APPENDIX J – CLEAN WATER ACT SECTION 404 CONCEPTUAL MITIGATION PLAN

ASARCO LLC
RIPSEY WASH TAILINGS STORAGE FACILITY

REVISED
CLEAN WATER ACT SECTION 404
CONCEPTUAL MITIGATION PLAN

Prepared for:

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November 5, 2015
Project No. 203.25 05 04-312
CORPS FILE NO. SPL-2011-1005-MWL

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1. INTRODUCTION AND BACKGROUND

1.1. DOCUMENT PURPOSE AND ORGANIZATION

ASARCO LLC (Asarco or the Applicant) has identified the need for additional tailings storage to support ongoing mining operations at the Ray Mine in Pinal County, Arizona (***Figure 1***). The construction of a tailings storage facility (the Project) will require the discharge of fill material to surface drainage features that are considered waters of the United States (waters of the U.S. or waters) by the U.S. Army Corps of Engineers (Corps).

Asarco has identified the Ripsey Wash Tailings Storage Facility (TSF) as its proposed action in its Clean Water Act (CWA) Section 404 permit application to the Corps (Corps File No. SPL-2011-1005-MWL). As part of CWA Section 404 individual permit requirements for discharge into waters, a Mitigation Plan must be prepared in accordance with the Corps' and the U.S. Environmental Protection Agency's "Final Rule for Compensatory Mitigation for Losses of Aquatic Resources" (33 C.F.R. Part 332 and 40 C.F.R. Part 230; published in 73 Fed. Reg. 19594–19705 [April 10, 2008]), hereinafter referred to as the 2008 Mitigation Rule. This Conceptual Mitigation Plan has been prepared to describe Asarco's proposed mitigation as part of CWA Section 404 individual permit requirements. Asarco has coordinated with the Corps to identify the mitigation opportunities presented in this Conceptual Mitigation Plan, and a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed based on the concepts identified in this plan.

This Conceptual Mitigation Plan is presented in three sections: ***Section 1*** identifies the document's purpose and organization, introduces the Project, and summarizes Project impacts to Waters; ***Section 2*** provides a description of the mitigation goals, including avoidance and minimization, compensatory mitigation, and other aquatic resource conservation measures that will provide functional benefits; and ***Section 3*** outlines the site-specific conceptual plans for each proposed mitigation area and identifies the expected outcome, success criteria, and implementation plan for each site.

1.2. PROJECT DESCRIPTION

The proposed Ripsey Wash TSF is located approximately 4 miles south of the Ray Mine Complex, south of the Gila River, on lands currently owned and managed by the Arizona State Land Department that the Applicant is seeking to acquire. The Project will encompass approximately 2,575 acres (ac), nearly all of which will be located south of the Gila River. (The only facilities north of the Gila River will be pipelines and associated facilities for the transport of tailings and reclaimed water.)

The Applicant plans to employ conventional tailings deposition at the location of the proposed TSF. The TSF is proposed for development within Ripsey Wash and unnamed tributaries. It would be built with cyclone centerline and upstream construction methods. A diversion embankment would be constructed to divert flows around the facility to the west to Zelleweger Wash and to the east to an unnamed ephemeral wash.

The Project includes a tailings delivery and reclaim water pipeline that would follow the Pinal County right-of-way along the existing Florence-Kelvin Highway spanning the Gila River at a new pipeline bridge located directly adjacent to (upstream of) a new Florence-Kelvin Highway bridge proposed by Pinal County; a power line for project-related infrastructure to be placed along the Florence-Kelvin Highway opposite the proposed pipelines; a proposed drain down pond and associated infrastructure north of the Gila River; the realignment of a portion of the existing Florence-Kelvin Highway; the realignment of a portion of the existing San Carlos Irrigation Project power line; and the realignment of a portion of the Arizona Trail.

1.3. JURISDICTIONAL IMPACTS

The development of the Ripsey Wash TSF Project included a substantial effort to avoid and minimize impacts to waters of the U.S. as outlined in the 404(b)(1) alternatives analysis prepared for the project[1]. ***Table 1*** summarizes the unavoidable impacts to waters of the U.S. that would result from the construction of the Project.

Table 1. Ripsey Wash Tailings Storage Facility Project Impacts to Waters

Impact Type	Acreage
Direct impacts to ephemeral flows	130.23
Dewatered ephemeral flows	4.13
Total	**134.36**

The Project is expected to result in direct impacts to 130.23 ac of ephemeral waters. An additional 4.13 ac of ephemeral waters will be cut off from upstream flows (these are hereinafter referred to as "dewatered" drainages). The proposed project will not adversely impact any special aquatic sites (including wetlands) or any perennial or intermittent waters.

To facilitate mitigation planning, impacted drainages within the Project area were grouped into three different classes; each is described below.

Ephemeral Class 1 – This class consists of very large, wide, ephemeral drainages which, within the Project footprint, are limited to the main channel of Ripsey Wash. Drainages within this class have a median width of 180 feet (ft) and an average width of 167 ft.

Ephemeral Class 2 – This class consists of relatively smaller drainages in comparison to Ephemeral Class 1. Ephemeral Class 2 drainages within the Ripsey Wash site include the larger tributaries of Ripsey Wash and another unnamed ephemeral channel that drains toward the Gila River. Drainages within this class have a median width of 35 ft and an average width of 60 ft.

[1] WestLand Resources, Inc. 2015. Alternatives Screening and Clean Water Act Section 404(b)(1) Alternatives Analysis. Prepared for Corps File No. SPL-2011-1005-MWL. Dated July 17, 2015.

Ephemeral Class 3 – This class consists of headwaters and relatively smaller drainages in comparison to Ephemeral Class 2 drainages. Ephemeral Class 3 drainages within Ripsey Wash are in the upper parts of the watershed and may drain into Class 2 or Class 1 ephemeral drainages. Drainages within this class have a median width of 6 ft and an average width of 10 ft.

The total amount of impacted waters was calculated and determined to be 134.36 ac., all of which are ephemeral. Impacts by drainage class are summarized in ***Table 2***.

Table 2. Impacts to Waters by Impacted Drainage Class

Impacted Drainage Class	Direct Impacts	Dewatered Drainages	Total
Ephemeral Class 1	65.0	3.03	68.03
Ephemeral Class 2	45.38	0.52	45.90
Ephemeral Class 3	19.85	0.58	20.43
Total	**130.23**	**4.13**	**134.36**

For impacts to ephemeral waters associated with the Project, offsite mitigation actions will provide functional gain through the active management, enhancement, and restoration of rare and valuable riparian zones adjacent to the San Pedro and Gila Rivers, major intermittent and perennial systems.

2. MITIGATION SITE SELECTION OVERVIEW

2.1. MITIGATION SITE SELECTION AND APPROACH

The 2008 Mitigation Rule identifies general classes of compensatory mitigation and identifies clear preferences among these classes, specifically noting that Mitigation Banking and then In-Lieu-Fee Mitigation are preferred over Applicant-sponsored onsite or offsite mitigation. As a general matter, in-kind mitigation is preferred over out-of-kind mitigation. Asarco considered these general classes of compensatory mitigation from a watershed perspective when developing this Conceptual Mitigation Plan.

There are currently no mitigation banks established in Arizona and no approved In-Lieu-Fee mitigation projects within the Hydrologic Unit Code (HUC)-6 watershed associated with the Project.

The development of the Project design included a substantial effort to avoid and minimize impacts to waters. A number of onsite mitigation measures were incorporated into the Project design to address water quality and quantity functions. These measures include the construction of a detention dam, diversion channel, and piping infrastructure to route any runoff from undisturbed areas above the TSF around the facility; the installation of energy dissipaters at the outfall locations of the diversion channel and piping; and the installation of monitoring and pump-back wells downstream from seepage-collection points and reclaim ponds.

