	Warnock condalia, Warnock's snakeweed	Perennial Shrub	low
	Encelia farinosa	Brittlebush	Perennial shrub	low
	Ericameria laricifolia (Haplopappus laricifolius)	Turpentine bush	Perennial Shrub	low
	Gossypium thurberi (Thurberia thespesioides)	Native cotton, Thurber's cotton	Perennial Shrub	moderate
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, Single whorl burrobrush	Perennial Shrub	Moderate
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	low
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacke	Perennial Shrub	low
	Simmondsia chinensis	Jojoba	Perennial Shrub	low
	Trixis californica	Trixis, American threefold	Perennial Shrub	low
	Vauquelinia californica ssp. Californica/sonorensis	Arizona Rosewood	Perennial shrub	low
	Ziziphus obtusifolia	Graythorn	Perennial shrub	low
VINES				
	Clematis drummondii	Old Man's Beard	Perennial vine	moderate
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	low-moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	moderate
CACTI & SUCCULENTS				
	Cylindropuntia arbuscula	Arizona Pencil Cholla	Perennial cactus	low
	Cylindropuntia leptocaulis	Christmas Cholla	Perennial cactus	low
	Ferocactus wislizeni	Candy Barrel Cactus	Perennial cactus	low
	Nolina microcarpa	Beargrass, sacahuista	Perennial Lily	low
	Opuntia phaeacantha	Prickley Pear	Perennial cactus	low
	Yucca elata	Soaptree Yucca	Perennial shrub	low
PERENNIAL FORB/SUB-SHRUBS				
	Allionia incarnata	Trailing windmills, trailing four-o'clocl	Perennial Forb	low
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	moderate
	Baileya multiradiata	Desert Marigold	Perennial forb	low
	Brickellia coulteri	Brickelbush	Perennial subshrub	moderate
	Dichelostemma capitatum (Dichelostemma	Bluedicks	Perennial Forb	low
	Epilobium canum ssp. latifolium	Hummingbird trumpet	Perennial Forb	moderate
	Glandularia gooddingii (Verbena	Goodding's verbena, southwest mock	Perennial Forb	low
	Penstemon parryi	Penstemon, Parry, beardtongue	Perennial Forb	low
	Rumex hymenosepalus	Canaigre dock	Perennial Forb	moderate
	Senna hirsuta var. glaberima (Cassia leptocarpa var. glaberrima)	Slimpod senna, woolly senna	Perennial Forb	moderate
	Sphaeralcea ambigua ssp. Ambigua	Desert globemallow, apricot globemallow	Perennial Forb	low
	Zinnia acerosa	Desert Zinnia	Perennial subshrub	low
ANNUAL WILDFLOWERS				
	Bowlesia incana	Bowlesia, hoary bowlesia	Annual Forb	low
	Datura wrightii	Datura, sacred, jimsonweed, sacred thorn-apple	Annual or Perennial Forb	low
	Eschscholzia californica ssp. Mexicana (Eschscholtzia mexicana)	Mexican Gold Poppy, California poppy	Annual Forb	low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	low
	Lesquerella gordonni	Gordon's bladderpod	Annual or Perennial forb	moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	moderate
	Phacelia distans	Blue-eyed scorpionweed, distant phacelia	Annual or Perennial Forb	moderate
	Polansia dodecandra	Western Clammyweed	Annual Forb	moderate
	Salvia columbariae var. columbariae	Chia	Annual Forb	low
GRASSES				
	Aristida ternipes	Spidergrass	Perennial Grass	low
	Bothriochloa barbinodis (Andropogon barbinoides)	Cane beardgrass	Perennial Bunchgrass	moderate
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	low
	Bouteloua curtipendula	Sideoats grama	Perennial Tufted Grass	low
	Bouteloua rothrockii	Rothrock grama	Perennial Tufted Grass	low
	Dasyochloa pulchella	Fluffgrass	Perennial grass	low
	Leptochloa dubia	Green sprangletop	Annual Grass	moderate
	Muhlenbergia porteri	Bush Muhly	Perennial tufted grass	moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	moderate
	Sporobolus cryptandrus	Sand dropseed, spike dropseed	Perennial Bunchgrass	moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

Western Pima County

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Populus fremontii ssp. fremontii	Fremont cottonwood	Perennial Tree	High
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
GRASSES				
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	Moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate
MESORIPARIAN				
TREES				
	Acacia constricta	Whitethorn Acacia	Perennial shrub/small tree	low-moderate
	Acacia greggii	Catclaw Acacia	Perennial tree	low
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Chilopsis linearis	Desert Willow	Perennial shrub/small tree	low-moderate
	Parkinsonia florida	Blue Palo Verde	Perennial tree	low-moderate
	Populus fremontii ssp. fremontii	Fremont cottonwood	Perennial Tree	High
	Prosopis pubescens	Screwbean mesquite	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Anisacanthus thurberi (Drejera thurberi)	Desert honeysuckle	Perennial Shrub	Moderate
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacket	Perennial Shrub	Low
	Lycium fremontii	Fremont Wolfberry, Fremont's desert-thorn	Perennial Shrub	Low
	Mahonia haematocarpa (Berberis haematocarpa)	Red Mahonia, Red Barberry	Perennial Shrub	low-moderate
VINES				
	Clematis drummondii	Old man's beard, Virgin's bower, Drummond's Clematis	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (Dichelostemma pulchellum)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Glandularia gooddingii (Verbena gooddingii)	Goodding's verbena, southwest mock vervain	Perennial Forb	Low
	Penstemon pseudospectabilis	Desert Penstemon	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
GRASSES				
	Muhlenbergia porteri	Bush muhly	Perennial Tufted Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	Moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate
	Sporobolus cryptandrus	Sand dropseed, spike dropseed	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

Western Pima County

	Botanical Name	Common Name	Life Form	Water Requirements
XERORIPARIAN				
TREES				
	Acacia constricta	Whitethorn Acacia	Perennial shrub/small tree	low-moderate
	Acacia greggii	Catclaw Acacia	Perennial tree	low
	Chilopsis linearis	Desert Willow	Perennial shrub/small tree	low-moderate
	Olneya tesota	Desert Ironwood	Perennial Tree	Low
	Parkinsonia florida	Blue Palo Verde	Perennial tree	low-moderate
	Parkinsonia microphylla	Foothills Palo Verde	Perennial tree	low
	Prosopis pubescens	Screwbean mesquite	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Ambrosia deltoidea	Triangle-leaf bursage	Perennial Shrub	Low
	Atriplex canescens	Four-winged saltbush	Perennial Shrub	Low
	Atriplex lentiformis	Quailbush	Perennial Shrub	Low
	Calliandra eriophylla	Fairy duster	Perennial Shrub	Low
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Dodonaea viscosa	Hopbush	Perennial Shrub	Moderate
	Encelia farinosa	Brittlebush	Perennial Shrub	Low
	Ericameria laricifolia (Haplopappus laricifolius)	Turpentine bush	Perennial Shrub	Low
	Eriogonum fasciculatum var. foliolosum/polifolium	Flat-top buckwheat	Perennial Shrub	Moderate
	Hyptis emoryi	Desert lavender	Perennial Shrub	Low
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	Low
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacket	Perennial Shrub	Low
	Lycium fremontii	Fremont Wolfberry, Fremont's desert-thorn	Perennial Shrub	Low
	Simmondsia chinensis	Jojoba	Perennial Shrub	Low
	Trixis californica	Trixis, American threefold	Perennial Shrub	Low
	Vauquelinia californica ssp. Californica/sonorensis	Arizona Rosewood	Perennial shrub	low
	Ziziphus obtusifolia var. canescens	Graythorn, lotebush	Perennial Shrub	Low
VINES				
	Clematis drummondii	Old man's beard, Virgin's bower, Drummond's Clematis	Perennial Vine	Moderate
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	Low-Moderate
	Cucurbita palmata (Cucurbita californica)	Coyote melon, Coyote gourd	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Cylindropuntia arbuscula, (Opuntia arbuscula)	Arizona Pencil cholla	Perennial Cactus	Low
	Cylindropuntia leptocaulis, (Opuntia leptocaulis)	Christmas cholla, desert Christmas cactus	Perennial Cactus	Low
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
	Nolina microcarpa	Beargrass, sacahuista	Perennial Lily	Low
	Opuntia phaeacantha	prickly pear	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (Dichelostemma pulchellum)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium	Hummingbird trumpet	Perennial Forb	Moderate
	Glandularia gooddingii (Verbena gooddingii)	Goodding's verbena, southwest mock vervain	Perennial Forb	Low
	Penstemon parryi	Penstemon, Parry, beardtongue	Perennial Forb	Low
	Sphaeralcea ambigua ssp. Ambigua	Desert globemallow, apricot globemallow	Perennial Forb	Low
	Zinnia acerosa (Zinnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Eschscholzia californica ssp. Mexicana (Eschscholtzia mexicana)	Mexican Gold Poppy, California poppy	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
GRASSES				
	Bothriochloa barbinodis (Andropogon barbinoides)	Cane beardgrass	Perennial Bunchgrass	Moderate
	Bouteloua curtipendula	Sideoats grama	Perennial Tufted Grass	Low
	Bouteloua rothrockii	Rothrock grama	Perennial Tufted Grass	Low
	Dasyochloa pulchella (Erioneuron pulchellus, Tridens pulchellus)	Fluffgrass, low woolly grass	Perennial Grass	Low
	Muhlenbergia porteri	Bush muhly	Perennial Tufted Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Setaria macrostachya	Plains bristlegrass, large-spike bristlegrass	Perennial Bunchgrass	Moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate
	Sporobolus cryptandrus	Sand dropseed, spike dropseed	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

PANTANO/RILLITO/LOWER CANYON DEL ORO WASH

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
GRASSES				
	Panicum obtusum	Vine mesquite	Perennial Tufted Grass	Moderate
MESORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Prosopis pubescens	Screwbean mesquite	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Rhus microphylla	Littleleaf sumac	Perennial Sub-Shrub	Moderate
VINES				
	Clematis drummondii	Old man's beard, Virgin's bower, Drummond's Clematis	Perennial Vine	Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (*Dichelostemma pulchellum*)	Bluedicks	Perennial Forb	Low
	Penstemon pseudospectabilis	Penstemon, desert	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Bowlesia incana	Bowlesia, hoary bowlesia	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Salvia columbariae var. columbariae	Chia	Annual Forb	Low
GRASSES				
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	Low
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Panicum obtusum	Vine mesquite	Perennial Tufted Grass	Moderate
	Sporobolus cryptandrus	Sand dropseed, spike dropseed	Perennial Bunchgrass	Moderate
	Vulpia octoflora (Festuca octoflora)	Sixweeks fescue	Annual Grass	Low

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

PANTANO/RILLITO/LOWER CANYON DEL ORO WASH				
	Botanical Name	**Common Name**	**Life Form**	**Water Requirements**
XERORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Prosopis pubescens	Screwbean mesquite	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Calliandra eriophylla	Fairy duster	Perennial Shrub	Low
	Encelia farinosa	Brittlebush	Perennial Shrub	Low
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, single whorl burrobrush	Perennial Shrub	Moderate
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	Low
	Parthenium incanum	Mariola	Perennial Shrub	Low
	Rhus microphylla	Littleleaf sumac	Perennial Sub-Shrub	Moderate
	Trixis californica	Trixis, American threefold	Perennial Shrub	Low
	Ziziphus obtusifolia var. canescens	Graythorn, lotebush	Perennial Shrub	Low
VINES				
	Clematis drummondii	Old man's beard, Virgin's bower, Drummond's Clematis	Perennial Vine	Moderate
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	Low-Moderate
	Cucurbita palmata (Cucurbita californica)	Coyote melon, Coyote gourd	Perennial Vine	Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
	Cylindropuntia arbuscula, (*Opuntia arbuscula*)	Arizona Pencil cholla	Perennial Cactus	Low
	Cylindropuntia leptocaulis, (*Opuntia leptocaulis*)	Christmas cholla, desert Christmas cactus	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Baileya multiradiata	Desert marigold	Perennial Forb	Low
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum	Bluedicks	Perennial Forb	Low
	Machaeranthera tanacetifolia (Aster tanacetifolius)	Tanseyleaf tansyaster, purple aster	Perennial Forb	Low
	Sphaeralcea ambigua ssp. Ambigua	Desert globemallow, apricot globemallow	Perennial Forb	Low
	Zinnia acerosa (Zinnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Bowlesia incana	Bowlesia, hoary bowlesia	Annual Forb	Low
	Eriastrum diffusum	Miniature woollystar	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Salvia columbariae var. columbariae	Chia	Annual Forb	Low
GRASSES				
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	Low
	Dasyochloa pulchella (Erioneuron pulchellum, Tridens pulchellus)	Fluffgrass, low woolly grass	Perennial Grass	Low
	Hilaria belangeri var. belangeri	Curly-mesquite	Perennial Tufted Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Sporobolus cryptandrus	Sand dropseed, spike dropseed	Perennial Bunchgrass	Moderate
	Vulpia octoflora (Festuca octoflora)	Sixweeks fescue	Annual Grass	Low

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

BLACK/BRAWLEY WASH

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
SHRUBS				
	Acacia constricta	Whitethorn acacia	Perennial Shrub/Small Tree	Low-Moderate
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ruellia nudiflora var. nudiflora	Violet wild petunia	Perennial Forb	Moderate
MESORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Prosopis pubescens	Screwbean mesquite	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacket	Perennial Shrub	Low
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (*Dichelostemma pulchellum*)	Bluedicks	Perennial Forb	Low
	Penstemon pseudospectabilis	Desert penstemon	Perennial Forb	Moderate
	Ruellia nudiflora var. nudiflora	Violet wild petunia	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lesquerella gordonii var. gordonii	Gordon's bladderpod	Annual or Perennial Forb	Moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
GRASSES				
	Aristida ternipes	Spidergrass	Perennial Grass	Low
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	Low
	Muhlenbergia porteri	Bush muhly	Perennial Tufted Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Vulpia octoflora (Festuca octoflora)	Sixweeks fescue	Annual Grass	Low

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APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

BLACK/BRAWLEY WASH

	Botanical Name	Common Name	Life Form	Water Requirements
XERORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Prosopis pubescens	Screwbean mesquite	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Atriplex canescens	Four-winged saltbush	Perennial Shrub	Low
	Atriplex lentiformis	Quailbush	Perennial Shrub	Low
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, single whorl burrobrush	Perennial Shrub	Moderate
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	Low
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacket	Perennial Shrub	Low
VINES				
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	Low-Moderate
	Cucurbita palmata (Cucurbita californica)	Coyote melon, Coyote gourd	Perennial Vine	Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
	Cylindropuntia leptocaulis, (*Opuntia leptocaulis*)	Christmas cholla, desert Christmas cactus	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Allionia incarnata	Trailing windmills, trailing four-o'clock	Perennial Forb	Low
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum	Bluedicks	Perennial Forb	Low
	Machaeranthera tanacetifolia (Aster tanacetifolius)	Tanseyleaf tansyaster, purple aster	Perennial Forb	Low
	Sphaeralcea ambigua ssp. Ambigua	Desert globemallow, apricot globemallow	Perennial Forb	Low
	Zinnia acerosa (Zinnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Eriastrum diffusum	Miniature woollystar	Annual Forb	Low
	Eschscholzia californica ssp. Mexicana (Eschscholtzia mexicana)	Mexican Gold Poppy, California poppy	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lesquerella gordonii var. gordonii	Gordon's bladderpod	Annual or Perennial Forb	Moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
GRASSES				
	Aristida ternipes	Spidergrass	Perennial Grass	Low
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	Low
	Dasyochloa pulchella (Erioneuron pulchellum, Tridens pulchellus)	Fluffgrass, low woolly grass	Perennial Grass	Low
	Hilaria belangeri var. belangeri (Anthephora belangeri)	Curly-mesquite	Perennial Tufted Grass	Moderate
	Muhlenbergia porteri	Bush muhly	Perennial Tufted Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Vulpia octoflora (Festucaoctoflora)	Sixweeks fescue	Annual Grass	Low

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

UPPER CANYON DEL ORO WASH

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Cephalanthus occidentalis	Buttonbush, Common buttonbush	Perennial Shrub	High
	Ribes aureum var. aureum	Wax currant, golden currant	Perennial Shrub	Moderate-High
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Lobelia cardinalis	Cardinalflower	Perennial Forb	Moderate-High
MESORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Anisacanthus thurberi (Drejera thurberi)	Desert honeysuckle	Perennial Shrub	Moderate
	Asclepias tuberosa	Butterfly milkweed	Perennial Sub-Shrub	Moderate
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Garrya wrightii	Wright's silktassel	Perennial Shrub	Moderate
	Rhus glabra	Smooth sumac	Perennial Shrub	Moderate
	Rhus ovata	Sugar bush, sugar sumac	Perennial Shtub	Moderate
	Rhus trilobata	Three-leafed sumac, skunkbush sumac	Perennial Shrub	Moderate
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush	Perennial Sub-Shrub	Moderate
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium (Zauschneria californica)	Hummingbird trumpet	Perennial Forb	Moderate
	Penstemon pseudospectabilis	Desert penstemon	Perennial Forb	Moderate
	Rumex hymenosepalus	Canaigre dock	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lesquerella gordonii var. gordonii	Gordon's bladderpod	Annual or Perennial Forb	Moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Phacelia distans	Blue-eyed scorpionweed, distant phacelia	Annual or Perennial Forb	Moderate
GRASSES				
	Bouteloua aristidoides	Needle grama	Annual Tufted Grass	Low