The Project entails active mining operations requiring the diversion of upstream flows around the TSF and the Project area contains only ephemeral drainage channels with no potential for improvement through restoration. Therefore, no onsite mitigation opportunities exist and habitat functions that will be lost

through the development of the Project will be mitigated offsite. The identification of offsite compensatory mitigation options was made after a review of various options within the watershed.

We are aware of no watershed planning efforts for the HUC-6 or HUC-8 watersheds (the watersheds in which the Project is located) that identify specific compensatory mitigation goals for aquatic resources. We have reviewed the Arizona Non-Point Education for Municipal Officials website for watershed plans[2] for the Middle Gila River to gain perspective on the nature of the resources within the watershed, looked at previous Corps mitigation projects associated with the Ray Mine, and reviewed general conservation efforts along the Gila and San Pedro Rivers to inform site selection and plan development.

Asarco has identified four sites located along the San Pedro River (Sites A through D) and one site along the Gila River (Site E) that are relatively close to the Project (9 to 29 river miles upstream) to compensate for unavoidable project impacts to waters of the U.S. (***Figure 1***). All of these sites are associated with perennial or intermittent aquatic resources, contain or have the potential to support high-value mesoriparian and hydroriparian habitats, and provide regional conservation benefit. The San Pedro River mitigation sites are associated with existing Corps-approved mitigation projects that have been developed in support of previous Corps permitting efforts at the Ray Mine and are contiguous with or near other conservation properties that have been established by the Bureau of Reclamation, the Salt River Project, and the Arizona Game and Fish Department (AGFD) (***Figure 2***). While the proposed mitigation measures will not create xeroriparian habitat similar to the habitats associated with the ephemeral drainages that will be impacted by the Project, the habitats within the mitigation sites that will be preserved, enhanced, and restored are rarer within the regional landscape and have higher productivity and wildlife values. ***Table 3*** [following page] provides a brief summary of these five offsite mitigation properties. A more detailed discussion of the mitigation sites and proposed activities is provided in ***Section 3***.

2.2. FUNCTIONAL ASSESSMENT AND DETERMINATION OF MITIGATION RATIOS

The South Pacific Division of the Corps has developed a standard operating procedure for determining compensatory mitigation requirements called a Mitigation Ratio-Setting Checklist (MRSC; U.S. Army Corps of Engineers, South Pacific Division, Special Public Notice 12501-SPD, February 20, 2012). As part of the MRSC, a detailed functional assessment of the Ripsey Wash TSF-impacted waters and the proposed mitigation sites was conducted. The MRSC and the accompanying functional assessment have been reviewed and approved by the Corps and are the basis for the mitigation ratios used in this Conceptual Mitigation Plan (***Appendix A***).

[2] NRCS Rapid Watershed Assessment of the Middle Gila River HUC-8 has not been completed (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_064841.pdf; accessed 08272014).

Table 3. Summary of Offsite Mitigation Areas

Mitigation Site	Acreage	Description
Site A – PZ Ranch Northeastern Mesquite Bosque (Preservation)	29.8	Adjacent to an existing Corps mitigation site (***Figures 3 and 4***) and is included within the fenced boundary of that mitigation site. Active management of this site through proposed preservation efforts will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict off-road vehicle access to the site to enhance its riparian habitat values. The existing bosque habitat is second growth and was likely part of an earlier agricultural operation or the mesquite had been harvested for fuel wood or some other purpose. Mesquite bosque habitats were once relatively common and widespread along Arizona's larger rivers and streams, but mature bosque habitat has become relatively rare. The preservation and active management of this site will facilitate the development and maintenance of this habitat.
Site B – PZ Ranch Southern Mesquite Field (Restoration)	28.2	Former agricultural field on the eastern bank of the San Pedro River. This field is within an existing Corps mitigation site. In 1993, the field was planted with containerized mesquite. The portion of this field included here represents excess mitigation area not needed for the original project. The functional values of this site have increased as indicated by a measurable increase in vegetative cover (***Figures 5a and 5b***). The restoration area is part of the San Pedro River riparian corridor and is contiguous with other Corps mitigation sites and conservation areas managed by the Bureau of Reclamation (***Figure 3***).
Site C – PZ Ranch Northwestern Mesquite Field (Restoration)	25.8	Adjacent to an existing Corps mitigation site on the western bank of the San Pedro River (***Figures 3 and 6***) and included within the fenced boundary of that mitigation site. Active management of the site will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict off-road vehicle access to enhance its riparian habitat values. The site is vegetated by patches of native mesquite and an understory of native forbs and shrubs mixed with weedy forbs (***Figure 6***). Portions of the site are associated with prior agricultural practices, and it appears that fuel wood harvesting occurred at some point in the past. Proposed restoration activities will include the control of weedy plant species (principally tamarisk), planting native mesquite trees, and seeding with native plant species. These activities will restore the functional values of the site as a riparian buffer for the San Pedro River.
Site D – San Pedro River Active Floodplain (Preservation)	14.1	Area within the active floodplain of the San Pedro River adjacent to an existing Corps mitigation site on the western bank of the San Pedro River (***Figures 3 and 6***). The dominant vegetation is tamarisk, although cottonwoods are also present. The site will be actively managed to exclude livestock and off-road vehicle traffic to enhance its riparian value.
Site E – Gila River Channel and Riparian Buffer (Preservation and Restoration)	124.9	Straddles a perennial reach of the Gila River (***Figure 7***). A significant portion of the existing riparian vegetation was destroyed by the Shipman Fire in July 2013. Prior to the fire, the site was dominated by tamarisk. As the site recovers from the fire, tamarisk will again become the dominant riparian species, resulting in riparian habitat with lower functioning value than that offered by riparian habitat dominated by native species. Planned activities include: (1) Active management and enhancement of the 11.4 ac of the site that include the active channel of the Gila River and immediately adjacent areas to preclude grazing and other activities such as wood harvesting and off-road vehicle use and the control of tamarisk within and along the river channel. (2) Active restoration of the remaining 113.5 ac of riparian habitat will include site preparation to remove tamarisk stumps and to control the resprouting and establishment of tamarisk, seeding with native trees and shrubs, and active management to control grazing, off-road vehicle use, and other activities incompatible with the restoration of the site.

3. SITE-SPECIFIC CONCEPTS

3.1. SAN PEDRO RIVER SITE A (MESQUITE BOSQUE PRESERVATION)

Site A is a 29.8-ac site adjacent to and within the fence constructed for an existing approved Corps mitigation property (***Figures 3 and 4***). The existing bosque habitat is second growth and was likely part of an earlier agricultural operation or the mesquite had been harvested for fuel wood or some other purpose. Measurements of vegetation structure and composition using Total Vegetative Volume[3] along two transects within the site were 1.14 and 2.01 m^3/m^2. These values are substantially greater than measurements taken from riparian habitats within Ripsey Wash, which ranged from 0.08 to 0.68 m^3/m^2. Mesquite bosque habitats were once relatively common and widespread along Arizona's larger rivers and streams, but mature bosque habitat has become relatively rare. The preservation and active management of this site will facilitate the development of mature bosque habitat.

Goal: Active management and protection to provide opportunity for mesquite bosque habitat to mature and develop.

Implementation: The active management of this site through proposed preservation efforts will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict off-road vehicle access to the site to enhance its riparian habitat values. The mitigation goals for the site will be met when a conservation easement is recorded to protect the site in perpetuity. No on-the-ground implementation activities are required.

Establishment Period Activities: Quantitative goals are not proposed. The site will be considered established and successful when the site-protection instrument has been recorded on the property. No establishment period activities are planned.

3.2. SAN PEDRO RIVER SITE B (MESQUITE FIELD RESTORATION)

Site B is a 28.2-ac former agricultural field on the eastern bank of the San Pedro River. This field is part of an existing Corps mitigation site (Corps File No. 1990-4008400-RJD). In 1993, the field was planted with containerized mesquite. The portion of the field included here represents excess mitigation area not needed for the original project. Although managed in conjunction with the mitigation established under that permit, this 28.2-ac parcel ***is not*** part of the required mitigation under that permit.