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

UPPER CANYON DEL ORO WASH

	Botanical Name	Common Name	Life Form	Water Requirements
XERORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Olneya tesota	Desert Ironwood	Perennial Tree	Low
	Parkinsonia microphylla (*Cercidium microphyllum*)	Foothills Palo Verde, yellow palo verde	Perennial Tree	Low
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
SHRUBS				
	Dodonaea viscosa	Hopbush	Perennial Shrub	Moderate
	Ericameria laricifolia (Haplopappus laricifolius)	Turpentine bush	Perennial Shrub	Low
	Eriogonum fasciculatum var. foliolosum/polifolium)	Flat-top buckwheat, Eastern Mohave buckwhear	Perennial Shrub	Moderate
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, single whorl burrobrush	Perennial Shrub	Moderate
	Tecoma stans	Yellow bells, yellow	Perennial Shrub	Low
	Trixis californica	Trixis	Perennial Shrub	Low
	Ziziphus obtusifolia var.	Graythorn, lotebush	Perennial Shrub	Low
VINES				
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	Low-Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
	Nolina microcarpa	Beargrass, sacahuista	Perennial Cactus-Grasslike	Low
	Opuntia phaeacantha	prickly pear	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Yucca elata	Soaptree yucca	Perennial Shrub	Low
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. Latifolium (*Zauschneria californica*)	Hummingbird trumpet	Perennial Forb	Moderate
	Machaeranthera tanacetifolia (Aster tanacetifolius)	Tanseyleaf tansyaster, purple aster	Perennial Forb	Low
	Penstemon parryi	Penstemon, Parry, beardtongue	Perennial Forb	Low
	Rumex hymenosepalus	Canaigre dock	Perennial Forb	Moderate
	Zinnia acerosa (Zinnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Eriastrum diffusum	Miniature woollystar	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lesquerella gordonii var. gordonii	Grodon's bladderpod	Annual or Perennial Forb	Moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Phacelia distans	Blue-eyed scorpionweed, distant phacelia	Annual or Perennial Forb	Moderate
GRASSES				
	Bouteloua curtipendula	Sideoats grama	Perennial Tufted Grass	Low
	Bouteloua rothrockii	Rothrock grama	Perennial Tufted Grass	Low
	Dasyochloa pulchella (Erioneuron pulchellum, Tridens pulchellus)	Fluffgrass, low woolly grass	Perennial Grass	Low
	Hilaria belangeri var. belangeri (Anthephora belangeri)	Curly-mesquite	Perennial Tufted Grass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

TANQUE VERDE/AQUA CALIENTE/RINCON WASH

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Juglans major	Arizona black walnut	Perennial Tree	High
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Cephalanthus occidentalis	Buttonbush, Common buttonbush	Perennial Shrub	High
	Ribes aureum var. aureum	Wax currant, golden currant	Perennial Shrub	Moderate-High
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Anemopsis californica	Yerba Mansa	Perennial Forb	High
	Lobelia cardinalis	Cardinalflower	Perennial Forb	Moderate-High
GRASSES				
	Distichlis stricta	Desert saltgrass	Perennial Turfgrass	Moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate
MESORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Celtis laevigata (Celtis reticulata)	Netleaf/Canyon hackberry	Perennial Tree	Moderate
	Juglans major	Arizona black walnut	Perennial Tree	High
	Mahonia haematocarpa (Berberis haematocarpa)	Red mahonia, red barberry	Perennial Shrub	Low-Moderate
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
	Sambucus nigra ssp.cerulea (Sambucus mexicana)	Mexican elderberry, blue elderberry	Perennial Shrub/Small Tree	Moderate
	Sapindus saponaria var. *drummondii*	Western soapberry	Perennial Tree	Low
SHRUBS				
	Anisacanthus thurberi (Drejera thurberi)	Desert honeysuckle	Perennial Shrub	Moderate
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Celtis ehrenbergiana (Celtis pallida)	Desert hackberry, spiny hackberry	Perennial Shrub	Low
	Condalia warnockii	Warnock condalia, Warnock's snakeweed	Perennial Shrub	Low
	Garrya wrightii	Wright's silktassel	Perennial Shrub	Moderate
	Justicia candicans	Red justicia, Arizona water-willow	Perennial Shrub	Moderate
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacket	Perennial Shrub	Low
	Rhus glabra	Smooth sumac	Perennial Shrub	Moderate
	Rhus ovata	Sugar bush, sugar sumac	Perennial Shrub	Moderate
	Rhus trilobata	Three-leafed sumac, skunkbush sumac	Perennial Shrub	Moderate
VINES				
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Anemopsis californica	Yerba Mansa	Perennial Forb	High
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (Dichelostemma pulchellum)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium (Zauschneria californica)	Hummingbird trumpet	Perennial Forb	Moderate
	Penstemon pseudospectabilis	desert penstemon	Perennial Forb	Moderate
	Senna hirsuta var. *glaberima (Cassia leptocarpa var. glaberrima)*	Slimpod senna, woolly senna	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Datura wrightii	Datura, sacred, jimsonweed, sacred thorn-apple	Annual or Perennial Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lesquerella gordonii var. gordonii	Gordon's bladderpod	Annual or Perennial Forb	Moderate
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Polansia dodecandra	Clammyweed, western	Annual Forb	Moderate
GRASSES				
	Distichlis stricta	Desert saltgrass	Perennial Turfgrass	Moderate
	Leptochloa dubia	Green sprangletop	Annual Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

TANQUE VERDE/AQUA CALIENTE/RINCON WASH

	Botanical Name	Common Name	Life Form	Water Requirements
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate
XERORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Prosopis velutina	Velvet mesquite	Perennial Tree	Low
	Sapindus saponaria var. *drummondii*	Western soapberry	Perennial Tree	Low
SHRUBS				
	Calliandra eriophylla	Fairy duster	Perennial Shrub	Low
	Condalia warnockii	Warnock condalia, Warnock's snakeweed	Perennial Shrub	Low
	Dodonaea viscosa	Hopbush	Perennial Shrub	Moderate
	Encelia farinosa	Brittlebush	Perennial Shrub	Low
	Ericameria laricifolia (Haplopappus laricifolius)	Turpentine bush	Perennial Shrub	Low
	Eriogonum fasciculatum var. foliolosum/polifolium	Flat-top buckwheat, Eastern Mohave buckwheat	Perennial Shrub	Moderate
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, single whorl burrobrush	Perennial Shrub	Moderate
	Hyptis emoryi	Desert lavender	Perennial Shrub	Low
	Justicia candicans	Red justicia, Arizona water-willow	Perennial Shrub	Moderate
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	Low
	Lycium andersonii var. andersonii	Anderson Wolfberry, water jacket	Perennial Shrub	Low
	Tecoma stans	Yellow bells, yellow trumpetbush	Perennial Shrub	Low
	Trixis californica	Trixis, American threefold	Perennial Shrub	Low
	Ziziphus obtusifolia var. canescens	Graythorn, lotebush	Perennial Shrub	Low
VINES				
	Cucurbita digitata	Coyote gourd	Perennial Vine	Low-Moderate
	Maurandya antirrhiniflora	Snapdragon vine	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
	Nolina microcarpa	Beargrass, sacahuista	Perennial Lily	Low
	Opuntia phaeacantha	prickly pear	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (Dichelostemma pulchellum)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium (Zauschneria californica)	Hummingbird trumpet	Perennial Forb	Moderate
	Glandularia gooddingii (Verbena gooddingii)	Goodding's verbena, southwest mock vervain	Perennial Forb	Low
	Machaeranthera tanacetifolia (Aster tanacetifolius)	Tanseyleaf tansyaster, purple aster	Perennial Forb	Low
	Senna hirsuta var. glaberima (Cassia	Slimpod senna, woolly senna	Perennial Forb	Moderate
	Zinnia acerosa (Zinnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Datura wrightii	Datura, sacred, jimsonweed, sacred thorn-apple	Annual or Perennial Forb	Low
	Eriastrum diffusum	Miniature woollystar	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lesquerella gordonii var. gordonii	Gordon's bladderpod	Annual or Perennial Forb	Moderate
	Lupinus sparsiflorus ssp mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
	Polansia dodecandra	Western Clammyweed	Annual Forb	Moderate
GRASSES				
	Distichlis stricta	Desert saltgrass	Perennial Turfgrass	Moderate
	Dasyochloa pulchella (Erioneuron pulchellum, Tridens pulchellus)	Fluffgrass, low woolly grass	Perennial Grass	Low
	Hilaria belangeri var. belangeri	Curly-mesquite	Perennial Turfgrass	Moderate
	Leptochloa dubia	Green sprangletop	Annual Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate
	Sporobolus airoides	Alkali sacaton	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

SABINO CANYON WASH

	Botanical Name	Common Name	Life Form	Water Requirements
HYDRORIPARIAN				
TREES				
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
	Populus fremontii ssp. fremontii	Fremont cottonwood	Perennial Tree	High
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Cephalanthus occidentalis	Buttonbush, Common buttonbush	Perennial Shrub	High
	Ribes aureum var. aureum	Wax currant, golden currant	Perennial Shrub	Moderate-High
VINES				
	Ipomoea coccinea var. *hederifolia*	Scarlet creeper	Annual Vine	Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Aquilegia chrysantha	Yellow Columbine	Perennial Forb	High
	Lobelia cardinalis	Cardinalflower	Perennial Forb	Moderate-High
MESORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Chilopsis linearis	Desert willow	Perennial Shrub/Small Tree	Low-Moderate
	Fraxinus velutina	Arizona ash, Velvet ash	Perennial Tree	Moderate-High
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Platanus wrightii	Arizona sycamore	Perennial Tree	Moderate
	Populus fremontii ssp. fremontii	Fremont cottonwood	Perennial Tree	High
	Salix gooddingii	Goodding's willow	Perennial Tree	High
SHRUBS				
	Anisacanthus thurberi (Drejera thurberi)	Desert honeysuckle	Perennial Shrub	Moderate
	Baccharis salicifolia	Seep willow	Perennial Shrub	Moderate-High
	Garrya wrightii	Wright's silktassel	Perennial Shrub	Moderate
	Gossypium thurberi (Thurberia thespesioides)	Native cotton, Thurber's cotton	Perennial Shrub	Moderate
	Justicia candicans	Red justicia, Arizona water-willow	Perennial Shrub	Moderate
	Rhus glabra	Smooth sumac	Perennial Shrub	Moderate
	Rhus ovata	Sugar bush, sugar sumac	Perennial Shrub	Moderate
	Rhus trilobata	Three-leafed sumac, skunkbush sumac	Perennial Shrub	Moderate
VINES				
	Ipomoea hederifolia (Ipomoea coccinea var. *hederifolia)*	Scarlet creeper	Annual Vine	Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Aquilegia chrysantha	Yellow Columbine	Perennial Forb	High
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum (*Dichelostemma pulchellum*)	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium (*Zauschneria californica*)	Hummingbird trumpet	Perennial Forb	Moderate
	Penstemon pseudospectabilis	Desert Penstemon	Perennial Forb	Moderate
ANNUAL WILDFLOWERS				
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
GRASSES				
	Aristida ternipes	Spidergrass	Perennial Grass	Low
	Leptochloa dubia	Green sprangletop	Annual Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate

APPROVED PLANT SPECIES (BY WATERSHED) FOR USE IN RIPARIAN MITIGATION AREAS, PIMA COUNTY, ARIZONA

SABINO CANYON WASH

	Botanical Name	Common Name	Life Form	Water Requirements
XERORIPARIAN				
TREES				
	Acacia greggii	Catclaw acacia	Perennial Tree	Low
	Chilopsis linearis	Desert willow	Perennial Shrub/Small Tree	Low-Moderate
	Parkinsonia florida (*Cercidium floridum*)	Blue paloverde	Perennial Tree	Low-Moderate
	Parkinsonia microphylla (*Cercidium microphyllum*)	Foothills Palo Verde, yellow palo verde	Perennial Tree	Low
	Ambrosia deltoidea	Triangle-leaf bursage	Perennial Shrub or Sub-Shrub	Low
SHRUBS				
	Ambrosia deltoidea	Triangle-leaf bursage	Perennial Shrub	Low
	Calliandra eriophylla	Fairy duster	Perennial Shrub	Low
	Condalia warnockii	Warnock condalia, Warnock's snakeweed	Perennial Shrub	Low
	Dodonaea viscosa	Hopbush	Perennial Shrub	Moderate
	Encelia farinosa	Brittlebush	Perennial Shrub	Low
	Ericameria laricifolia (Haplopappus laricifolius)	Turpentine bush	Perennial Shrub	Low
	Eriogonum fasciculatum var. foliolosum/polifolium	Flat-top buckwheat	Perennial Shrub	Moderate
	Gossypium thurberi (Thurberia thespesioides)	Native cotton, Thurber's cotton	Perennial Shrub	Moderate
	Hymenoclea monogyra (Ambrosia monogyra)	Burrobrush, single whorl burrobrush	Perennial Shrub	Moderate
	Hyptis emoryi	Desert lavender	Perennial Shrub	Low
	Justicia candicans	Red justicia, Arizona water-willow	Perennial Shrub	Moderate
	Larrea tridentata var. tridentata	Creosote bush	Perennial Shrub	Low
	Simmondsia chinensis	Jojoba	Perennial Shrub	Low
	Tecoma stans	Yellow bells, yellow trumpetbush	Perennial Shrub	Low
	Trixis californica	Trixis, American threefold	Perennial Shrub	Low
VINES				
	Cucurbita digitata	Fingerleaf gourd	Perennial Vine	Low-Moderate
	Ipomoea hederifolia (Ipomoea coccinea var. *hederifolia)*	Scarlet creeper	Annual Vine	Moderate
	Maurandya antirrhiniflora	Snapdragon vine, roving sailor	Perennial Vine	Moderate
CACTI & SUCCULENTS				
	Ferocactus wislizeni (Echinocactus wislizeni)	Candy barrel cactus	Perennial Cactus	Low
	Nolina microcarpa	Beargrass, sacahuista	Perennial Lily	Low
	Opuntia phaeacantha	prickly pear	Perennial Cactus	Low
PERENNIAL FORB/SUB-SHRUBS				
	Ambrosia ambrosioides	Canyon ragweed	Perennial Sub-Shrub	Moderate
	Brickellia coulteri	Brickelbush, Coulter's brickelbush	Perennial Sub-Shrub	Moderate
	Dichelostemma capitatum	Bluedicks	Perennial Forb	Low
	Dicliptera resupinata	Arizona foldwing	Perennial Forb	Low
	Epilobium canum ssp. latifolium (*Zauschneria californica*)	Hummingbird trumpet	Perennial Forb	Moderate
	Machaeranthera tanacetifolia (Aster tanacetifolius)	Tanseyleaf tansyaster, purple aster	Perennial Forb	Low
	Zinnia acerosa (Zinnia pumila)	Desert zinnia	Perennial Sub-Shrub	Low
ANNUAL WILDFLOWERS				
	Eriastrum diffusum	Miniature woollystar	Annual Forb	Low
	Kallstroemia grandiflora	Arizona poppy	Annual Forb	Low
	Lupinus sparsiflorus ssp. mohavensis	Coulter's lupine	Annual Forb	Moderate
	Nama demissum var. demissum	Purplemat	Annual Forb	Moderate
GRASSES				
	Aristida ternipes	Spidergrass	Perennial Grass	Low
	Bothriochloa barbinodis (Andropogon barbinoides)	Cane beardgrass	Perennial Bunchgrass	Moderate
	Dasyochloa pulchella (Erioneuron pulchellus, Tridens pulchellus)	Fluffgrass, low woolly grass	Perennial Grass	Low
	Hilaria belangeri var. belangeri (Anthephora belangeri)	Curly-mesquite	Perennial Tufted Grass	Moderate
	Leptochloa dubia	Green sprangletop	Annual Grass	Moderate
	Muhlenbergia rigens	Deergrass	Perennial Bunchgrass	Moderate

appendix C
installation & maintenance requirements

Draft

The use of proper planting techniques for installing plant material in mitigation areas is important for initial plant establishment. Inadequate plant installation may have detrimental effects on the long-term health of plant material and could cause plant mortality prior to reaching maturity.