Since 1993, the functional values of this site have increased as indicated by a visible increase in vegetation on the site (***Figures 5a and 5b***). In addition, based on field studies conducted in 2008, the percent canopy cover of this field has increased from no native plant cover to approximately 47 percent native cover since the 1993 planting.

[3] Mills, G. S., J. B. Dunning, Jr., and J. M. Bates. 1991. The Relationship between Breeding Bird Density and Vegetation Volume. *The Wilson Bulletin*, Vol. 103, No. 3, pp. 468–479.

Goal: The mitigation goal for this site is the restoration of mesquite-dominated riparian habitat. (This has been achieved.)

Implementation: Restoration activities took place at this site in 1993. Most recently, fencing maintenance and repair activities were completed there. This site is within an area that is subject to a management agreement with the AGFD. No further implementation actions are necessary.

Establishment Period Activities: The site is established and no establishment period activities are required.

3.3. SAN PEDRO RIVER SITE C (MESQUITE FIELD RESTORATION)

Site C is a 25.8-ac site adjacent to an existing Corps mitigation site on the western bank of the San Pedro River. The site is vegetated by patches of native mesquite and an understory of native forbs and shrubs mixed with weedy forbs (***Figure 6***). Portions of the site are associated with prior agricultural practices, and it appears that fuel wood harvesting occurred at some point in the past. The site is included within the fencing constructed for the existing adjacent mitigation site. Proposed restoration activities will include the control of weedy plant species (principally tamarisk), planting native mesquite trees, and seeding with native plant species. Active management of the site will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict off-road vehicle access to enhance its riparian habitat values. These activities will restore the functional values of the site as a riparian buffer for the San Pedro River.

Goal: Restoration goals for this site include the establishment of mesquite-dominated riparian habitat that is established and no longer requires supplemental watering and active management and protection to provide opportunity for mesquite bosque habitat to mature and develop.

Implementation: During the development of a final approved mitigation plan, a detailed site inventory and restoration plan will be developed. This plan will identify the existing resources to be protected during restoration activities, any grading or other site stabilization that might be necessary, preferred approaches to irrigation based on engineering constraints and available water rights, and the development of a planting plan.

The mitigation concept anticipates containerized plantings that would be contract-grown in tall pot containers for the Project. Tall pot containers are used because they allow for the cultivation of plants with a large root-to-shoot ratio to facilitate establishment. If practicable, the seed used to grow the trees will be collected from local sources. We anticipate that contract growing will take approximately 9 months. Supplemental irrigation will be used (either gel packs or temporary irrigation from an existing well [#15] located within the adjacent mitigation site). The principal tree species that will be used at this restoration and enhancement site is mesquite, although other trees (ash, hackberry) and shrubs (wolfberry, desert hackberry) will be incorporated into the final planting plan. The anticipated density of tree and shrub plantings within the disturbed/open portions of the site is 100 per acre. Prior to the implementation of any work at the site, desirable stands of native vegetation will be fenced and/or flagged to prevent damage during construction. Once trees and shrubs are planted and suitable irrigation systems and other site

improvements have been completed, the disturbed portions of the site will be seeded with native grasses and forbs to establish an understory.

The implementation period is anticipated to take approximately 1 year.

Establishment Period Activities: During the establishment period, supplemental watering (drip irrigation or gel pack) will be provided, as necessary, and in a manner that allows for the gradual weaning of the planted trees from requiring supplemental watering. The site and plantings will be regularly monitored, and issues that might affect plant health and riparian function will be identified. The existing fence around the site will also be maintained, and the site will be inspected for erosion and undesirable vegetation. Maintenance to address any of these issues will take place as necessary.

3.4. SAN PEDRO RIVER SITE D (ACTIVE FLOODPLAIN PRESERVATION)

Site D (14.1 ac) is within the active floodplain of the San Pedro River (***Figure 6***). The dominant riparian tree species within this area is tamarisk, with cottonwoods and mesquite also present. The site will be actively managed to exclude livestock and off-road vehicle traffic, and to preclude fuel wood harvesting.

Goals: Active management and protection to preserve riparian habitat along the San Pedro River corridor and adjacent to existing Corps-approved mitigation sites.

Implementation: The active management of this site through proposed preservation efforts will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict off-road vehicle access to the site to enhance its riparian habitat values. The mitigation goals for the site will be met when a conservation easement is recorded to protect the site in perpetuity. No on-the-ground implementation activities are required.

Establishment Period Activities: Quantitative goals are not proposed. The site will be considered established and successful when the site-protection instrument has been recorded on the property. No establishment period activities are planned.

3.5. GILA RIVER SITE E (RIVER CHANNEL AND RIPARIAN BUFFER PRESERVATION AND RESTORATION)

Site E is located within the Gila River riparian corridor immediately upstream of the town of Kearny (***Figure 7***). A significant portion of the existing riparian vegetation within the site was destroyed by the Shipman Fire in July 2013. Prior to the fire, the site had been dominated by non-native tamarisk. There is a concern that as the site recovers from the fire, tamarisk will again become the dominant riparian species, resulting in riparian habitat with a lower functioning value than that offered by riparian habitat dominated by native species. West of the Gila River is a large, relatively level floodplain terrace dominated by tamarisk. Virtually every tree on this floodplain terrace within the mitigation site was burned by the Shipman Fire, and all of the tamarisk observed during field investigation are re-sprouting from their root

crown. During initial site reconnaissance, there was very little indication of other vegetation establishment. Within the site, a corridor of living and dead cottonwoods closely follows the course of the river. Within this corridor of cottonwoods, tamarisk is present at a relatively low density. Soils within the site were sampled from five locations. These samples were submitted for horticultural analysis, which provided the recommendation for amendment of the site soils at one location prior to planting. The remaining site soils are typical of alluvial soils derived from desert upland soils.

Goals: Restoration of 113.5 ac of mesquite-dominated riparian habitat and active management and preservation of the cottonwood-tree-dominated riparian corridor along the Gila River within the mitigation parcel.

Implementation: During the development of a final approved mitigation plan, a detailed site inventory and restoration plan will be developed. This plan will identify the existing resources to be protected during restoration activities, any grading or other site stabilization that might be necessary, depth to groundwater, soil conditions, preferred approaches for seeding, suitable seed mixes, the need for soil amendments, and the tamarisk-control activities necessary to achieve mitigation goals and objectives.

Restoration activities at the site will commence with the construction of the fencing necessary to control access by cattle and to clearly delineate conservation area boundaries. The site will be fenced using AGFD wildlife-friendly fencing specifications, and initial tamarisk control, including the removal of standing dead tamarisk, will be completed. Any soil amendments required would be applied at this time.

Heavy equipment will be used to clear, grub, and remove from the site the burned tamarisk trees. The corridor of mature cottonwoods (both living and dead) will remain undisturbed, although dead tamarisk will be selectively removed from within this corridor. In the unlikely event that the Gila River experiences a flood event during the establishment period, it is anticipated that these cottonwoods will serve to diminish flood velocities and reduce erosion.

The depth to groundwater will be measured across the site. Depending on the findings of the groundwater analyses, one or more mixes of native seed will be developed. In those areas where the groundwater table is less than 12 feet below existing grade, the seed mix will contain species that benefit from greater moisture, such as cottonwood and ash and potentially alkali sacaton. In those areas where the groundwater is deeper than 15 feet, the seed mix will contain more mesic species such as mesquite, hackberry, and saltbush. The seed mixes will be applied by seed drill, a technique that provides good seed-to-soil contact and reduces loss through predation. The entire area will be mulched with straw, which helps to maintain higher levels of soil moisture as well as reduces soil temperatures and loss through predation. Since the restoration area is fairly flat, it is not anticipated that equipment access will be an issue.

Establishment Period Activities: During the establishment period, the site and plantings will be regularly monitored and issues that might affect plant health and riparian function will be identified. The fence around the site will also be reviewed and repaired, as necessary, and the site will be inspected for erosion and undesirable vegetation. Maintenance to address any of these issues will take place as necessary.

4. LONG-TERM SITE PROTECTION AND MANAGEMENT

All of the mitigation parcels will have a suitable site-protection instrument (Conservation Easement or Restrictive Covenant) recorded with the County to provide long-term protection of the conservation objectives outlined here and to comply with the Corps' 2008 Mitigation Rule. The details of the site-protection instrument to be recorded on the mitigation parcels have not been finalized at this time. At PZ Ranch, Asarco has been working with the Corps and the AGFD to develop a Conservation Easement for the existing approved mitigation projects. We anticipate Mitigation Sites A through D will be incorporated into this instrument once the final form of the site-protection instrument has been accepted by the Corps and the AGFD and a permit is issued for the Project. The final Conservation Easement will include prohibitions on any forms of grazing or other land uses, such as fuel wood harvesting, that are not compatible with maintaining the aquatic functions of the parcel. Some low public uses such as hiking and bird watching or minor forms of hunting may be allowed.

Similar restrictions are anticipated for the site-protection instruments for Mitigation Site E. Grazing and other non-supported uses will be excluded from the parcel, but some low public use is anticipated to be acceptable.

The mitigation sites will be monitored and maintained to preserve their resource value in accordance with the 2008 Mitigation Rule. To ensure the availability of funding for future monitoring and maintenance, Asarco will establish a long-term funding source, referred to in this document as the Dedicated Account. Asarco shall fund the Dedicated Account over a 10-year period, beginning in Year 1. The first payment will be due within a year of permit issuance. Asarco shall also pay all maintenance, monitoring, and management costs associated with the implementation of the approved final Mitigation Plan during Years 1 through 10. These funds are not included in the Dedicated Account.

Once the Dedicated Account is funded, Asarco, its successors, or assigns (including the AGFD or other third-party conservation entity) shall not be required to expend any additional funds for annual monitoring and maintenance activities. In the event that extraordinary circumstances require the significant expenditure of funds that would threaten the integrity of the Dedicated Account, Asarco, its successors, or assigns (including any third-party conservation entity) shall notify the Corps of the specific circumstances. Asarco, its successors, or assigns and the Corps will jointly consider the specific circumstances and will mutually agree upon the appropriate action(s) to be taken and how to fund these action(s). This may include Asarco, or its successors or assigns, voluntarily contributing additional funds and/or the Corps, Asarco, and its successors or assigns working cooperatively to seek outside funding to accomplish the extraordinary maintenance actions.

FIGURES

Pinal County
Photo Source: NAIP, 2013

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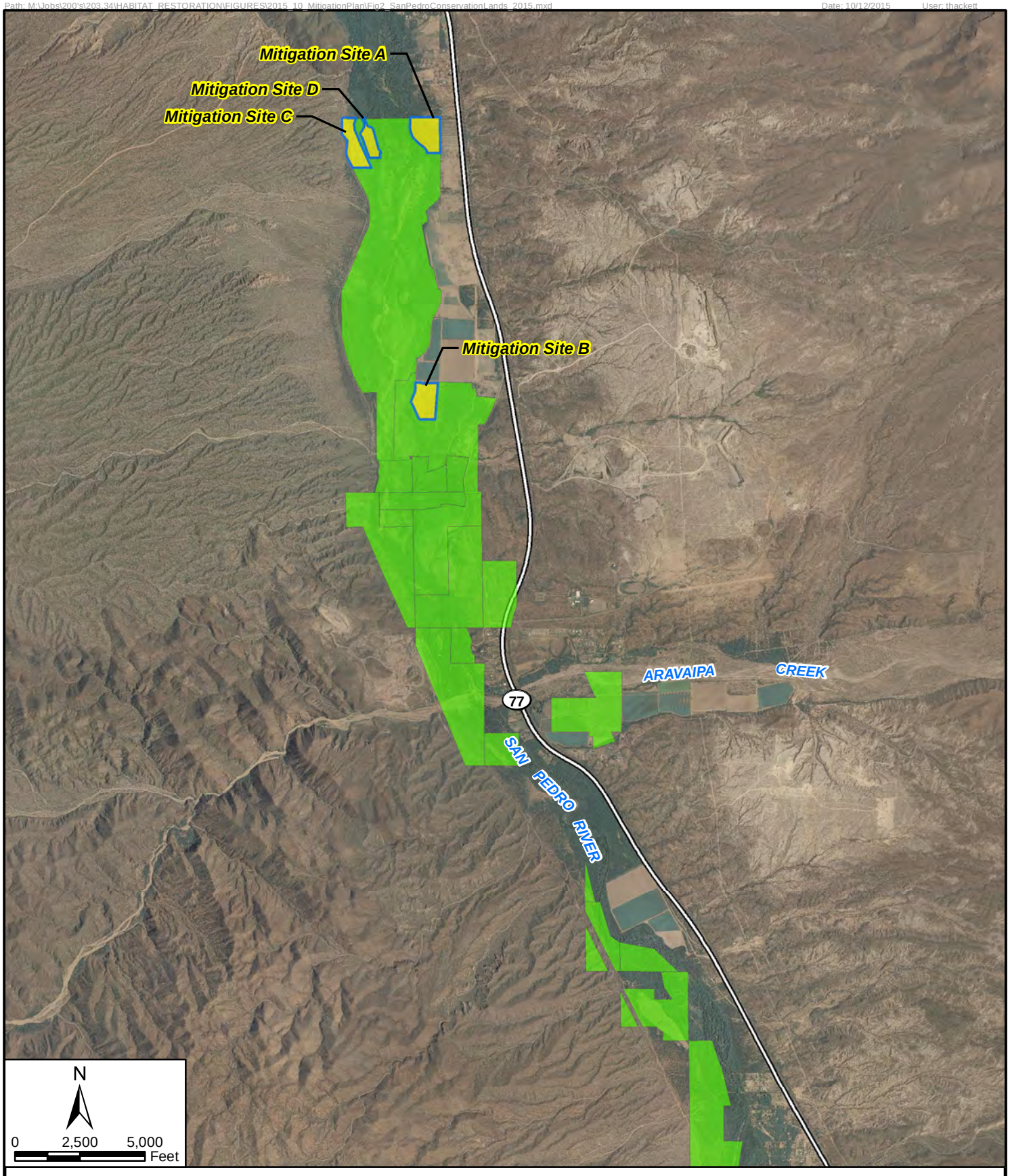
N