Standard Plant Installation Methods

All plant material shall be installed in accordance with planting details referenced in the *City of Tucson and Pima County Standard Specifications for Public Improvements (2003)* and *City of Tucson and Pima County Standard Details for Public Improvements (2003)*, available online at:

http: //www.dot.pima.gov/transeng/stdspecsdet/standardspecs2003.pdf

http://www.dot.pima.gov/transeng/stdspecsdet/standarddetails2003_vector.pdf

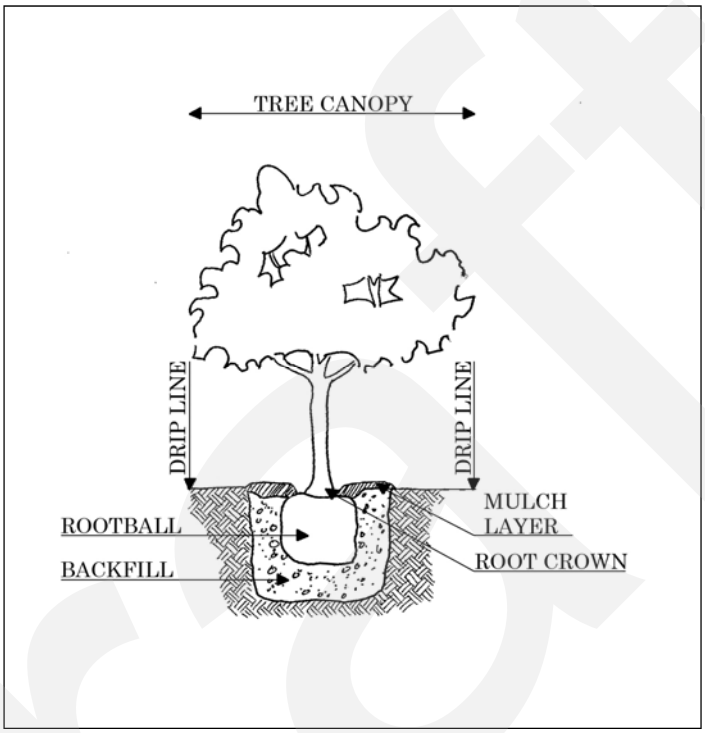
The following recommendations use landscaping industry accepted planting methods to ensure survival and long-term health of installed plant material. For additional information on standard planting methods, consult with a local nursery (see Appendix B), or contact a Landscape Architect, or reputable landscape contractor.

- Inspect all plant material upon arrival to the site.
    - ◊ Check for any signs of mechanical damage, such as wounds in the bark or stems or broken branches.
    - ◊ Check for any signs of serious insect or disease problems.
    - ◊ Examine foliage, color, and density as signs of general health.
    - ◊ Check sales invoice and plant label to ensure correct native plant species were delivered (see Appendix B, pages B-9 thru B-11).
    - ◊ Check container plants to ensure they are not root-bound.* If the plants are root-bound they should be rejected.

      **A plant is considered root-bound when kept in a container too long, resulting in the root growth becoming restricted, tangled and matted. This condition typically results in stunted plant growth.*

- The planting hole should be wider and deeper than the root ball. See planting detail no. 408-410 from *City of Tucson and Pima County Standard Details for Public Improvements (2003)* .

- Make sure the root crown will be above grade level when the hole is filled.



Typical planting detail and terms.

- Remove all non-biodegradable nursery wrappings (i.e. plastic containers, wires, and tags).

- Place the plant in the center of the hole, and make sure the plant is straight, as it is difficult to reposition the plant once the hole is backfilled.

- Backfill half of the hole with soil (preferably with the same soil that was removed). Saturate the soil to fill all holes and cavities around the roots. Finish backfilling the hole and water. Make sure the root crown remains exposed.

- Three to four inches of organic mulch material should be spread 5 to 7 feet around trees, and 3 feet around other plantings. Two to three inches of bare soil should be left around the base of the plant to avoid trunk suffocation or rot.

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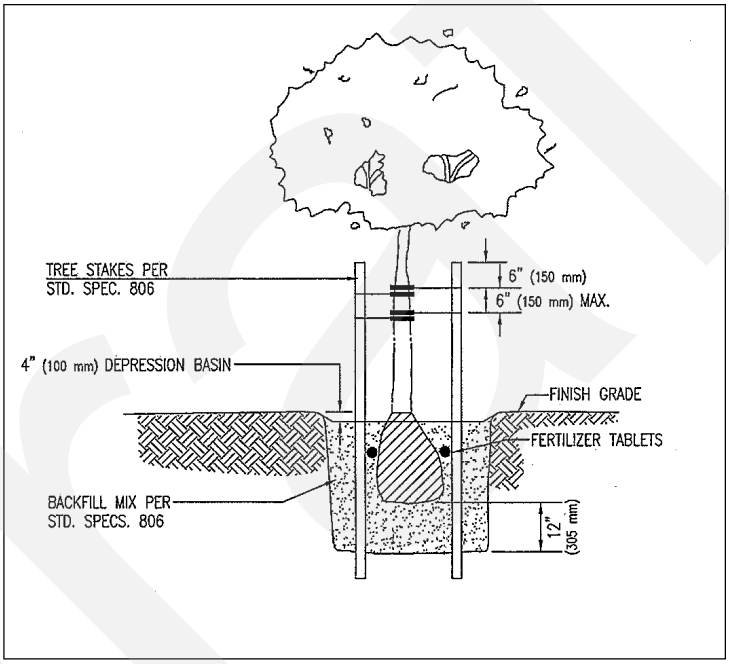
- Plants generally do not require staking. Staking is usually required when a plant cannot support itself with its existing root system, for example, in a strong wind situation, loose soils, wet conditions, or very large specimen size. The critical issue with staking is attaching the plant to the stake. It is recommended that wide, flexible cloth or elastic trapping be used as it causes less injury to the plant and can expand as the plant grows. A section of old hose works well for this purpose. The ties should be tight enough to support the tree but not so tight as to prevent swaying. Stakes should be removed after one year, once the plant's root system has established.



Tree Staking Detail no. 410 from *City of Tucson and Pima County Standard Details for Public Improvements (2003)*

- Proper spacing of plant material is determined by the mature canopy width of each plant species. In order to maintain proper plant spacing within the landscape, plants should be spaced no closer than their maximum width at maturity, using the larger mature canopy width to determine spacing. For example, if shrub "A" has a mature width of three feet and shrub "B" has a mature width of two feet, then both shrubs should be planted no closer than three feet apart. All distances should be measured from the center of plant "A" to the center of plant "B".

Standard Plant Installation Methods (continued)

- Applicants should review the mature canopy width table at the end of this appendix to assist in establishing proper plant spacing within the mitigation area. If the mitigation area is located within existing habitat, the applicant must account for existing vegetation when placing new plantings.
- Based on average planting densities for each riparian habitat classification, and accounting for an average mature canopy width, the actual size of the mitigation area provided shall be no less than 70 % of the disturbed area, unless an onsite vegetation survey has been provided that justifies sustainability of a more densely planted area (see Section 2 and Appendix G). Additionally, a higher planting density may be allowed if the applicant can demonstrate the new planting density is sustainable (i.e., plants will receive enough water once established to survive, without supplemental irrigation). This may be accomplished by placing plants within an artificially constructed basin, such as a detention basin or water harvesting basin and by providing a water balance calculation based on plant water needs, average annual rainfall amounts for the Tucson basin, and retention volumes for the constructed basins.

Seed Application

Seed shall be applied by one of three methods: hydroseeding, drill seeding with crimped straw mulch, or broadcast seeding and raking into seedbed with straw or other appropriate mulch. For previously disturbed areas that will be hydroseeded, imprinting or pitting of the soil surface prior to seed application is recommended. This process creates niches for water , seed, and mulch to accumulate, increasing chances for seed germination. Seed shall be applied in accordance with standard specifications detailed in Sections 805-2.03 thru 3.01, 805-3.02 (B), and 805-3.03 thru 805-4 of the *City of Tucson and Pima County Standard Specifications for Public Improvements*.

To ensure proper seed germination, seeding shall occur prior to the summer or winter rains, which may or may not coincide with planting of containerized plants. If this occurs, please note when seeding will occur on the Mitigation Plan and initial monitoring report submittal.

During the initial establishment period, the irrigation of trees and shrubs is essential. As part of the mitigation plan, irrigation must be provided to trees and shrubs in order to establish all transplanted plant material. A properly designed and installed automatic drip irrigation system is required for subdivision and commercial development, but is also recommended for single-lot development, and should be designed and installed as required by *City of Tucson and Pima County Standard Specifications for Public Improvements (2003) and City of Tucson and Pima County Standard Details for Public Improvements (2003)*. The specifications and standard details are available online at:

http://www.dot.pima.gov/transeng/stdspecsdet/standardspecs2003.pdf

http://www.dot.pima.gov/transeng/stdspecsdet/standarddetails2003_vector.pdf

An applicant may submit a proposal for an alternative system, such as an automatic bubbler or a soaker hose on a timer. Hand watering is an option available only to single-lot property owners. To obtain approval, the applicant must demonstrate that an alternative irrigation system will provide sufficient irrigation water at appropriate intervals to ensure establishment and long-term survival of mitigation plantings.

Watering Requirements for Installation

Once the irrigation system is installed, establish an irrigation schedule. An irrigation schedule should take into account soil type, plant water requirements, plant size and time of year. The schedule also needs to be adjusted seasonally to accommodate variations in localized temperatures, rainfall, day length, growing season, age of plants, drought tolerance of plants, and other factors. There are several publications that can assist you in determining an irrigation schedule, including the following:

An interactive version of the *Landscape Watering by the Numbers* booklet from Water Use It Wisely can be found online at:
http://www.wateruseitwisely.com/region/arizona/100-ways-to-conserve/outdoor-tips/water-guides/Landscape-Watering-Guide.pdf

The *Guidelines For Landscape Drip Irrigation Systems (2001)* booklet from the Arizona Landscape Irrigation Guidelines Committee (Appendix M - "A Simplified Approach for Determining Landscape Watering Schedules" and Appendix J - "Estimated Water Requirements for Tucson, Arizona—Desert Adapted Plants, Native) is available for download online at:
http://www.amwua.org/pdfs/drip_irrigation_guide.pdf

For additional information on irrigation systems and irrigation water schedules, consult with a local irrigation professional or contact a Landscape Architect or reputable landscape contractor.

Table 1 contains a general outline of an irrigation schedule. This schedule represents irrigation requirements during the initial establishment period of 1 to 2 years. Temperature and rainfall can vary significantly even within normally hot and cold seasons, and normally wet or dry times of the year, therefore, months are shown to overlap, representing a range of conditions. The two primary rainfall seasons in the Sonoran desert are the summer monsoon season, which typically extends from July to September, and the winter rainfall season from December to March.

TABLE 1. Example Irrigation Schedule for Establishing New Plants

Daytime Temperature	Precipitation	Approximate months	Tree watering*	Shrub watering*
Hot to warm	Dry	September, October, November	Once every 2 weeks	Once every week
Cool to cold	Occasional rain	November, December, January, February	Once a month	Once every 2 weeks
Cool to warm	Occasional rain	February, March, April	Once every 2 weeks	Once a week
Hot	Dry	April, May, June	Once every 5 days	Once every 3 days
Hot	Monsoon rains	July, August, September	Once every 2 weeks	Once a week

*To determine an irrigation schedule specifically for your site, review the publications noted on page C-6, and consult with a local irrigation professional, Landscape Architect, or reputable landscape contractor.

Maintaining Mitigation Plantings

The mitigation area shall be maintained for a period of 5 calendar years following installation, to ensure establishment of a new riparian plant community.

The intent of the mitigation area is to establish vegetation that replicates the natural conditions within a riparian habitat. With this goal, regular pruning and shaping of trees is prohibited. Understory plants should also be allowed to grow to their natural form. Mowing and/or chemical control of understory plant growth should be avoided, unless it is selectively used on noxious and/or invasive plant species.

The ultimate goal is to ensure plants develop a deep and stable root system to survive in arid conditions. The monitoring, repair, and proper operation of the irrigation system will be an essential part of the maintenance program.

The following is an outline of the minimum requirements for mitigation planting maintenance. Site specific conditions may make additional maintenance necessary and appropriate for certain projects.

What to do	How often
Check plants/replace dead trees and shrubs	4 times/year until plants have established (typically through the second year). Success criteria outlined on page C-9 will need to be met.
Remove Noxious and/or Invasive Plant Species/Weeds	2 times/year or as needed (see Appendix E)
Reseed & Stabilize Eroded Areas	As-needed
Check & Repair Damaged Tree Stakes and browser cages	Once a month for first growing season. Tree stakes can typically be removed after one year.
Fencing used to exclude livestock from Mitigation Area.	As needed

Irrigation Standards for Maintenance

An irrigation system needs regular maintenance to run properly. The following is an outline of minimum requirements for maintaining a drip irrigation system.

What to do	How often
Check irrigation system operation	At least once a month
Reprogram irrigation system controller(s)	4 times/year (see general schedule)
Repair damaged irrigation system components	As needed
Run the irrigation for double the normal run time to flush salt buildup from the soil.	Twice yearly
Move drip irrigation emitters to drip line as the plant grows	As needed

Watering Requirements for Maintenance

Once healthy root systems are established (approximately two years but varies with site conditions), the plants should be "weaned" from supplemental irrigation. Adjust the irrigation schedule until plants can survive on natural rainfall. This can be accomplished by decreasing the frequency of irrigation each year. For example, if plants are watered once each week during the establishment period, the frequency would be adjusted to once every two weeks during the first year of weaning, once every three weeks during the second year of weaning, once every four weeks during the third year of weaning, and no watering would occur in subsequent years. Even after establishment, during extreme drought, certain plants may require supplemental irrigation.

Criteria for Success

Native plants are well adapted to annual rainfall amounts in the Tucson Basin and most will survive on natural rainfall alone, once established. To create a successful mitigation area, initial plant establishment is important. Proper "weaning" of the plant from supplemental irrigation in order to establish a healthy root system, as mentioned above, is essential. Once supplemental irrigation has been reduced or eliminated, it is the applicant's or their successor's responsibility to continue monitoring plant health for the remainder of the five year maintenance period. Establishment of the mitigation area will be considered successful when 80% of the plants are living and actively growing (without significant die back or loss) after one year without supplemental irrigation.

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Average Mature Canopy Width Table

Botanical Name	Common Name	Average Mature Canopy Width
Trees		
Acacia constricta	Whitethorn acacia	16
Acacia greggi	Catclaw acacia	18
Celtis reticulata	Netleaf/Canyon hackberry	28
Chilopsis linearis	Desert Willow	23
Fraxinum velutina	Arizona Ash, Velvet Ash	28
Juglans major	Arizona black walnut	50
Olneya tesota	Ironwood	24
Parkinsonia florida	Blue Palo Verde	28
Parkinsonia microphylla	Foothills Palo Verde	17
Platanus wrightii	Arizona sycamore	35
Populus fremontii	Fremont cottonwood	40
Prosopis pubenscens	Screwbean Mesquite	20
Prosopis velutina	Velvet mesquite	28
Quercus emoryi	Emory oak	40
Salix gooddingii	Goodding's willow	25
Sambucus nigra (mexicana)	Mexican elderberry	18
Sapindus saponaria var. drummondii	Western Soapberry	30
Shrubs		
Ambrosia ambrosioides	Canyon Ragweed	4
Ambrosia d eltoidea	Triangle-leaf bursage	2
Anisacanthus thurberi	Desert honeysuckle	4
Asclepias tuberosa ssp. Interior	Butterfly milkweed	2
Atriplex canescens	Four-winged saltbush	9
Atriplex canescens	Quailbush	11
Baccharis salicifolia	Seep Willow	9
Berberis haematocarpa	Red mahonia	12

Botanical Name	Common Name	Average Mature Canopy Width
Shrubs, cont.		
Calliandra eriophylla	Fairy Duster	4
Celtis pallida	Desert Hackberry	10
Cephalanthus occidentalis	Buttonbush	9
Condalia warnockii	Warnock condalia	7
Dodonaea viscosa	Hopbush	10
Encelia farinosa	Brittlebush	4
Ericameria laricifolia	Turpentine Bush	3
Eriogonum fasciculatum	Flat-top Buck-wheat	3
Garrya wrightii	Silktassel	6
Gossypium thurberi	Native Cotton	3
Hymenoclea monogyra	Burrobush	5
Hyptis emoryi	Desert Lavender	7
Justicia candicans	Red Justicia	3
Larrea tridentata	Creosote Bush	6
Lycium andersonii	Anderson Wolf-berry	6
Lycium fremontii	Fremont Wolfberry	7
Parthenium incanum	Mariola	3
Rhus glabra	Smooth Sumac	10
Rhus microphylla	Little-Leafed Su-mac	9
Rhus Ovata	Sugar Bush	10
Rhus trilobata	Three-Leafed Sumac	9
Ribes aureum	Wax Current	3
Senecio Salignus	Senecio	7
Simmondsia chinensis	Jojoba	8
Tecoma stans v. angustata	Yellow bells	6
Trixis californica	Trixis	3
Vauquelinia californica	Arizona Rosewood	11
Ziziphus obtusifolia	Graythorn	8

appendix D:
water harvesting guidelines

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Water Harvesting

Water harvesting is the process of capturing, diverting, and storing rainwater and stormwater runoff for plant irrigation and other uses. Runoff may be collected from roofs, parking/paved areas, patios, and other land surfaces. Collected runoff can be retained and allowed to infiltrate into the ground or routed through landscaped areas using water harvesting structures, such as microbasins or swales.

Benefits of Water Harvesting

Urban development tends to have a high ratio of impervious areas (roofs, driveways) to pervious areas (undeveloped, vegetated areas). There are numerous benefits to harvesting and using stormwater onsite, such as:

- A reduction in potable water use for landscape irrigation;
- Groundwater recharge;
- Reduce water bills and groundwater pumping;
- Reduce offsite flooding and erosion by retaining and infiltrating rainwater onsite;
- Increase water availability for onsite vegetation;
- Extend the life of landscaping by reducing salt accumulation in the soil which can be harmful to root growth.

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Water Harvesting Techniques

Water harvesting techniques range from simple to complex systems. A simple water harvesting system may include extending downspouts from a roof to reach planted areas, or creating onsite depressions designed specifically to harvest rainwater and planting in and around these depressions. A more complex water harvesting system utilizes some type of collection and storage (cisterns, rain barrels, etc.), conveyance and distribution systems to retain and control where water goes.

Many methods are available to harvest rainwater for landscape use. Some of these include, but are not limited to:

Microbasins	Localized basins served by small drainage areas that collect stormwater.
Swales On-Contour	Swales and associated berms constructed parallel to contour lines that intercept small to moderate volumes of shallow, slow-moving stormwater (sheet flow).
Swales Off-Contour	Swales constructed at a slight angle to the contour line that convey stormwater slowly down the slope in a controlled manner to maximize infiltration, support vegetation, control erosion, and reduce stormwater flow velocity.
French Drains	Rock-filled trenches that are designed to encourage rapid stormwater infiltration through the sides, ends and bottom of the trench where soil and water meet.
Water Tank/Cisterns	Collection and storage devices that capture and store rooftop runoff for use at a later time

Source: City of Tucson Water Harvesting Guidance

Important Notes

- All rainwater harvesting structures should be designed to fully infiltrate rainwater into the soil within 12 hours of the rainfall event in order to avoid creation of an environment that will encourage mosquito breeding.
- Rainwater harvesting depressions should be placed at least 10 feet from the foundations of buildings or walls to prevent saturated soil conditions that could cause settling of foundations.

Additional Information

- Information on how to design and construct water harvesting features is available in the City of Tucson Water Harvesting Guidance Manual. The manual is available from the Stormwater Division of the City of Tucson Department of Transportation and from the Arizona Department of Water Resources, Tucson Active Management Area. The manual can also be downloaded online at:

  http://dot.tucsonaz.gov/stormwater/downloads/2006WaterHarvesting.pdf

- Websites

  http://ag.arizona.edu/pubs/water/az1052

  http://www.sahra.arizona.edu/

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appendix E

list of noxious & invasive
plant species
&
best management practices

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Noxious and Invasive Species Plant List

Maintenance of riparian mitigation area(s) includes removal of "noxious and/or invasive plant species" from the mitigation area over the five year maintenance period. The following lists and definitions are provided to assist property owners in following these requirements.

Noxious Weed Species

Noxious weeds included on Federal and State noxious weed species lists are non-native plant species that are regulated by legislative action or statue controlling the management and/or movement of these species throughout the U.S. (Federal Noxious Weed Act of 1974). This list includes plant species most commonly deemed a threat to agriculture, mainly from an economic and/or environmental aspect.

Invasive Species

In 2007, Governor Napolitano signed Executive Order (EO) 2007-07, which provides guidance in establishing a coordinated and comprehensive plan for invasive species management, including a definition and listing of invasive species. EO 2007-07 defines an invasive species as, "A species that is (1) non-native to the ecosystem under consideration and, (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health." The Final Arizona Invasive Species Management Plan was published on June 30, 2008 and can be viewed at:
http://governor.state.az.us/ais

The Federal and State noxious weed lists have not been included in this appendix but can be viewed at the following websites:

Federal Noxious Weed Species List:
http://plants.usda.gov/java/noxious?ptType=Federal

State Noxious Weed Species List:
http://www.azda.gov/PSD/quarantine5.htm

For property owners without internet access, hard copies will be available at our customer service counter.

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Arizona Wildlands Invasive Plant Working Group: Invasive Species Plant List

The following list was developed by the Arizona Wildlands Invasive Plant Working Group and adopted by the Arizona Invasive Species Advisory Council under EO 2007-07. The list was created to address invasive, non-native plant species that pose an ecological threat to wildlands in Arizona, and is divided into three categories, indicating the severity of ecological impacts on plant communities by invasive species. Plant species listed shall be controlled within disturbed and mitigated area(s) to prevent the spread into surrounding areas.

The entire document can be viewed at:

http://www.swvma.org/InvasiveNon-NativePlantsThatThreatenWildlandsInArizona.pdf

Hard copies of this document are available at our customer service counter, located at 97 E. Congress Street, 3rd floor.

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Arizona Wildlands Invasive Plant Working Group: Invasive Species Plant List (continued)

Scientific Name	Common Name
High	
Acroptilon repens	Russian knapweed
Arundo donax	Giant reed
Bromus rubens	Red brome
Bromus tectorum	Cheatgrass
Centaurea solstitialis	Yellow starthistle
Eichhornia crassipes	Water hyacinth
Elaeagnus angustifolia	Russian olive
Eragrostis lehmanniana	Lehmann lovegrass
Euphorbia esula	Leafy spurge
Euryops multifidus	Sweet resinbush
Lepidum latifolium	Perennial pepperweed
Myriophyllum aquaticum	Parrot's feather
Myriophyllum spicatum	Eurasian watermilfoil
Pennisetum ciliare	Buffelgrass
Pennisetum setaceum	Fountain grass
Salvina molesta	Giant salvinia
Tamarix chinensis	Fivestamen tamarisk
Tamarix parviflora	Smallflower tamarisk
Tamarix ramosissima	Saltcedar
Medium	
Alhagi maurorum	Camelthorn
Avena fatua	Wild oat
Brassica tournefortii	Sahara mustard
Bromus diandrus	Ripgut brome
Bromus inermis	Smooth brome
Cardaria chalapensis	Lenspod whitetop
Cardaria draba	Whitetop
Cardaria pubescens	Hairy whitetop
Carduus nutans	Musk thistle
Centaurea biebersteinii	Spotted knapweed
Centaurea diffusa	Diffuse knapweed
Centaurea melitensis	Malta starthistle
Chondrilla juncea	Rush skeletonweed
Cirsium arvense	Canada thistle
Conium maculatum	Poison hemlock
Convolvulus arvensis	Field bindweed

Arizona Wildlands Invasive Plant Working Group: Invasive Species Plant List (continued)

Scientific Name	Common Name
Cortaderia selloana	Pampas grass
Cynodon dactylon	Bermudagrass
Erodium cicutarium	Redstem filaree
Hordeum murinum	Mouse barley
Linaria dalmatica	Dalmatian toadflax
Linaria vulgaris	Yellow toadflax
Lolium perenne	Perennial ryegrass
Melilotus alba	White sweetclover
Melilotus officinalis	Yellow sweetclover
Mesembryanthemum nodiflorum	Slenderleaf iceplant
Rhus lancea	African sumac
Rubus armeniacus	Himalayan blackberry
Rubus discolor	Himalayan blackberry
Saccharum ravennae	Ravennagrass
Salsola collina	Slender Russian thistle
Salsola paulsenii	Barbwire Russian thistle
Salsola tragus	Prickly Russian thistle
Schismus arabicus	Arabian schismus
Schismus barbatus	Common Mediterranean grass
Sonchus asper	Spiny sowthistle
Sonchus oleraceus	Annual sowthistle
Sorghum halepense	Johnsongrass
Ulmus pumila	Siberian elm
Vinca major	Bigleaf periwinkle
Low	
Aegilops cylindrica	Jointed goatgrass
Asphodelus fistulosus	Onionweed
Cirsium vulgare	Bull thistle
Cynoglossum officinale	Houndstongue
Echinochloa crus-galli	Barnyardgrass
Elymus repens	Quackgrass
Eragrostis curvula	Weeping lovegrass
Leucanthemum vulgare	Oxeye daisy
Mesembryanthemum crystallinum	Common iceplant
Onoprodum acanthium	Scotch thistle
Panicum antidotale	Blue panicum
Tamarix aphylla	Athel tamarisk

Noxious and Invasive Weed Control

Methods for control of noxious and invasive weeds is species specific and may depend on the site conditions (i.e., the presence of desirable plants, sensitive areas, or terrain conditions).

For the successful removal of noxious/invasive species, one must consider the plant's characteristics and context in which it is growing. What may be a successful solution in one situation does not mean it will be effective or appropriate in another.

Weed control may require a combination of different methods (i.e., mechanical, chemical, etc.), and some follow-up work will nearly always be required in order to achieve success.

Noxious and Invasive Weeds Best Management Practices

Best Management Practices (BMPs) are practices and/or procedures that can be used to mitigate and/or prevent the adverse effects of noxious and invasive weeds. The following is a list of BMPs for noxious and invasive weeds:

- Use native plants for landscaping or plants that are not known to be invasive. Work with local nurseries that specialize in native plants if you are unsure about plant identification and selection.

- Learn to identify invasive and noxious plants in your area. If an invasive or noxious weed is identified, research the best method for control of the plant.

- Mechanical control (pulling, mowing, or cutting) is common for plants that do not reproduce vegetatively (roots, stolons) and can be successful if implemented annually, prior to seed setting (i.e., when seeds are ready for distribution).

    - Mechanical control should be timed with the life cycle of the plant species targeted to prevent seed distribution.
    - Pulling may be effective earlier in the life cycle when tap roots and plant size are smaller.
    - Cutting or mowing may be successful after flowering or significant growth but prior to seed set.
    - The removal of plant material will reduce root reserves to prevent reflowering and seeding for the year.

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- Chemical control is typically used on plants with a prolific root system to prevent resprouting. This type of control may be repeated on an annual basis, typically before the plant flowers or sets seed. Trees such as Russian olive or salt cedar may be injected with herbicide rather than spraying. This type of control may be necessary for large populations or where mechanical removal and disposal are not practicable.

    - There are a number of chemical controls available at local stores that are sufficient for removal/control of most noxious and invasive weeds, such as Round Up, Rodeo, and Surflan.

    - If using chemicals, take adequate safety precautions and always read the instructions on the labels.

- Since weeds are not stopped by fences or property lines, it is important to inform neighbors about existing weed populations and how to prevent their spread. A cooperative effort from surrounding neighbors may be necessary to prevent and protect the landscape from invasive weeds. There may be state or county weed programs in your area that can offer assistance or guidance for cooperative control.

- To prevent the spread or possible invasion of new weeds, avoid disturbance to natural areas or clearing of native vegetation and clean off equipment, vehicles, and/or domestic animals that may have been exposed to weeds.

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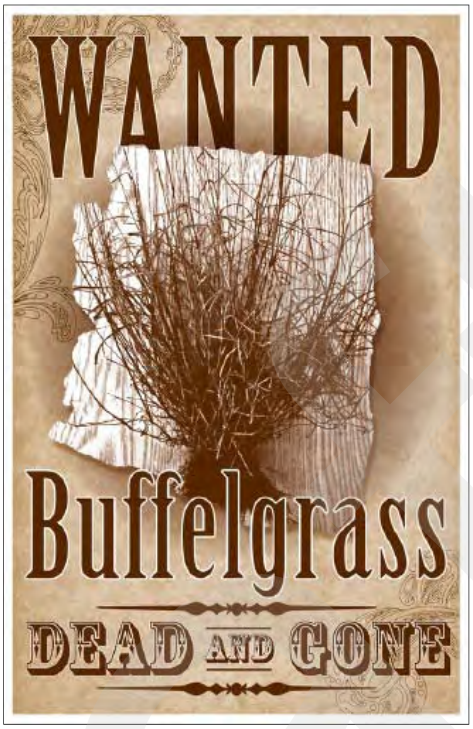

Buffelgrass is spreading rapidly across Arizona's deserts and poses an immediate threat to the integrity of the Sonoran desert. Buffelgrass, (*Pennisetum ciliare*), is a fire-prone grass introduced from the African savannah that grows in dense stands, crowds out native plants and can fuel frequent and devastating fires in what has been generally a fireproof desert. Competition for water can weaken and kill desert plants, even larger trees and cacti, while dense roots and ground shading prevent germination of native seeds. Buffelgrass can kill or exclude most native plants by these means alone; wildfires will only hasten the process. Buffelgrass will produce new leaves and flower spikes very quickly after a light rain, almost anytime of the year, making it an extremely prolific seed producer.

For more information, view the Buffelgrass Action Center website:

http://www.buffelgrass.org/

Websites:

USGS Southwest Exotic Plant Information Clearinghouse — http://sbsc.wr.usgs.gov/research/projects/swepic/swepic.asp

National Invasive Species Information Center (NISIC) – http://www.invasivespeciesinfo.gov/

Natural Resources Conservation Service Plants Database – http://plants.usda.gov

The Bureau of Land Management Weeds Website – http://www.blm.gov/weeds

TNC Global Invasive Species Team – http://tncinvasives.ucdavis.edu/

Center for Invasive Plant Management – http://www.weedcenter.org/index.html

U.S. Fish and Wildlife Service Invasive Species Program —http://www.fws.gov/invasives/

Plant Conservation Alliance Alien Plant Working Group – http://www.nps.gov/plants/alien/index.htm

Weed Science Society of America (WSSA) – http://www.wssa.net

University of California Cooperative Extension Weed Research and Information Center (WRIC) – http://wric.ucdavis.edu/index.html

Information on Buffelgrass— http://Buffelgrass.org

http://www.desertmuseum.org/invaders/

http://www.pima.gov/nrpr/eeduc/outreach/outabout.htm

Books:

Weeds of the West. 2001. Tom D. Whitson

Biology and Management of Noxious Rangeland Weeds. 1999. Roger L. Sheley and Janet K. Petroff.

Aquatic and Riparian Weeds of the West. 2003. Joseph M. DiTomaso and Evelyn A. Healy.

Draft

appendix F
field mapping
&
onsite vegetation survey

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Field Verification & Mapping of Riparian Habitat

The regional scale mapping of riparian habitat provides a starting point for the delineation of riparian habitat regulated under the Ordinance and requiring mitigation. An applicant has the option of accepting the maps adopted by the Board or completing site specific field verification and mapping to better understand the vegetative characteristics of riparian habitat on the property. Site specific field assessment and verification of the adopted Riparian Classification Maps, based upon current aerial photographs, rectified to the proposed project's engineering and planning base maps, is the preferred means of establishing a baseline for impact assessment and mitigation planning. The following criteria apply to the field verification of Regulated Riparian Habitat (RRH) within a property or project area.

Qualifications

Field mapping of RRH for the purpose of adjusting habitat boundaries or an onsite vegetation survey to document total vegetative volume, species composition, and quantities for purposes of mitigation calculations shall be completed by a qualified professional with one or more of the following qualifications:

1. An arborist with International Society of Arboriculture certification;
2. A landscape architect with Arizona state technical registration as a landscape architect;
3. A biologist, horticulturist, or botanist with a minimum B.A. or B.S. in a plant oriented natural resource field.

Applicability

Requests for adjusting RRH boundaries will be considered for all classifications except for IRA. IRA boundaries are part of the Conservation Land System (CLS) mapping adopted by the Pima County Board of Supervisors and were created to preserve landscape linkages and biological corridors for wildlife movement along with providing critical watershed and water resource functions. Therefore, IRA boundaries are not subject to adjustment or modification.

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Quantitative Methods for Field Mapping RRH

The Riparian Classification Maps were produced at a scale of 1" = 2,000', using orthophotography, 2000 LANDSAT satellite imagery, and other data, such as plant community structure and composition, vegetation density and the availability of water, and provide a general location of RRH. The Ordinance allows for delineation of mapped riparian boundaries and characterization of mapped riparian habitat to reflect site conditions for purposes of mitigation. Technical data may be submitted by a qualified professional to determine onsite conditions, for review and approval by the District.

Modification of RRH Boundaries

A qualified professional will identify and delineate homogenous vegetation units along a watercourse using a combination of aerial photographs, topographic maps, on-the-ground photographs, field observation, and field survey. See TECH-116 in Appendix G for boundary delineation requirements.