0 2 4 Miles

ASARCO LLC

Ripsey Wash Tailings Storage Facility
Conceptual Mitigation Plan

LOCATION MAP
Figure 1



Pinal County
Photo Source: NAIP, 2010

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LEGEND

- Mitigation Site Location
- Existing Conservation Lands

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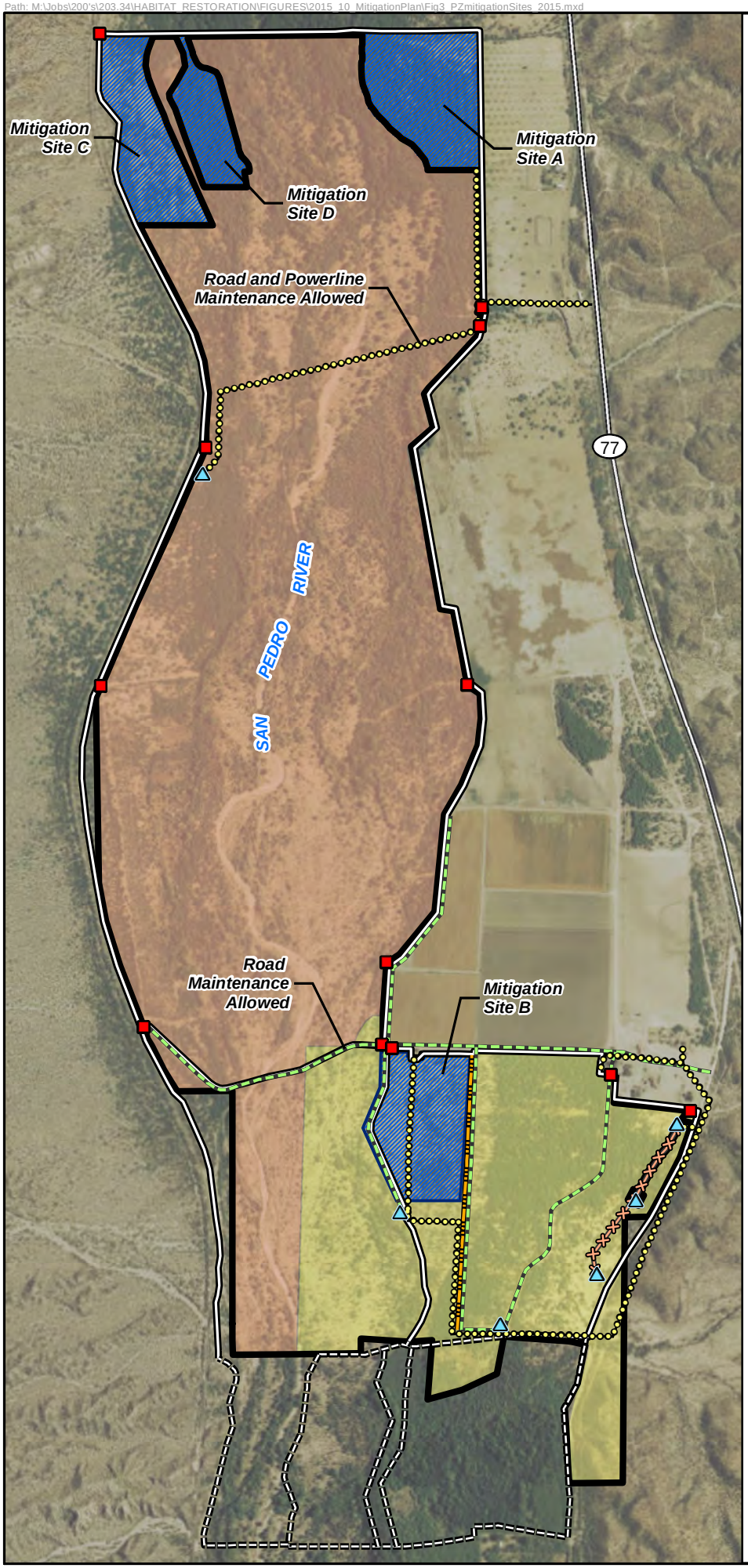
Ripsey Wash Tailings Storage Facility
Conceptual Mitigation Plan

CONSERVATION LANDS
ALONG THE LOWER
SAN PEDRO RIVER
Figure 2



N

0 750 1,500 Feet

Photo Source: NAIP (6/8/2013)

NOTE: Fence and land ownership boundaries provided by Cardinal Land Surveying.

LEGEND

- PZ Ranch
- PZ-1 Mitigation Lands
- PZ-2 Mitigation Lands
- Available for Future Mitigation
- PZ Ranch Fencing
- Fencing Maintained by Others
- Access Road
- Powerline
- BuriedPowerline
- Irrigation Canal
- Well Location Within Mitigation Lands
- Gate Location

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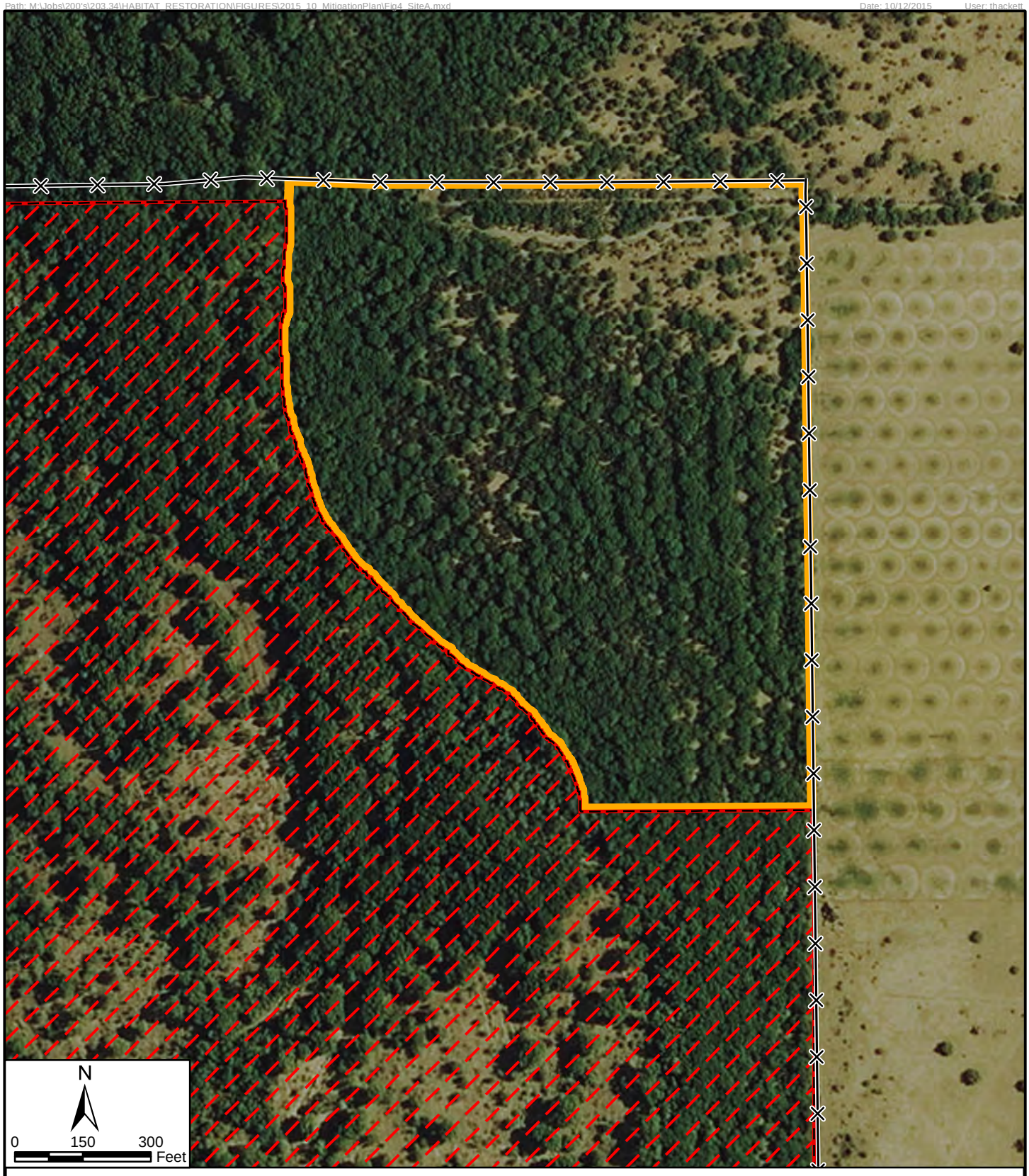
Ripsey Wash Tailings Storage Facility
Conceptual Mitigation Plan