Onsite Vegetation Survey: Determining Plant Community Characteristics within a Mapped RRH Boundary

For purposes of calculating mitigation requirements for disturbance to RRH or when the applicant believes site conditions vary from the mapped RRH (major boundary modifications and/or total vegetation volume estimates), either of two sampling methods may be used. Methods include; 1) Total Vegetation Volume (TVV) and Belt Transects, or 2) Plot sampling.

TVV and Belt Transects – The TVV and belt transect sampling method can be used to determine or classify RRH and its boundaries by providing a detailed analysis of plant community structure and composition. The TVV and belt transect sampling method approved for use by the District is a vertical line-intercept technique and can be found in Section 2.0 of TECH-116, Appendix G.

Plot Sampling – Plot sampling (also called quadrat sampling) is used to define plant community characteristics, including cover type, frequency, and density. The plot sampling method approved for use by the District is found in Section 3.0 of TECH-116, Appendix G.

Onsite Vegetation Survey Requirements for Xeroriparian Class D

Section 2 of the Guidelines state that requirements for determination of mitigation within Xeroriparian Class D habitat are as follows; for tree mitigation, *"At least 30 trees per acre of mitigation or 1 tree per existing tree (whichever is less). Vegetation in Xeroriparian Class D mitigation areas must be replaced in-kind from existing species."* And for shrub mitigation, *"Replace in like-kind and density."*

This will require an onsite determination of plant species composition for both trees and shrubs along with a determination of shrub density prior to disturbance of the site. To assist an individual property owner in determining mitigation requirements for Xeroriparian Class D habitat, the following checklist was created, outlining submittal requirements for an onsite vegetation survey. Unlike the other classes of habitat which require that onsite vegetation surveys be completed by a qualified professional (landscape architect, biologist, horticulturist, botanist, or arborist), a survey of Xeroriparian Class D habitat can be completed by the property owner. The following guidelines may only be used for determination of mitigation requirements within Xeroriparian Class D habitat. All other classes of habitat shall be surveyed by a qualified professional and use the methods outlined in this Appendix and TECH-116, found in Appendix G.

One 11 x 17" or larger plan sheet will be required. The plan sheet shall include the following information:

- ☐ Provide a recent aerial photograph of the property. Recent aerial photography can be obtained at: http://www.dot.pima.gov/gis/maps/mapguide/
- ☐ Plan sheet shall show property boundaries, north arrow and scale, property information (owners name, address, and parcel code), and be to a measureable scale of 1" = 100' or larger. If your parcel is larger than five acres, use of a smaller scale may be allowed per consultation with staff prior to submittal.
- ☐ Label plan "Onsite Plant Survey for Xeroriparian Class D Habitat"
- ☐ Show the 2005-FC2 RRH limits on the plan and label by classification. RRH limits may be viewed at: http://www.dot.pima.gov/gis/maps/mapguide/
- ☐ Show plot locations, to scale.
- ☐ If the vegetation was previously removed, a representative sampling of the site shall be performed using the plot method. For purposes of this survey, the plot method outlined in TECH-116 (Appendix G) shall be used and modified so that only tree and shrub plant species are surveyed. If the site does not contain tree or shrub plant species, the existing vegetation shall be qualitatively described and photographs taken. Mitigation for Xeroriparian Class D habitat that does not contain trees or shrubs may

consist of reseeding the mitigation area with plants from the approved plant list and will be determined on a case-by-case basis. Survey submittals are subject to review and approval by the District.

- ☐ If the site is undisturbed, the applicant shall stake the area of proposed disturbance and provide a count of all trees and shrubs within this area.

Survey Report (provided on an 8 ½" x 11" sheet(s) of paper) shall include the following information:

- ☐ Provide at least one photograph of each survey plot. A sufficient number of photographs shall be taken of each plot so that the entire area is captured within the photograph or series of photographs.
- ☐ If the person performing the survey is unable to identify a specific plant species, the following information must be provided; photographs of the entire plant and a close-up of any identifying characteristics, such as fruit, flowers, thorns and leaf shape/size. Describe the characteristics in writing, and, if possible, bring in a specimen of the plant to be identified. The photographs, written description, and specimen can then be shown either to staff for identification or taken to the University of Arizona Herbarium for identification, (http://ag.arizona.edu/herbarium/index.php, which is located at Herring Hall, 1130 E. South Campus Drive, Tucson, AZ 85721, open M-F, 8:30-4:30 pm for plant identification services at no charge to the public).
- ☐ Provide a table that lists the following information by plot; plant species name (botanical and common) and number of individual plant species (for shrubs only). For trees, provide a list of plant species by name only, if the standard 30/trees per acre option will be used. If the number of trees used for mitigation will be based upon the actual number of trees onsite, a quantity, listed by plant species, will be required.
- ☐ Provide a calculations section. Calculate number of shrubs required for mitigation as follows (example uses a square plot):

  50 feet x 50 feet = 2,500 square feet (sq ft)

  2,500 sq ft /43,560 sq ft/ac = acreage of plot area (ac)

  Acreage of plot area (ac) ***x*** # of shrubs per plot = # of shrubs/ac

  # shrubs/ac ***x*** acreage of disturbance (ac) = # of shrubs required for mitigation

  And calculate the number of trees as follows:

  30 trees ***x*** acreage of disturbance = # of trees

required for mitigation, or

# of trees within regulated riparian habitat = # of trees required for mitigation

When calculating the number of shrubs per acre required for mitigation using the plot method, use the average for all plots sampled. The method used for calculating shrubs can also be utilized for determination of the onsite mitigation requirement for trees, instead of using the standard calculation method outlined in Section 2.

- ☐ Provide any additional information about the site, including plant health, presence of noxious and/or invasive plant species, existing disturbance, etc. that the surveyor feels may be important for assessing on site mitigation requirements.

It is strongly recommended the applicant consult with staff prior to performing an onsite plant survey, to discuss requirements.

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appendix G

pima county regional flood control district technical policies & procedures

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PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
TECHNICAL POLICY

POLICY NO.: Technical Policy, TECH-009 EFFECTIVE DATE: June 13, 2006

POLICY NAME: Standards and conditions for the design and placement of landscaping in or adjacent to drainage channels and basins.

PURPOSE: To clarify section 4.3.2 "Basin Landscaping" of the Stormwater Detention/Retention Manual (Manual) regarding the design and placement of landscaping in or adjacent to drainage channels and detention/retention basins (basins) and explain the potential limitations of this landscaping in satisfying other landscaping requirements, due to the need for access and maintenance required pursuant to 16.36.130 of the Ordinance.

BACKGROUND:

Section 4.3.2 of the Manual establishes basin landscaping guidelines, including specifications of the type, size, and location of trees, shrubs, ground cover and inert materials. Due to the lack of clearly defined terms and implementation procedures as well as the desire by Development Services Department (DSD) and Design Review Committee (DRC) to encourage environmentally sensitive design, a number of proposals have been submitted that do not conform to this Section.

The following design statements require clarification:

- "Trees may be used on basin side slopes, bottom, and periphery. They may not be planted in flow channels".
- "Shrubs may be planted on basin side slopes (both above and below the flood zone), in the periphery, and with special precautions, in the basin bottom. They may not be planted in flow channels."

These statements suggest that the flow channels exist within the basins themselves. Furthermore, the inclusion of a list of water-tolerant species recommended for planting below the inundation level, may compound the confusion. However, the intent of the landscaping guidelines is to **prohibit** landscaping within the flows channels, which are constructed drainageways designed to convey flow, and to **require** landscape buffering around and, in some cases, even within basins; thus the list of plant that can tolerate periodic inundation. Simply put, planting is allowed within basins; plantings in constructed channels are not allowed.

Finally, when placing landscaping around or within basins, the need for maintenance access must be considered. Due to invasive nature of the periodic basin maintenance using heavy equipment, the use in-basin landscaping to satisfy other landscaping or open space requirements is not recommended without taking the maintenance issue into consideration during design.

In order to minimize the number of submittals which do not comply with Section 4.3.2 of the Manual, the following policy establishes that landscaping is prohibited in "flow channels", at basin inlets and outlets, and other areas requiring access. In addition, it states that the use of landscaping in basins to satisfy other requirements must be acknowledged and addressed at the time of basin design.
POLICY:

For the purposes of implementation of landscaping standards of the Manual, the following shall apply:

1) The "flow channel" shall be defined as "Constructed drainageways which are required in order to convey storm water flow" and landscaping shall be prohibited in these areas,

2) In addition, landscaping is also prohibited in the following locations:
   a. Detention/retention basin sediment traps,
   b. Any area within a 20' radius of the detention/retention basin inlet or outlet as measured from the edge of the structure, and
   c. A 12' physical access corridor adjacent to the inflow channel and within the 16' access easement for maintenance purposes.

3) If the in-basin landscaping is intended to satisfy other landscaping requirements, then a sediment trap shall be installed in the basin to reduce the frequency and extent of basin maintenance, the design of the trap shall address the following:
   a. Designed pursuant to the criteria established in Section 3.4 of the Manual,
   b. Permanent concrete monument shall be installed in the trap to define the limits of sediment removal, and
   c. Adequate routine inspection and maintenance schedule pursuant to the maintenance plan that has been reviewed and approved by the District.
   d. If in a public basin, channel or easement, a license agreement which establishes on-going landscaping maintenance responsibilities as well as any mitigation, if needed, shall be completed.

APPROVED BY:

Suzanne Shields 6/14/06

Suzanne Shields
Director Date

Original Policy Approved:
Date(s) Revised:

Draft

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
TECHNICAL PROCEDURE

PROCEDURE NO.: Technical Procedure, TECH-116 EFFECTIVE DATE:

PROCEDURE NAME: Quantitative Methods for Regulated Riparian Habitat (RRH) Boundary Modifications and Onsite Vegetation Surveys

PURPOSE: Delineation of riparian habitat boundaries and characterization of RRH to reflect site conditions for purposes of mitigation of Class H and Xeroriparian Classes A-D under Section 16.30, Floodplain and Erosion Hazard Management Ordinance No. 2005-FC2 (Ordinance).

BACKGROUND:

Section 16.30, *Watercourse and Riparian Habitat Protection and Mitigation Requirements*, of the Ordinance is designed to "promote stable flow and sediment transport conditions, preserve natural floodplain functions, and provide watercourse management by preserving and/or enhancing riparian vegetation and habitat along watercourses and floodplains..." To assist with this goal, Riparian Classification Maps were created to define riparian vegetation along watercourses and floodplains. In addition to the Maps, *Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines* (Guidelines) were created for determining onsite mitigation requirements when greater than 1/3 acre of RRH is disturbed.

The Riparian Classification Maps were produced at a scale of 1" = 2000' using digital orthophotography, 2000 LANDSAT satellite imagery, and data prepared for the Sonoran Desert Conservation Plan, such as water resource and plant community structure and composition mapping. These Maps provide a general location of RRH within unincorporated Pima County. Due to photo rectification issues, i.e., the shifting of RRH polygons relative to the parcel and aerial photograph bases, habitat boundaries shown on the GIS-based Riparian Classification Maps may not accurately reflect the actual location of RRH onsite. Additionally, the Xeroriparian classification system is based on the Total Vegetation Volume (TVV) of riparian habitat within Pima County. The TVV was measured from satellite imagery and averaged for each classification, resulting in average values across the landscape. Mitigation requirements provided in the Guidelines for each class of riparian habitat are based upon these average values.

If an applicant feels the Riparian Classification Maps do not accurately reflect the site conditions, either from the aspect of vegetation density outlined in the Guidelines, delineation of the RRH limits relative to the parcel base, or extent of riparian habitat as shown on the Riparian Classification Maps, they may submit technical data for consideration by the Chief Engineer using the guidelines outlined in this procedure.

APPROVED BY:

_____

Suzanne Shields
Director Date

Original Procedure Approved:
Date(s) Revised:

Draft

Modification of Regulated Riparian Habitat (RRH) Boundaries

General Method:

Identify and delineate homogenous vegetation units along a watercourse using a combination of aerial photographs, topographic maps, on-the-ground photographs, field observation and field survey by a qualified professional. See *Map Revisions for the Riparian Habitat Mitigation Ordinance* report on mapping methodology for which the Revised Riparian Classification Maps are based. The report may be viewed at: http://www.pima.gov/cmo/sdcp/reports/d25/129MAPRE.PDF

IRA:

Boundary modifications are not allowed for IRA. IRA polygons were originally adopted by the Pima County Board of Supervisors through the Comprehensive Plan, which incorporates the Conservation Land System (CLS) and associated Conservation Guidelines into land use decisions, such as rezonings, specific plan requests, Comprehensive Plan amendments and Type II and Type II conditional use permits. In October 2005, when the Ordinance was adopted, IRA polygons were incorporated into the Riparian Classification Maps for regulation under Title 16, to promote avoidance and minimize disturbance to IRA on properties with an existing land use. These boundaries are used for review not only by the District, but also by other Pima County departments.

IRA is almost always associated with an underlying class of habitat and while the IRA boundaries shown on the adopted Riparian Classification Maps cannot be modified, boundaries and mitigation requirements for the underlying class of riparian habitat may be modified in accordance with this Procedure in order to more accurately reflect onsite conditions.

Class H:

For Class H, field verification of RRH boundaries shall document the presence of indicator species as well as size and density of plants moving out laterally from the watercourse. Plant communities shall be classified using the Brown, Lowe and Pase System and communities which are known to have obligate or preferential riparian plants, or have structures (canopy height or density) not attained outside riparian areas shall be considered hydroriparian or mesoriparian (Class H). Other physical features to consider and document are the presence of perennial or intermittent water, springs, depth to ground water, in addition to soil type, channel morphology, and connectivity or contiguity of habitat units and continuity of the associated drainage system. The data used to determine Class H habitat, such as groundwater mapping, Harris Riparian Maps, etc., can be viewed on the Sonoran Desert Conservation Plan Mapguide website: (http://www.dot.pima.gov/cmo/sdcpmaps/).

Class XA – XD:

For xeroriparian classifications, a measure of the TVV was used to classify each xeroriparian habitat type. TVV is a measure of the gradation of plant size and density indicating the transition from riparian to upland plant communities. Other factors to consider are contiguity of vegetation units, continuity of the drainage system and hydrological/geomorphological features generally associated with riparian habitat.

Boundary Delineation Method for Minor Boundary Modifications:

Minor boundary modifications are defined as changes to the outer limits of mapped RRH to align with topography, floodplain and riparian vegetation based upon field verified site conditions, and may follow

submittal requirements outlined below. Major boundary modifications, which propose removing extensive acreage of mapped RRH from a property or project site, shall provide an onsite vegetation survey as outlined in Section 2.0, *Regulated Riparian Habitat Determination and Boundary Modification*, for review and approval by the District.

Requirements for Minor Boundary Modifications:

Provide an exhibit that delineates minor boundary modifications. The exhibit shall include a recent aerial photograph (minimum scale 1”=100’) that compares the areal extent and acreage of the mapped RRH to the proposed modified boundaries. For Subdivisions and Commercial developments, the exhibit shall be prepared at the same scale as the plat, development plan or Native Plant Preservation Plan (NPPP). The following information must be shown on the exhibit:

- RRH boundary and classification designation as shown on the 2005-FC2 Riparian Classification Maps
- Proposed modified riparian habitat boundary
- Property boundary and any significant cultural features
- Limits of proposed disturbance (if applicable)
- Note the acreage of the 2005-FC2 RRH area on the property vs. the proposed modified riparian habitat acreage
- Pre-disturbance ground surface topography and 100-year floodplain limits
- NRCS (Natural Resource Conservation Service) Soils Classification
- Provide sufficient information to locate and orient the property, (north arrow, scale, tax parcel number, project number, address, owner, etc.)

Boundary modification submittals are subject to District review and approval.

Onsite Vegetation Survey: Determining or Classifying Regulated Riparian Habitat and its Boundaries and Plant Community Characteristics within a Mapped Regulated Riparian Habitat Boundary

For purposes of calculating mitigation requirements for disturbance to RRH or when the applicant believes site conditions vary from the mapped RRH (major boundary modifications and/or total vegetation volume estimates), either of two sampling methods may be used. Methods include; 1) Total Vegetation Volume (TVV) and Belt Transects, or 2) Plot sampling.

TVV and Belt Transects – The TVV and belt transect sampling method can be used to determine or classify RRH and its boundaries by providing a detailed analysis of plant community structure and composition. The TVV and belt transect sampling method approved for use by the District is a vertical line-intercept technique and can be found in Section 2.0 of this Procedure.

Plot Sampling – Plot sampling (also called quadrat sampling) is used to define plant community characteristics, including cover type, frequency, and density. The plot sampling method approved for use by the District is found in Section 3.0 of this Procedure.

Onsite Vegetation Survey submittals are subject to District review and approval.