MITIGATION SITES AT PZ RANCH

Figure 3



T6S, R16E, Portion of Section 21,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site A (Mesquite Bosque Preservation)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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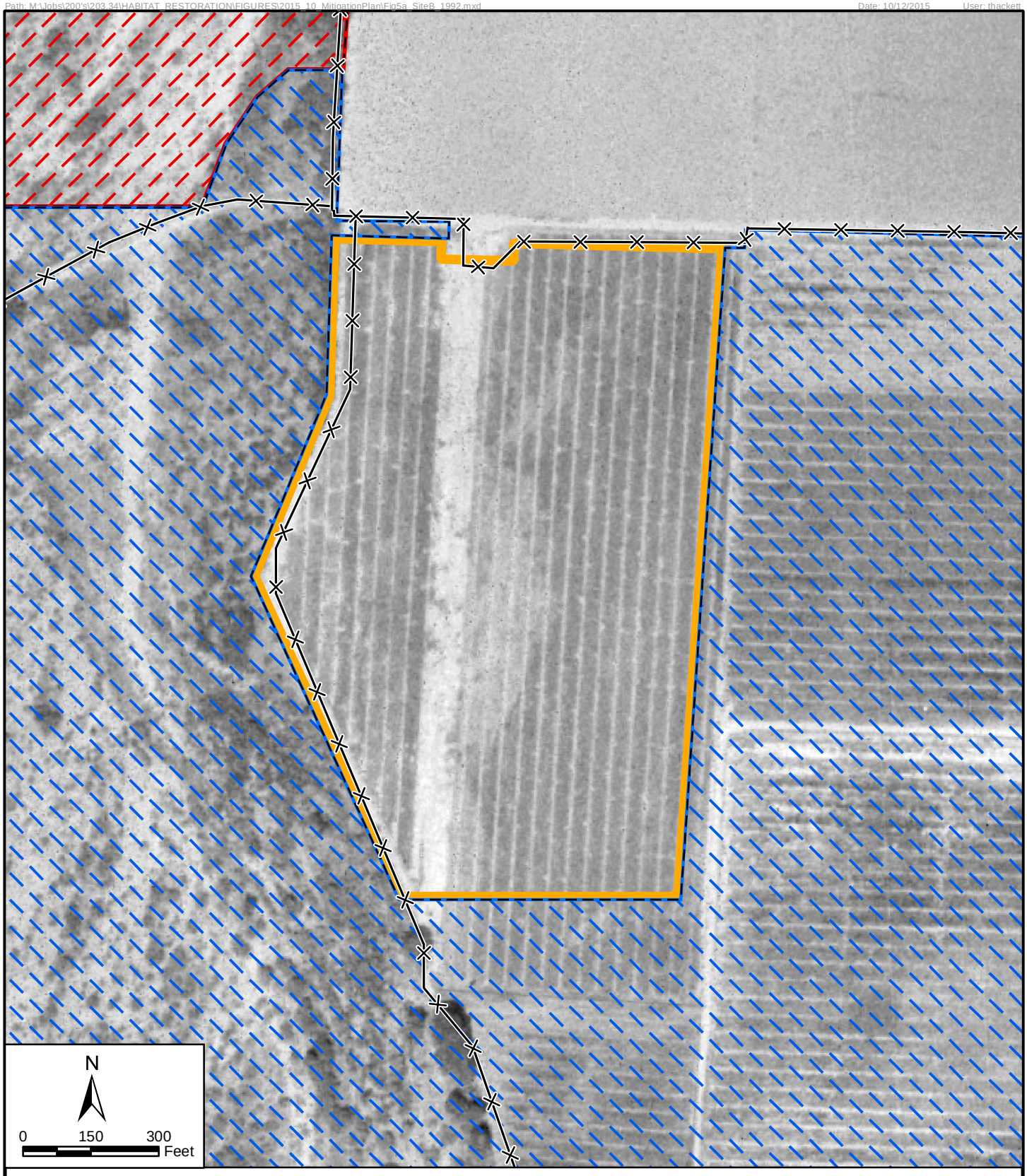
ASARCO LLC

Ripsey Wash Tailings Storage Facility
Conceptual Mitigation Plan

SAN PEDRO RIVER SITE A (PRESERVATION)

Figure 4



T6S, R16E, Portion of Section 33,
Pinal County, Arizona,
Photo Source: USGS DOQQ, 1992

LEGEND

- Site B (Mesquite Field Restoration)
- PZ-1 Mitigation Lands (Corps File No. 1990-400-8400-RJD)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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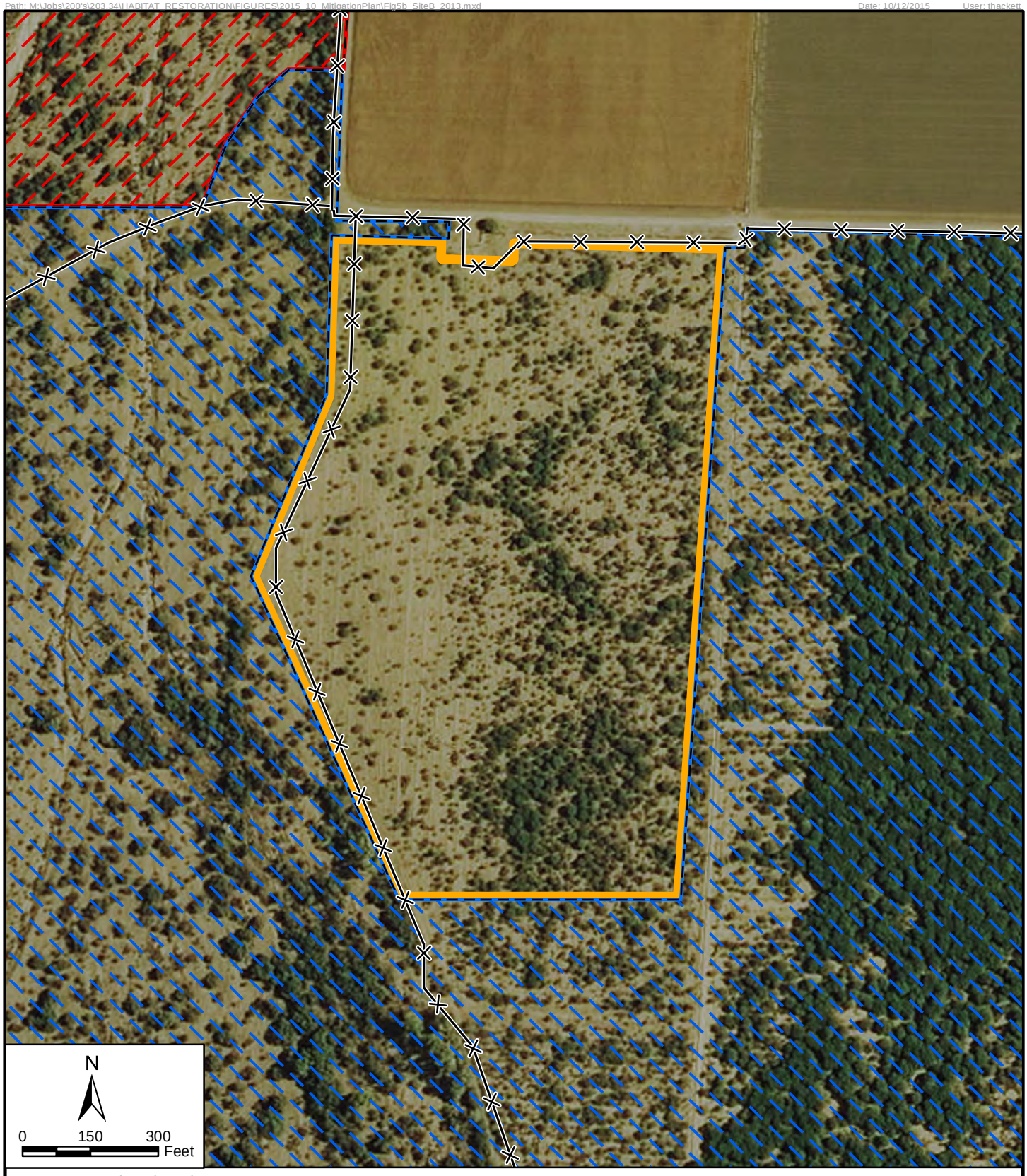
ASARCO LLC