Standard Operating Procedure: Quantitative Methods for Regulated Riparian Habitat Boundary Modifications and On-Site Vegetation Surveys

Prepared for
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June 10, 2009

Carianne S. Funicelli, Vegetation Ecologist

Draft

Standard Operating Procedure: Quantitative Methods for Regulated Riparian Habitat Boundary Modifications and On-Site Vegetation Surveys

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1.0 Introduction

Chapter 16.30 of the Ordinance, *Watercourse and Riparian Habitat Protection and Mitigation Requirements*, requires preservation, enhancement and/or mitigation of riparian habitat along watercourses and floodplains. The following procedures provide guidance to an applicant when a question arises as to the location, extent, and/or plant density and composition of riparian habitat on a property or project site by outlining vegetation measurement and characterization methods to determine and classify regulated riparian habitat.

Standard Operating Procedures (SOP) for two quantitative methods of vegetation measurement are presented in this document. The first method, which combines Total Vegetation Volume (TVV) and belt transects, can be used to determine or classify regulated riparian habitat and its boundaries. The second method, a plot (or quadrat) method, can be used to characterize on-site vegetation to assist in developing a riparian habitat mitigation plan.

2.0 Regulated Riparian Habitat Determination and Boundary Modifications

2.1 Total Vegetation Volume and Belt Transects

TVV has been shown to correlate statistically with breeding bird densities and to be an indicator of riparian habitat values in the Southwest (Mills et al. 1991a, 1991b). Pima County Regional Flood Control District (District) has used this indicator of habitat value to verify and classify regulated riparian habitat in the context of the Ordinance (SWCA 1993 and Harris Environmental Group 2000). The SOP for this method combines the work of the District, consultants, and researchers (MacArthur and Horn [1969], Mills et al. [1991a, 1991b], Stromberg et al. [1992, 1993]) into a modified procedure that is both streamlined and effective in determining TVV. Specifically, it updates recent work by Westland Resources (2008), which has been used as the basic framework for the SOP.

2.2 Methodology

2.2.1 Field equipment and Supplies

2.2.1.1 Standard

- Aerial photograph and map of project area
- Data forms (Appendix A)

- Measuring tape in metric units (25 meters [m])
- A telescoping pole marked in decimeter (dm) sections, at least 6 m in height. An example is shown in Appendix B. These are available from forestry or surveying suppliers, or can be constructed.
- Two 12–16” lengths of rebar (or other stake material)
- Hammer for installing rebar
- Global Positioning System (GPS) unit
- Digital camera

2.2.1.2 Optional

- Additional 12–16” lengths of rebar (or other stake material), if transects will be permanent
- Plastic rebar safety caps, if transects will be permanent

2.2.2 Sample Design

The following considerations will ensure the sample design used for a TVV transect sampling event will be configured in a manner that provides appropriate information in determining the areal extent of riparian habitat within a given location. Decisions and assumptions regarding sample entities, sample size, and transect configuration should be clearly described in the final report to the District.

2.2.2.1 Seasonality

Ideally, maximum TVV values for a given area should be obtained when perennial vegetation is actively growing[1], although measurements can be taken at any time of year. This is an important consideration when interpreting TVV results. For example, TVV values recorded during winter or extended drought when perennial species are deciduous or dormant may be lower than at the same location during active growth; if measurements taken during dormancy reflect a value that is just shy of a particular xeroriparian class, it may be reasonable to assume the higher designation. The converse, however, is not appropriate—the intent of the measurement is to capture the maximum TVV represented by a site. Interpretations are subject to District approval.

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[1] The most recent Riparian Classification Maps are based on June 2000 LANDSAT satellite imagery.

2.2.2.2 Sample entities

The first step in configuring the transect measurement sample design is to segregate the site into sample entities—areas on the ground within which transects will be established. Usually these entities correspond to different vegetation communities (e.g., regulated riparian habitat and the adjacent uplands would represent two different sample entities). Mueller–Dombois and Ellenberg (1974) used the following three requirements to define a sample stand (entity):

1. The area should be large enough to include all species belonging to the plant community.

2. The habitat should be relatively uniform throughout the area.

3. The amount of plant cover should be as homogenous as possible.

Sample entities, for the purposes of TVV, can usually be identified on aerial maps prior to fieldwork. Usually the boundary between upland vegetation and more densely vegetated riparian areas will allow these areas to be easily distinguishable. If there is more than one sample entity, transects will be located in each and in a manner such that each transect is fully contained within one sample entity (i.e., does not cross into another entity).

2.2.2.3 Sample Size

The number of transects established within each sample entity should be sufficient to document the range of vegetation conditions within the entity and to provide a reasonable estimate of the average TVV for that unit. A general rule of thumb would be a minimum of three TVV transects per sample entity.

2.2.2.4 TVV Transect Configuration

Transects should be distributed throughout the sample entity in a manner that captures the variability within the sample entity. Transects can be either located randomly within a sample entity or according to an orderly sampling scheme (e.g., on a grid, at regular intervals) as long as a sample entity is accurately described by the number of transects and their orientation within the sample entity.

Riparian and xeroriparian vegetation communities are linear landscape features that follow watercourses and thus result in linear sample entities. For smaller washes where strand (or wash bottom) habitat are mapped as part of the same delineated riparian habitat, sampling should be conducted in a fashion that includes (proportionately) both strand and terrace habitats[2]. For large wash and river systems (e.g., the Rillito River), transects should run parallel to the strand habitat but not include it. In this circumstance

[2] For small washes, transects should not be placed entirely in the strand habitat. This is only appropriate when the wash is large enough to warrant measuring the strand habitat as a separate entity, as in the Rillito River.

the strand would be considered a separate sample entity from the adjacent floodplain terrace and would have a separate set of transects to characterize its vegetation if deemed necessary by the District. Any variation from these general sampling guidelines should be clearly explained in the report.

See Appendix C for examples of TVV transect configuration for different circumstances.

2.2.3 Data Collection

Photograph 1. Transect data collection team.

In the field, a team of 2–3 people will be needed to establish, read, and record TVV transect data (Photograph 1). One person will be the data recorder, responsible for clearly and legibly entering data onto the data forms. The other 1–2 people will be responsible for setting up the transect and calling out data to the recorder. Below is a step-by-step description of how TVV transects are conducted.

1. Arrive at transect start location. Drive one length of rebar into the ground at the start point and pull measuring tape in a straight line (transect), 25 m in length. The goal is to capture the variation in vegetation forms that may exist within the plant community, therefore, avoid moving the transect into open areas, away from densely vegetated areas that would fall within the straight transect line. Install a second length of rebar at the end point. Keep tape at a height that will allow for easy reading.

2. Record location using a GPS unit (be sure to also indicate the coordinate system and datum used). This will allow for accurate mapping on an aerial photograph for the report.

3. Take digital photographs of the vegetation present from each transect end looking back at other end of transect.

4. If the transects will be permanent, install plastic rebar safety caps on the rebar ends.

5. At 1-m intervals horizontally along the 25-m transect, place the telescoping pole vertically to conduct TVV sampling. This technique samples a series of cylinders starting from the ground surface to the top of the vegetation canopy. Each cylinder is 1 dm high with a 1 dm radius, resulting in a volume of 3.1415 dm^3. See Figure 1 for a diagrammatic representation of the transect setup. Reading the transect involves recording the presence or absence of vegetation (including live, dormant, or dead material) within each cylinder. As such, the personnel conducting this portion of the method do not need detailed botanical identification skills.

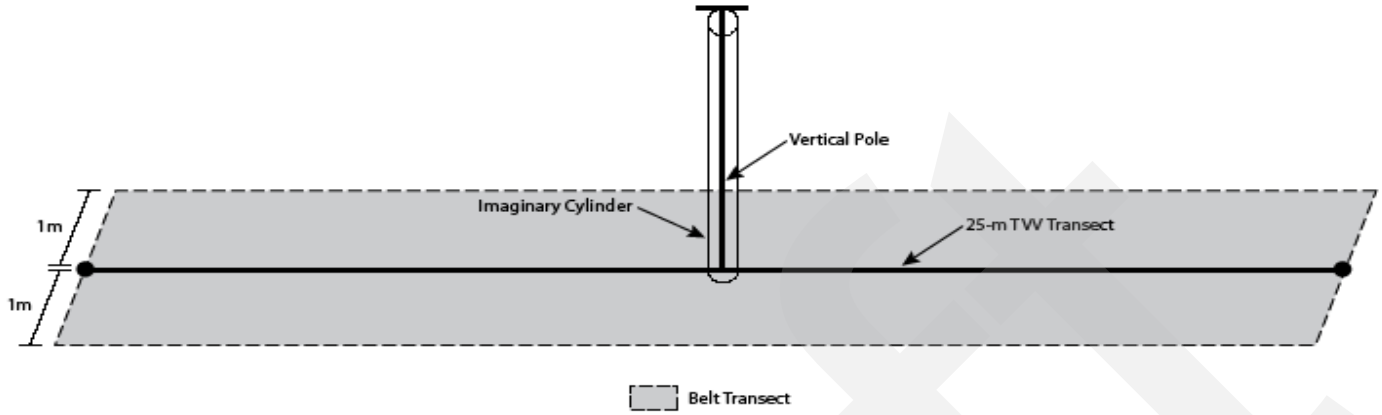

Figure 1. Diagrammatic representation of the TVV transect and belt transect.

- One “hit” is recorded for each 1-dm cylinder above the ground in which vegetation occurs within 1 dm of the pole, regardless of how much vegetation is within the cylinder. If no vegetation is present within the 1-dm cylinder, the cylinder is not counted.
- The number of (1-dm cylinder) hits possible within each meter layer ranges from 0 to 10—no more than one hit is possible for each dm segment.
- Plant species information is not recorded.
- Figure 2 shows an example data form and how it relates to the vegetation present.

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VEGETATION VOLUME DATA SHEET

RECON

Location: Canyon **Transect** 6 **Date:** 16-Jan-09 **Personnel:**

UTM (NAD 83) Transect start: 533483 / 3532965 **UTM (NAD 83) Transect end:** 533496 / 3532949

	Horizontal Transect Samples (# of cubic decimeters containing vegetation within each vertical meter)																								
Vertical cubic meters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	6	10	1	9	1	4	2	3	3	3	7	5	5	7	8	4	3	5	3	10	10	10	5	8	5
2	1	4	1	3	3	1	3	7	4	2	2	3	5	0	5	5	3	2	7	4	4	4	1	4	2
3		5	1	6	3	0	5	7	7	2	2	0	0	1	5	3	9	10	2			0	6	0	4
4		1	4	2	1	6	2	7	3	2	2	0	0		3	3	2	0	1			1	8	2	7
5					2	5	3	1	9	5	1	8	2		4			1					4	3	3
6					8	7	2	5	5	0	0												4		
7						1	1	3	9	4	3														
8							6	8	8	8															
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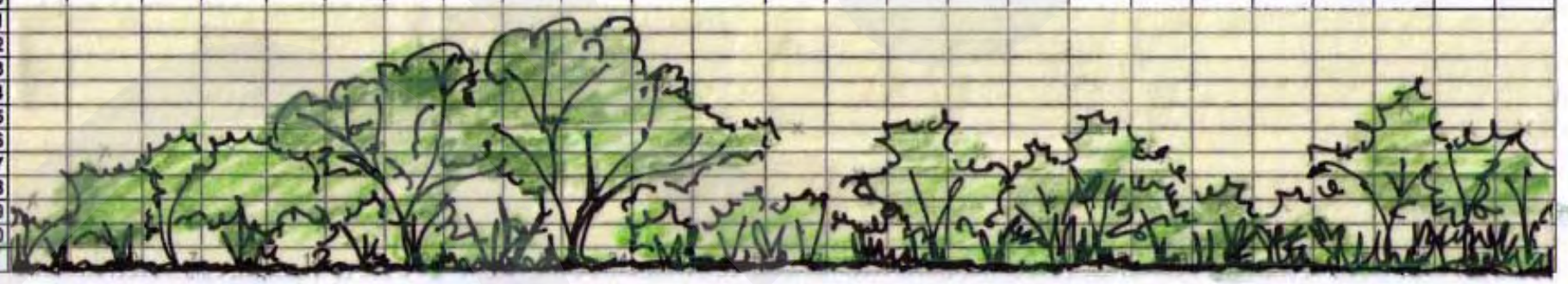

Figure 2. Vegetation Volume Data Sheet—example showing how the vegetation volume measurements correspond to the vegetation structure present on the ground.

6. Conduct belt transect (see Figure 1). Personnel conducting this portion of the method will need to be able to identify the plant species within the belt transect. Belt transects are added directly to the already established TVV transect to gather density and diversity information to more completely characterize the vegetation. Information is recorded from within a 1 m wide swath on each side of the transect and can either be measured at the same time as TVV is measured or after TVV has been measured:

    - Diversity: On each side of the 25-m horizontal transect, record all species present (within 1 m of the transect).

    - Density: For woody perennials (and perennial grass if desired), count all individuals (live, dormant, or dead) that are rooted within the 2 m x 25 m belt transect.

7. Ensure that the data form (Appendix A) is filled out completely and all pertinent notes recorded.

8. Remove rebar lengths if the transects are not intended to be permanent.

2.2.4 Data Analysis

2.2.4.1 TVV Transects

The TVV for each transect is calculated through the following equation:

TVV = Sum of h / (10n)

Where:

n = number of sample points along the transect (this will be 25 for a standard 25 m transect)

h = the number of 1 dm cylinders with hits

For example, in the TVV transect shown in Figure 2, there were 501 total hits. TVV = 501/250 = 2.004.

For each sample entity, the TVV values for each transect should be presented individually; a mean should also be calculated and presented for each sample entity. The Ordinance provides for three types of information to be used in defining and differentiating riparian habitats: species composition, vegetation density, and availability of water. This information is used to classify riparian vegetation as hydro-mesoriparian, or xeroriparian class A, B, C, or D (Fonseca and Regan 2002). For xeroriparian habitats, the TVV values of transects within an entity can be used to classify the type of regulated riparian habitat present, utilizing values listed in Table 1. For hydro-mesoriparian

habitats, classification is based not only on TVV, but also on the availability of water and the presence of preferential plant species. Therefore, the TVV method cannot be applied to hydro-mesoriparian plant communities without also assessing these additional characteristics. Boundaries of these areas are determined through analysis of aerial photographs, ground surface topography, 100-year floodplain limits (if available), and on-the-ground observations in conjunction with the TVV transect information.

TABLE 1
TVV PARAMETERS FOR XERORIPARIAN DESIGNATIONS

Habitat Type	Total Vegetative Volume (TVV)
Xeroriparian A	Greater than 0.856 cubic meter per square meter (m^3/m^2)
Xeroriparian B	Less than or equal to 0.856 m^3/m^2 and greater than 0.675 m^3/m^2
Xeroriparian C	Less than or equal to 0.675 m^3/m^2 and greater than 0.500 m^3/m^2
Xeroriparian D	Less than or equal to 0.500 m^3/m^2

2.2.4.2 Belt Transects

Diversity and density values can be informative in describing the overall habitat composition and quality.

Diversity

Species recorded in the belt transects can be compiled by sample entity or by project area to describe the diversity of plant species present in the project area.

Density

Counts of perennial species result in a density of individual species per 50 m^2. These values can be averaged and extrapolated to whatever area (e.g., number of catclaw acacia shrubs per acre) is meaningful for the information desired. Please note that it may make sense to use the size of the proposed disturbance for this calculation.

For example: For 1 acre of proposed disturbance, three belt transects were established. They contained 3, 4, and 8 catclaw acacia shrubs, respectively. Those values could be used to calculate a mean density of catclaw acacia shrubs per acre:

$$3 + 4 + 8 = 15 \text{ catclaw acacia shrubs total per } 150\ m^2$$

$$150\ m^2 = 0.03707 \text{ acre}$$

$$15 \text{ catclaw acacia shrubs}/0.03707 \text{ acre} = 404.63 \text{ catclaw acacia shrubs per acre}$$

2.3 Reporting

The report for submittal to the District should contain at a minimum the following information:

1. Aerial photograph at an appropriate scale with the following items clearly labeled:
    - Project area
    - Regulated riparian habitat (2005-FC2) boundaries
    - Field mapped riparian habitat boundaries
    - Sampling entities
    - Transect locations
    - Proposed area of disturbance (if submitted with a development proposal)
    - Ground surface topography
    - 100-year floodplain limits, if available
    - Erosion Hazard Setback Limits, if available
2. Description of assumptions or reasoning for sample entity identification and sample design
3. Summary table with TVV values for each transect, mean TVV values for each entity, and UTM coordinates. See example summary table in Appendix D.
4. Field data forms
5. Photographs of transects
6. Other supporting data and evidence as appropriate

3.0 On-site Vegetation Characterization

The goal of on-site mitigation is to recreate the plant cover, distribution, and species composition of the site prior to disturbance. Accurate data on plant community composition is necessary for planning and evaluating on-site mitigation areas. This can be accomplished through a complete site inventory for small areas of disturbance, but for larger disturbances it may be more desirable to use a sampling technique to accurately estimate plant community characteristics that are of value.

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3.1 Plot Sampling

Plot sampling (also called quadrat sampling) can be used to describe a variety of plant community characteristics. It is one of the simplest and most common sampling methods used by ecologists and conservation biologists to describe plant communities (Mueller–Dombois and Ellenberg 1974; Bonham 1989; Elzinga et al. 1998). For the purposes of creating a mitigation plan, the parameters of interest are diversity (species present) and density (number of species in a given area).

Plot sampling is used to define a plant community's characteristics for a much larger area than that actually sampled. Several randomly or subjectively selected sampling areas (plots) are used to collect physical data within the survey entity. "Subjectively selected" (for the purposes of this sampling method) means choosing sampling sites that are representative of the plant community. The collected data are then used to estimate the characteristics of the whole plant community (the mapped riparian habitat on the parcel). Multiple plots ensure that collected data present an accurate representation of the plant community that includes all of its variation.

3.2 Methodology

3.2.1 Field Equipment

3.2.1.1 Standard

- Aerial photograph and map of project area with 2005-FC2 regulated riparian habitat boundary delineation
- Data forms (Appendix E)
- Measuring tape in metric units (25 m)
- One to four 12–16" lengths of rebar (or other stake material)
- Hammer for installing rebar
- Pin flags (string can be used for square or rectangular plots)
- Compass (if using square or rectangular plots)
- GPS unit
- Digital camera

3.2.1.2 Optional

- Additional 12–16” lengths of rebar, if plots will be permanent
- Plastic rebar safety caps, if plots will be permanent

3.2.2 Sample Design

The following considerations will ensure the sample design used for a plot sampling event will be configured in a manner to provide appropriate information for determining mitigation requirements. Decisions and assumptions regarding sample entities, sample size, and plot configuration should be clearly described in the report.

3.2.2.1 Sample entities

The first step in designing the plot sample design is to segregate the site into sample entities—areas on the ground within which plots will be established. Usually this will correspond to different vegetation communities (e.g., regulated riparian habitat and the adjacent uplands would represent two different sample entities). Mueller–Dombois and Ellenberg (1974) used the following three requirements to define a sample stand (entity):

1. The area should be large enough to include all species belonging to the plant community.
2. The habitat should be relatively uniform throughout the area.
3. The amount of plant cover should be as homogenous as possible.

Sample entities can usually be identified on aerial maps prior to fieldwork. Usually the boundary between upland vegetation and more densely vegetated riparian areas will allow these areas to be easily distinguishable. If there is more than one sample entity, plots will be located in each and in a manner such that each plot is fully contained within one sample entity (i.e., does not cross into another entity).

3.2.2.2 Plot Size and Shape

Plot size and shape should fit the nature of the vegetation community (i.e., mapped riparian habitat) to be sampled. Circular plots are generally recommended with these field mapping standards, as they are more efficient to accurately establish in the field. Plot size should be large enough to include a significant number of individual plants, representing all dominant species, but small enough that plants can be counted without duplication or omission of individuals. Below are suggested plot sizes that are usually appropriate for vegetation in Pima County, in the context of riparian habitat. Site characteristics may necessitate using a different plot size or shape (i.e., if the riparian vegetation entity is not wide enough); any deviations from these standard sizes should

be thoroughly described and justified in the report to the District. Plot shape and size should be the same throughout.

- Circular plots (preferred): 10-m radius (314 m^2 or 3,380 ft^2)
- Square plots: 15–20 m per side (225 m^2–400 m^2 or 2,422 ft^2– 4,306 ft^2)
- Rectangular plots: 15 m x 20 m (300 m^2 or 3,229 ft^2)

3.2.2.3 Sample Size (number of plots)

The number of plots conducted within each sample entity should be sufficient to characterize the range of vegetation condition within the entity. A general rule of thumb for xeroriparian areas in Pima County would be a minimum of three plots per sample entity, per acre, given the plot sizes suggested above. In certain circumstances, it may be necessary to sample more intensively in order to sufficiently describe the characteristics of the entity (mapped riparian habitat) being sampled. For example, if three plots are conducted in a sample entity but common shrubs and/or trees have not been recorded, additional plots should be added[3].

3.2.2.4 Plot Configuration

Plots should be distributed throughout the sample entity in a manner to capture all of the variability within that sample entity. Plots can be either located randomly within a sample entity or according to an orderly sampling scheme (e.g., on a grid, at regular intervals, etc.)—as long as the result is that the sample entity is accurately described by the plot number and arrangement. The sampling locations will be reviewed as part of the approval process, and must be representative of the area of regulated riparian habitat proposed for disturbance.

3.2.3 Data Collection

In the field, a team of two people will be needed to establish and read plots. One person will be the data recorder, responsible for clearly and legibly entering data onto the data forms. The other person will be responsible for setting up the plot and calling out the data to the recorder. Below is a step-by-step description of how the plots should be conducted.

1. Photograph representative areas within each sample entity. These photos may correspond to plot locations.
2. Set up plot, ensuring that it is located entirely within one vegetation entity.
    - **Circular plots:** arrive at the center point, install rebar, and use the meter tape to measure the radius, marking with pin flags.

[3] In this instance, the size of the plots should also be evaluated. Larger plots may record the diversity present more adequately.

- **Square or rectangular plots:** Set up plot using a compass to ensure true 90 degree corners. Install rebar. Mark edges with pin flags or string.

3. Record location using GPS (be sure to also indicate the units and datum used). This will allow for accurate mapping on an aerial photo for the report.

4. List all species rooted in the plot (live, dead, and dormant). Separate the list by using the following classifications:

   - Trees
   - Shrubs
   - Other Perennials
   - Annuals

5. Count and record the number of individuals of perennial tree and shrub species rooted within the plot (live, dead, and dormant). It may be helpful to separate the plot into sections to accomplish this accurately.

6. Note the presence and amount (percent cover) of noxious and/or invasive plant species, and map the invasives on the aerial photograph exhibit.

3.2.4 Data Analysis

For each entity sampled, calculate the mean (average) number of individuals per species based on the area of all plots in that entity. Extrapolate these values to a meaningful area (e.g. 1 acre or the proposed disturbance area) for each species as well as a total for shrubs and trees[4]. The mean value will be used to calculate the mitigation required, using the following formula:

$$\frac{\text{Total number of plants in all plots}}{\text{Total combined area of all plots}} = \frac{\text{X plants per area of interest}}{\text{Area of interest}}$$

Data in the summary table in Appendix F provides the following example calculation for all trees:

11 trees/1,256 m^2 (0.31 acre) = X trees/4,047m^2 (1 acre) = 35.4 trees/acre

Plant species to be used for mitigation should be the same as those removed, although, if the site has low plant diversity, for purposes of mitigation, species diversification is encouraged. The containerized plant replacement requirement in the Ordinance applies to trees and shrubs; other species will be included in the seed mix as appropriate and available. Substitutions and additions from the appropriate approved plant list may be made with the District's approval.

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[4] Online conversion tools such as http://www.convert-me.com/en/convert/area can be used to assist in converting measurements between metric and U.S. standard systems.

3.3 Reporting

The report for submittal to the District should contain at a minimum the following information:

1. Aerial photograph at an appropriate scale with the following items clearly labeled:
    - Project area
    - Regulated riparian habitat boundaries (2005-FC2)
    - Sampling entities
    - Plot locations, numerically labeled, to identify the plot relative to the data
2. Description of assumptions and reasoning for sample entities design and sample design
3. Summary table with all species listed (see Appendix F for example)
4. Summary table with species densities per plot; mean densities per species per entity (for tree and shrub species only); and extrapolated values for trees and shrubs for the area of interest (e.g. disturbance area or 1 acre). See Appendix F for an example summary table.
5. Field data forms
6. Representative photographs of each sample entity
7. Other supporting data and evidence as appropriate

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APPENDICES

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APPENDIX A
Blank TVV Transect Data Form

Draft

VEGETATION VOLUME DATA SHEET

RECON

Location: **Transect #** **Date:** **Personnel:**

UTM (NAD 83) Transect start: **UTM (NAD 83) Transect end:**

	Horizontal Transect Samples (# of cubic decimeters containing vegetation within each vertical meter)																								
Vertical cubic meters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
TOTAL																									

Tree and Shrub Density

species	stems per 50 m2

Other Species Present within Belt Transect

species

APPENDIX B
Example of One Type of Telescoping Rod for TVV Measurements
(see #2 in the picture)

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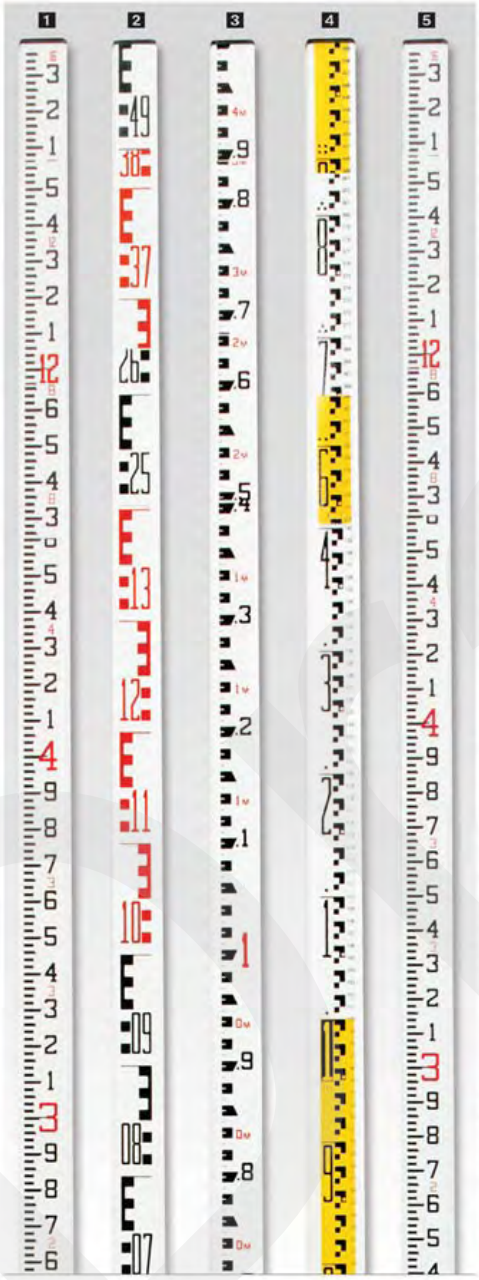


CRAIN Delivering Real Innovation

1 SVR Rectangular-Oval Shaped Telescoping Leveling/Measuring Rods

6411

New improved design!

- Shorter Collapsed length (58-1/2") for more convenient storage.
- Tighter locking mechanism features round buttons that resist jamming.
- New, sleeker design also features a lighter weight.
- New SVR rods come with a redesigned, stylish carrying case.

16' collapses to 59-1/4", while the 25' collapses to 58-1/2". Fiberglass construction and epoxy coating. Graduations are equal size the full length of rod. Red and white markings on back for stadia purposes. Can also be used as measuring rods – measurements are read at eye level. Markings are recessed for wear protection and epoxy-coated to resist fading and abrasions. Snap-together joint sections lock securely and separate easily for maintenance. The 16' models feature a square locking mechanism, and the 25' models feature a round locking mechanism. Protective case included with each rod.

16' in feet/10ths/100ths	E O	4.75 lbs.	43574	$153.50
25' in feet/10ths/100ths	E O	7.75 lbs.	43500	$179.50
			2+	$169.50
16' in feet/inches/8ths	E O	4.75 lbs.	43576	$153.50
25' in feet/inches/8ths	E O	7.75 lbs.	43501	$179.50
Carrying Case for 16' Rod		5 oz.	43520	$17.50
25' Replacement Case		9 oz.	43509	$11.25
Prism Mounting Adapter 5/8" x 11		4 oz.	43704	$15.75
Replacement Lock Set for 16'		8 oz.	43702	$24.95
Replacement Lock Set for 25'		9 oz.	43508	$34.95

Replacement Sections for 43574

0' to 4'	1.75 lbs.	43560	$47.75
4' to 8'	2 lbs.	43561	$44.25
8' to 12'	1.5 lbs.	43562	$39.95
12' to 16'	1.5 lbs.	43563	$36.50

Replacement Sections for 43576

0' to 4'	1.75 lbs.	43529	$47.75
4' to 8'	1.75 lbs.	43530	$44.25
8' to 12'	2 lbs.	43531	$39.95
12' to 16'	2 lbs.	43532	$36.50

Replacement Sections for 43500

0' to 5'	2 lbs.	43484	$52.75
5' to 9'	1.75 lbs.	43485	$49.50
9' to 13'	1.75 lbs.	43486	$47.75
13' to 17'	1.75 lbs.	43487	$44.25
17' to 21'	1.75 lbs.	43488	$39.95
21' to 25'	1.5 lbs.	43489	$36.50

Replacement Sections for 43501

0' to 5'	2 lbs.	43490	$52.75
5' to 9'	1.75 lbs.	43491	$49.50
9' to 13'	1.75 lbs.	43492	$47.75
13' to 17'	1.75 lbs.	43493	$44.25
17' to 21'	2 lbs.	43494	$39.95
21' to 25'	1.5 lbs.	43495	$36.50

Metric SVR Rectangular-Oval Rods

5628

Same quality rod as Crain® SVR Rectangular-Oval Shaped Telescoping Leveling/Measuring Rod with special metric markings. Protective case included.

2 "E" Style Metric

5.0m in m/dm/cm	M O	4.75 lbs.	43578	$159.00
7.6m in m/dm/cm	M O	7.5 lbs.	43503	$184.00

3 Philadelphia Style Metric

5.0 meter	M O	4.75 lbs.	43581	$159.00
7.6 meter	M O	7.5 lbs.	43504	$184.00

4 "1/2" Centimeter Style Metric

5.0 meter	M O	4.5 lbs.	43583	$159.00

Replacement Sections for 43578

0m to 1.4m	M	2 lbs.	43539	$47.75
1.4m to 2.6m	M	2 lbs.	43540	$44.25
2.6m to 3.8m	M	2 lbs.	43541	$39.95
3.7m to 5.0m	M	2 lbs.	43542	$36.50

5 Metric/English SVR Rectangular-Oval Rods

6412

Same quality rod as Crain® SVR Rectangular-Oval Shaped Telescoping Leveling/Measuring Rod with "1/2" Centimeter Style metric markings on one side and English markings on the reverse. Protective case included with each rod.

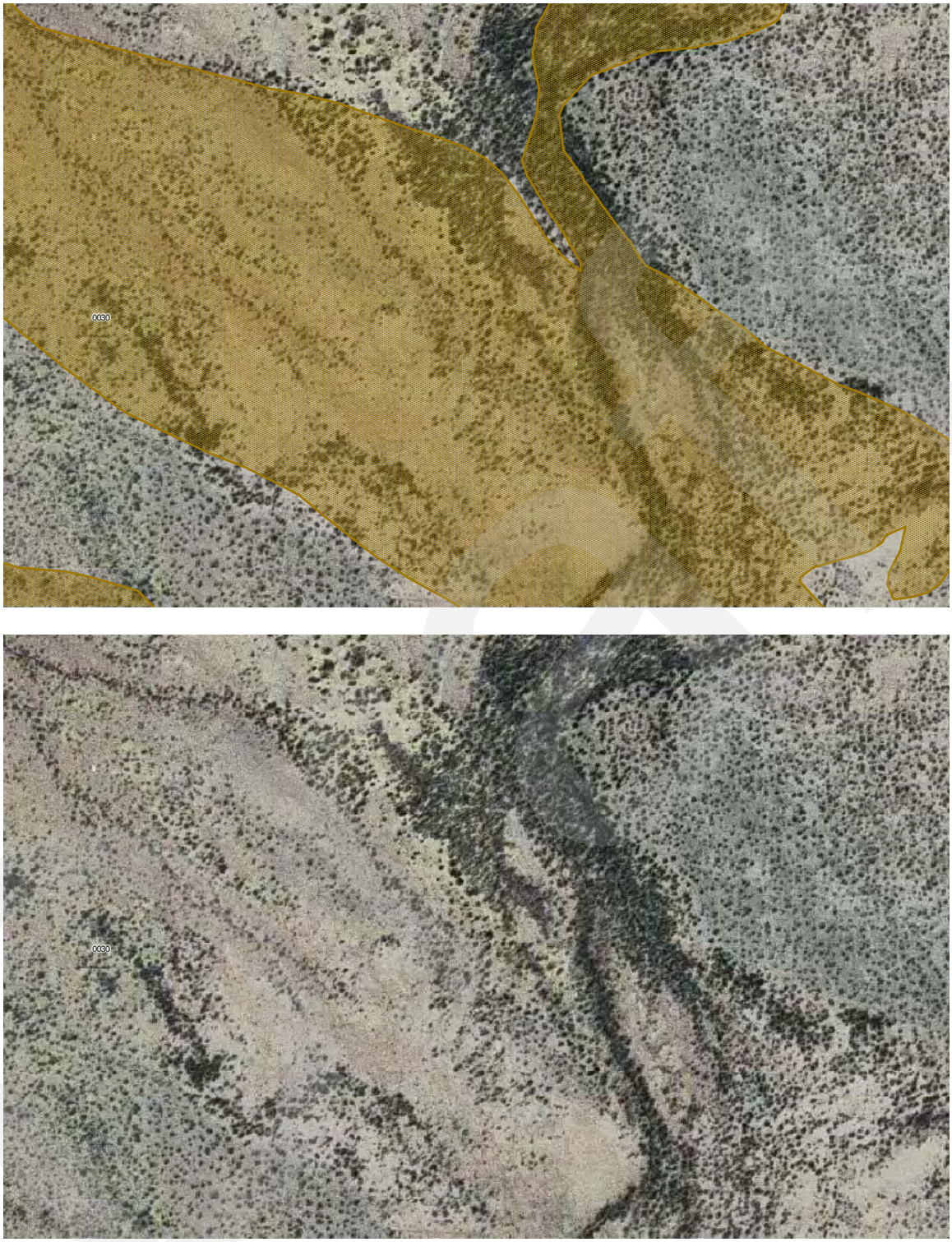
16' in feet/10ths/100ths/m/dm/cm/0.5 cm	C O	4.75 lbs.	43587	$158.00
25' in feet/10ths/100ths/m/dm/cm/0.5 cm	C O	7.5 lbs.	43505	$184.00

E English M Metric
C Combination English and Metric
O Oversize. Ships at Oversize rate. See Shipping Information for details.