Ripsey Wash Tailings Storage Facility
Conceptual Mitigation Plan

SAN PEDRO RIVER SITE B (RESTORATION) (1992)
Figure 5a



T6S, R16E, Portion of Section 33,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site B (Mesquite Field Restoration)
- PZ-1 Mitigation Lands (Corps File No. 1990-400-8400-RJD)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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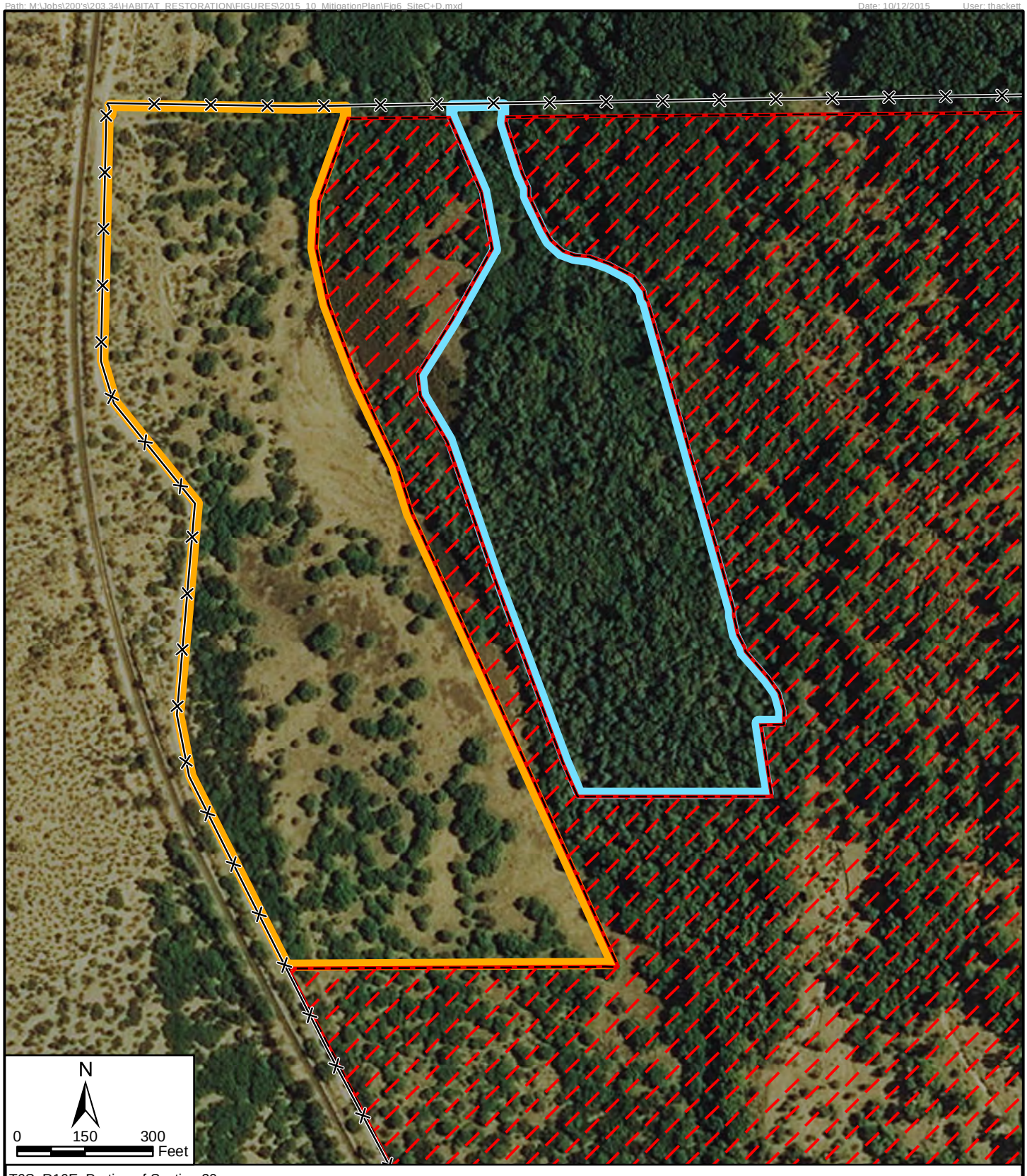
SAN PEDRO RIVER SITE B (RESTORATION) (2013)

Figure 5b



T6S, R16E, Portion of Section 20,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site C (Mesquite Field Restoration)
- Site D (Active Floodplain Preservation)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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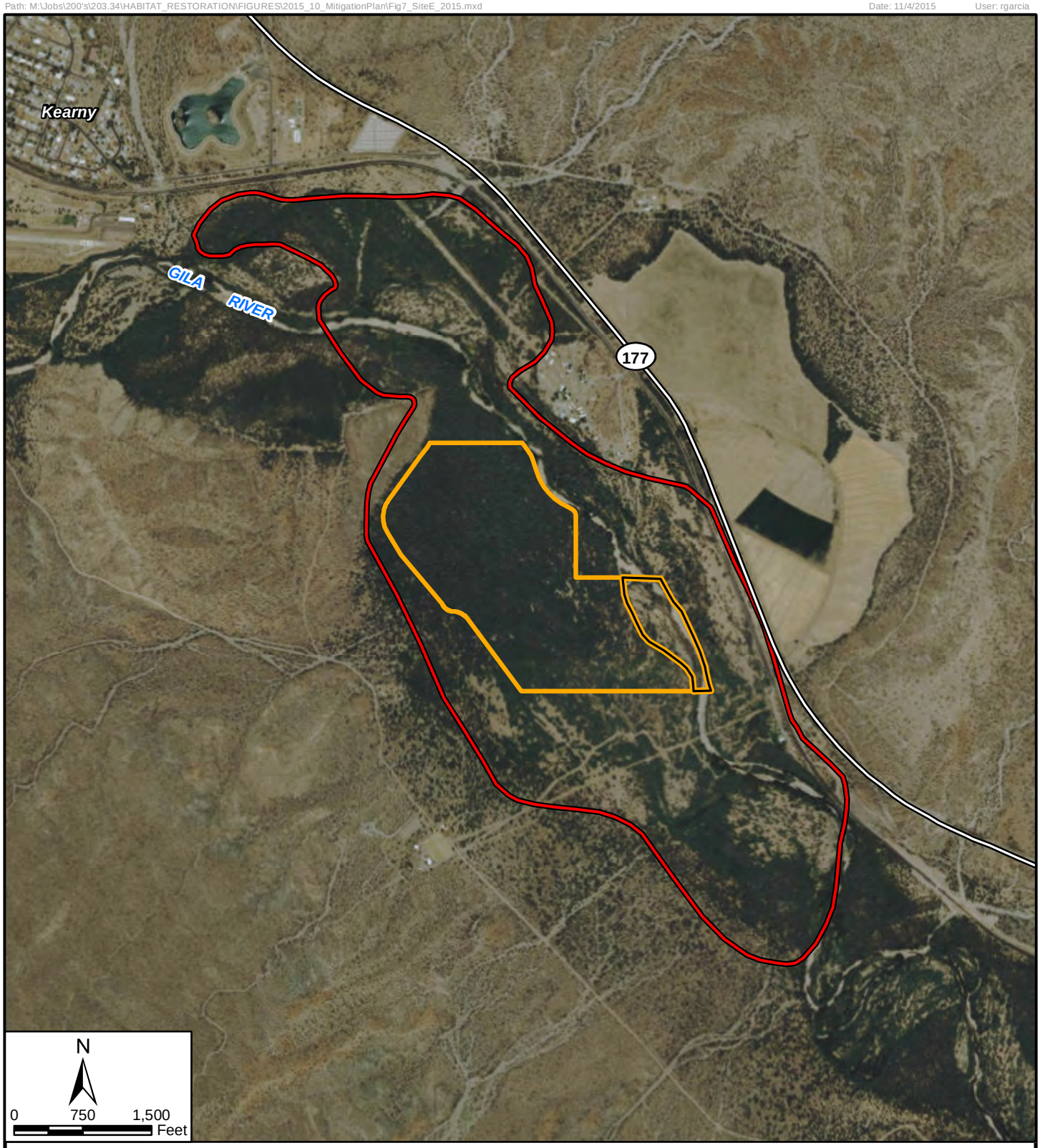
SAN PEDRO SITE C (RESTORATION) &
SAN PEDRO SITE D (PRESERVATION)

Figure 6



T4S, R14E, Portion of Sections 7, 17, 18, 20, 21 & 29,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

*Fire Perimeter Source: PDF of "Shipman Fire AZ-A15-130795 Vicinity Map"
(AZ State Forestry Division, 7/10/2013).