RECON

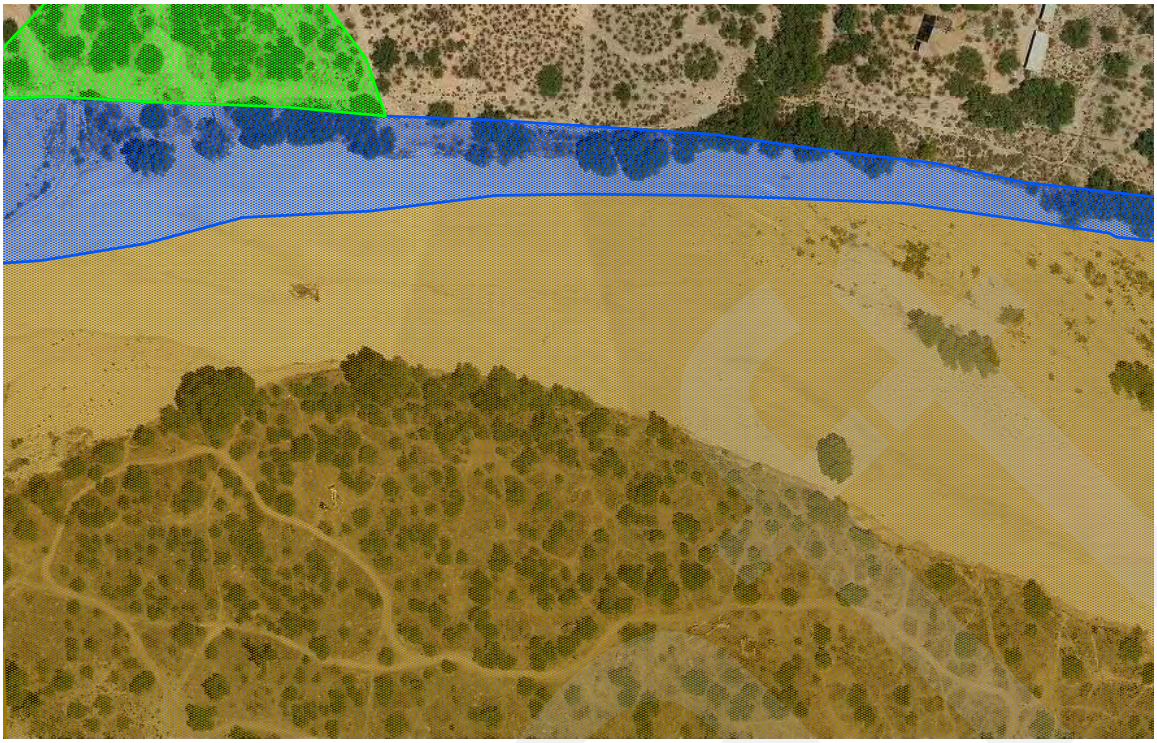
APPENDIX C
Examples of Transect Configurations for Different Sites

Draft

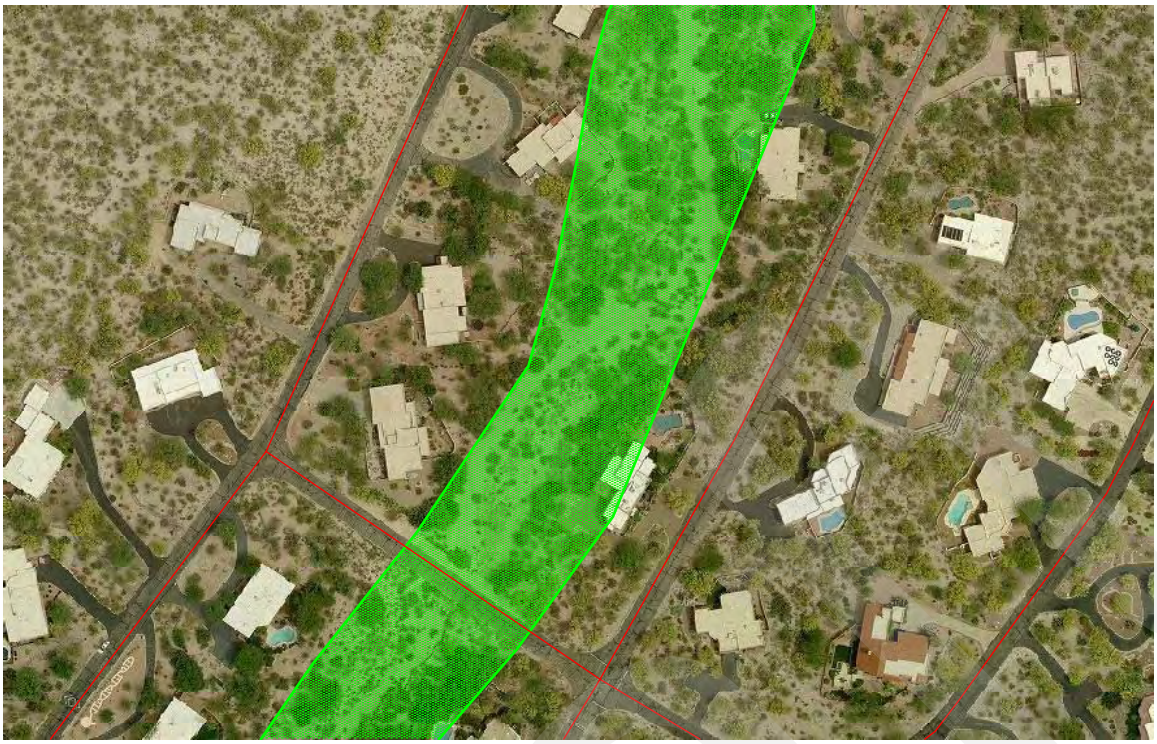


Example 1. Sheet Flooding Area. These photographs highlight the variations in vegetation density that can be observed in areas of sheet flooding. The shaded polygon represents Important Riparian Area with underlying Xeroriparian Class C habitat.

Example 2. Braided wash system with small channels. Photograph at top shows the general vicinity, and the bottom photograph is zoomed to the sample area. Here it is acceptable to place TVV transects across the sandy wash bottom, as long as the transects cover a representative sample of the vegetation.



Example 3. Large wash/river. Photograph at top shows the general vicinity with hydro-mesoriparian (blue), xeroriparian Class B habitat (green), and xeroriparian Class C habitat (gold); the bottom photograph is zoomed to the sample area, within xeroriparian Class C habitat. Transects are not placed in the wide sandy river bottom.



Example 4. Medium-sized wash with strand vegetation. Photograph at top shows the general vicinity with xeroriparian Class B habitat (green); the bottom photograph is zoomed to the sample area. In this example, there are 2 sampling entities. The pink transects are measuring the vegetation on the banks of the wash, and the blue transects are measuring the strand vegetation. Separate mean TVV values are calculated for each entity.

APPENDIX D
Example Summary Table for TVV Transects

Draft

	UTM Coordinates (NAD 1983)						
	Transect Start		Transect End				
Transect	Easting	Northing	Easting	Northing	TVV value	ENTITY (Habitat Type)	MEAN
1	533579	3533060	533588	3533077	1.136	bosque	1.349
2	533591	3533145	533604	3533158	1.172	bosque	
5	533582	3533021	533590	3533037	1.084	bosque	
6	533639	3533007	533629	3533034	2.004	bosque	
3	533606	3532966	533584	3532961	0.376	strand	0.489
4	533483	3532965	533496	3532949	0.54	strand	
7	533489	3532973	533509	3532974	0.552	strand	
8	533442	3533081	533447	3533058	0.264	upland	0.288
9	533474	3533061	533472	3533040	0.312	upland	

Draft

APPENDIX E
Blank On-site Vegetation Characterization Plot Data Form

Draft

On-site Vegetation Characterization Plot Data Sheet

Location: **Plot #** **Date:**

Plot shape (Circle one): **circle** **square** **rectangle**
Size:
UTM (NAD 83):

SPECIES:	**NUMBER IN PLOT:**
TREES	
SHRUBS	
LIST OTHER PERENNIALS	
LIST ANNUALS	
INVASIVE SPECIES NOTES:	
GENERAL NOTES:	

Draft

APPENDIX F
Example Summary Table for Plot Data

Draft

	Number of Individual Plants in Each 10-m Radius Plot (314 m^2)					
	Plot 1	**Plot 2**	**Plot 3**	**Plot 4**	**Total Number of Plants for All Plots (1,256 m^2)**	**Extrapolated Number of Plants per acre (4,047 m^2)**
TREES						
blue paloverde (*Parkinsonia florida*)	1	2	0	3	6	19.33
velvet mesquite (*Prosopis velutina*)	0	3	1	1	5	16.11
				TOTAL	**11**	**35.44**
SHRUBS						
bitter condalia (*Condalia warnockii*)	1	0	0	0	1	3.22
desert hackberry (*Celitis reticulata*)	3	0	0	1	4	12.89
gray thorn (*Zizyphus obtusifolia*)	0	0	1	1	2	6.44
white-thorn acacia (*Acacia constricta*)	4	0	2	1	7	22.55
wolfberry (*Lycium berlandieri*)	0	1	1	0	2	6.44
				TOTAL	**16**	**51.55**
OTHER PERENNIALS						
Bermuda grass (*Cynodon dactylon*)						
bristlegrass (*Setaria macrostachya*)						
buffelgrass (*Pennisetum ciliare*)						
bush muhly (*Muhlenbergia porteri*)						
deer grass (*Muhlenbergia rigens*)						
desert milkweed (*Sarcostemma cynanchoides*)						
globemallow (*Sphaeralcea ambigua*)						
sacaton (*Sporobolus wrightii*)						
sideoats grama (*Bouteloua curtipendula*)						
slimleaf bursage (*Ambrosia confertiflora*)						
snakeweed (*Gutierrezia sarothrae*)						
virgin's bower (*Clematis drummondii*)						
Wright's balsam apple (*Echinopepon wrightii*)						
ANNUALS						
Arizona poppy (*Kallstroemia grandiflora*)						
fleabane (*Erigeron divergens*)						
Mediterranean grass (*Schismus* sp.)						
Russian thistle (*Salsola* sp.)						
silverleaf nightshade (*Solanum eleagnifolium*)						

In this example, required mitigation container plantings would be 35 trees and 52 shrubs per acre. The species of container plants should be the same as those found in the plots. Any additions or substitutions are subject to advance District approval.

Management of invasive species (shaded) should be addressed in the mitigation plan; these species should not be included in the planting plan.

appendix H
glossary of terms

Draft

GLOSSARY OF TERMS

Approval: Written notice by the District approving riparian habitat mitigation plans (RHMP).

Approved plan: The most current RHMP which bears the authorized signature of approval of the District.

Disturbed: The condition of existing habitat after it has been damaged, demolished or eliminated.

Defensible Space: An area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards a structure. It also reduces the chance of a structure fire moving from the building to the surrounding area.

Development: Any permitted or non-permitted human alteration to land and its vegetation, soil, geology, drainage, hydrology and surface features; changing the appearance and character of land; and including but not limited to the acts of grubbing, clearing, and grading of land, and placing improvements on the land such as buildings, structures, signs, paving, vegetation, and outdoor use areas.

Drip line: For cacti, an area around the plant that overlays the mature root system. For trees and shrubs, an area under the undisturbed canopy of the tree or shrub.

Ephemeral: Streams that flow only during and immediately after rain.

Erosion: The wearing away of the ground surface as a result of the movement of wind, water or ice.

Floodplain: "Floodplain" means any areas within a watercourse which have been or may be covered partially or wholly by flood water from the 100-year flood including lands that have been, or may be, subject to flooding from stormwater runoff, overflow of flood waters from a watercourse, alluvial fans, sheet flood zones, or other property subject to flooding. The floodplain includes the stream channel, the floodway, and the floodway fringe area.

Grade: The vertical location of the ground surface.

Grading: The clearing, brushing, grubbing, excavating, or filling of a site.

Draft

Hydroriparian Habitat:	Riparian plant communities generally associated with perennial watercourses where plant species such as cottonwood and willow are present.
Hydroseed/ Hydromulch:	A mixture of seed, mulch and soil ameliorants sprayed by machine onto large or otherwise inaccessible areas.
Intermittent:	Streams which flow for only certain times of the year when they receive water from springs, groundwater, or runoff.
Important Riparian Areas (IRA):	IRA occur along the major river systems and provide critical watershed and water resources management functions as well as providing a framework for landscape linkages and biological corridors.
Mesoriparian Habitat:	Riparian habitats generally associated with perennial or intermittent watercourses or shallow ground water. Plant communities may be dominated by species that are also found in drier habitats.
Mitigation:	Providing a new riparian habitat of similar quality to that which was removed as a result of physical improvements or developments to a piece of property located within floodplain, an erosion hazard area, or riparian habitat regulated by the Ordinance. (See also Restoration).
Mitigation Plan:	A document submitted by the applicant to the District that clearly delineates RRH and the limits of development on a site. The mitigation plan indicates mitigation area(s) and includes a plant list (species/quantities), and irrigation methods,
Native Plant:	Growing in the Arizona portion of the Sonoran Desert, without cultivation, and not introduced after 1920. A plant that occurs within the range of Sonoran Desert plants, but only in Mexico, is not native.
Obligate:	Plant species occurring almost always (estimated probability 99%) under natural conditions in wetlands.
Perennial:	Streams that essentially flow continuously year-round.

Plant Community:	A biologic grouping of vegetation frequently found under natural conditions due to their common soils, moisture, climate and orientation requirements; also means a plant association.
Regulated Riparian Habitat (RRH):	Also referred to as "riparian habitat" shall mean riparian habitat areas identified on the Riparian Classification Maps as established by Section 16.30 of the Floodplain and Erosion Hazard Management Ordinance No. 2005-FC2.
Restoration:	The process of repairing a previously disturbed, damaged, or degraded site area or site feature and replicating its previously undisturbed, undamaged, or un-graded condition of vegetation, plant communities, geologic structures, grade, drainages, and riparian habitat that historically existed onsite or in the neighborhood.
Riparian habitat:	Plant communities occurring in association with any spring, cienega, lake, watercourse, river, stream, creek, wash, arroyo, or other body of water, either surface or subsurface, or channel having banks and bed through which waters flow at least periodically.
Site:	A single lot or a combination of contiguous lots (or parcels), or a leased area on a lot that meets the minimum zoning standards of the applicable zone.
Subdivision:	Improved or unimproved land or lands divided or proposed to be divided for the purpose of sale, lease, or for cemetery purposes, whether immediate or future, into six or more lots, parcels or fractional interests.
Watercourse:	Any lake, river, stream, creek, wash, arroyo or other body of water or channel having banks and bed through which waters flow at least periodically.
Wildlands:	Public and private lands (and waters) that support native ecosystems, including national, state, and local parks and forests, ecological reserves, wildlife areas, Bureau of Land Management Lands, and so on. Working landscapes—such as grazed rangeland and active timber lands—that support native ecosystems are included in the definition
Xeroriparian Habitat:	Riparian habitat generally associated with an ephemeral water supply. These communities typically contain plant species also found in upland habitats, however, these plants are typically larger and/or occur at higher densities than adjacent uplands.