*Vicinity Map PDF: Downloaded from http://inciweb.nwcg.gov/incident/map/3502/0/30745/

LEGEND

- Site E (Gila River Riparian Buffer Restoration)
- Site E (Gila River Active Channel Preservation)
- Shipman Fire (7/10/2013)

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Conceptual Mitigation Plan

GILA RIVER SITE E
(PRESERVATION & RESTORATION)
Figure 7

APPENDIX A

ASARCO LLC
RIPSEY WASH TAILINGS STORAGE FACILITY MITIGATION RATIO-SETTING CHECKLIST

RIPSEY WASH TAILINGS STORAGE FACILITY
MITIGATION RATIO-SETTING CHECKLIST

ASARCO LLC

Prepared for:

U.S. ARMY CORPS OF ENGINEERS

Prepared by:

WestLand Resources, Inc.
Engineering and Environmental Consultants

4001 E. Paradise Falls Drive
Tucson, Arizona 85712

On behalf of:

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Revised November 5, 2015
Project No. 203.25
Corps File No. SPL-2011-1005-MWL

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(*follow text*)

APPENDICES

1. INTRODUCTION AND BACKGROUND

1.1. DOCUMENT PURPOSE AND ORGANIZATION

ASARCO LLC (Asarco or the Applicant) has identified the need for additional tailings storage to support ongoing mining operations at the Ray Mine in Pinal County, Arizona (***Figure 1***). The construction of a tailings storage facility (the Project) will require the discharge of fill material to surface drainage features that are considered waters of the United States (waters of the U.S. or waters) by the U.S. Army Corps of Engineers (Corps).

Asarco has identified the Ripsey Wash Tailings Storage Facility (TSF) as its proposed action in its Clean Water Act (CWA) Section 404 permit application to the Corps (Corps File No. SPL-2011-1005-MWL). As part of CWA Section 404 individual permit requirements for discharge into waters, a mitigation plan must be prepared in accordance with the Corps' and the U.S. Environmental Protection Agency's (EPA) *Final Rule for Compensatory Mitigation for Losses of Aquatic Resources* (33 C.F.R. Part 332 and 40 C.F.R. Part 230; published in 73 Fed. Reg. 19594-19705 (April 10, 2008)), hereinafter referred to as the 2008 Mitigation Rule. The fundamental objective of the 2008 Mitigation Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters authorized through the issuance of a CWA Section 404 permit. The South Pacific Division of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation requirements.

Asarco has coordinated with the Corps to identify potential mitigation opportunities for the Project. Following review and approval (or modification, as appropriate) by the Corps of the concepts contained in Asarco's Ripsey Wash Tailings Storage Facility Conceptual Mitigation Plan (submitted under separate cover), a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed.

This MRSC report has been prepared to support the Ripsey Wash Tailings Storage Facility Conceptual Mitigation Plan. This report is presented in three sections: ***Section 1*** introduces the Project and summarizes Project impacts to waters; ***Section 2*** provides an overview of proposed mitigation actions; and ***Section 3*** describes the methods used for determining final mitigation ratios and acreages in this analysis, and provides the results of applying the checklist.

1.2. PROJECT DESCRIPTION

The proposed Ripsey Wash TSF is located approximately four miles south of the Ray Mine Complex, south of the Gila River, on lands currently owned and managed by the Arizona State Land Department (ASLD) that the Applicant is seeking to acquire. The Project will encompass approximately 2,575 acres, nearly all of which will be located south of the Gila River. (The only facilities north of the Gila River will be pipelines and associated facilities for the transport of tailings generated at the existing Ray Concentrator and reclaimed water.)

The Applicant plans to employ conventional tailings deposition at the location of the proposed TSF. The TSF would impact portions of Ripsey Wash and unnamed tributaries. The proposed TSF would be built with cyclone centerline and upstream construction methods. A diversion embankment would be constructed to divert flows around the facility to the west to Zelleweger Wash and to the east to an unnamed ephemeral wash.

The Project includes tailings delivery and reclaim water pipelines that would follow the Pinal County right of way along the existing Florence-Kelvin Highway and span the Gila River at a new pipeline bridge located directly adjacent to (upstream of) a new Florence-Kelvin Highway bridge proposed by Pinal County; a power line for project related infrastructure to be placed along the Florence-Kelvin Highway opposite the proposed pipelines; a proposed drain down pond and associated infrastructure north of the Gila River; realignment of a portion of the existing Florence-Kelvin Highway; realignment of a portion of the existing San Carlos Irrigation Project power line; and realignment of a portion of the Arizona Trail.

1.3. JURISDICTIONAL IMPACTS

The development of the Ripsey Wash TSF Project included a substantial effort to avoid and minimize impacts to waters of the United States as outlined in the 404(b)(1) alternatives analysis prepared for the project.[1] ***Table 1*** summarizes unavoidable impacts to waters of the U.S. that would result from construction of the Project. The Project is expected to result in the direct impact to 130.23 acres of ephemeral waters. An additional 4.13 acres of ephemeral waters will be cut off from upstream flows. The proposed project will not adversely impact any special aquatic sites including wetlands.

Table 1. Ripsey Wash Tailings Storage Facility Project Impacts to Waters

Impact Type	Acreage
Direct impacts to ephemeral flows	130.23
Dewatered ephemeral flows	4.13
Total	**134.36**

2. MITIGATION SITE SELECTION OVERVIEW

The 2008 Mitigation Rule identifies general classes of compensatory mitigation and identifies clear preference among these classes, specifically noting that Mitigation Banking and then In Lieu Fee Mitigation are preferred over applicant sponsored, on-site, or off-site mitigation. As a general matter, in-kind mitigation is preferred over out-of-kind mitigation. Asarco considered these general classes of compensatory mitigation from a watershed perspective when developing this conceptual mitigation plan.

There are currently no mitigation banks established in Arizona and no approved In-Lieu-Fee mitigation projects within the Hydrologic Unit Code (HUC)-6 watershed associated with the Project.

[1] WestLand Resources, Inc. 2015. Alternatives Screening and Clean Water Act Section 404(b)(1) Alternatives Analysis. Prepared for Corps File No. SPL-2011-1005-MWL. Dated July 17, 2015.

The development of the Project design included a substantial effort to avoid and minimize impacts to waters. A number of onsite mitigation measures were incorporated into the Project design to address water quality and quantity functions. These measures include the construction of a detention dam, diversion channel, and piping infrastructure to route any runoff from undisturbed areas above the TSF around the facility; the installation of energy dissipaters at the outfall locations of the diversion channel and piping; and the installation of monitoring and pump-back wells downstream from seepage-collection points and reclaim ponds.

The Project entails active mining operations requiring the diversion of upstream flows around the TSF and the Project area contains only ephemeral drainage channels with no potential for improvement through restoration. Therefore, no onsite mitigation opportunities exist and habitat functions that will be lost through the development of the Project will be mitigated offsite. The identification of offsite compensatory mitigation options was made after a review of various options within the watershed.

We are aware of no watershed planning efforts for the HUC-6 or HUC-8 watersheds that contain the Project that identify specific compensatory mitigation goals for aquatic resources. We have reviewed the Arizona Non-point Education for Municipal Officials (NEMO) website for watershed plans[2] for the Middle Gila to gain perspective on the nature of the resources within the watershed, looked at previous Corps mitigation projects associated with the Ray Mine, and reviewed general conservation efforts along the Gila and the San Pedro Rivers to inform site selection and plan development.

Asarco has identified four sites located along the San Pedro River (Sites A-D) and one site along the Gila River (Site E) that are relatively close to the Project (9 – 29 river miles upstream) to compensate for unavoidable project impacts to waters of the United States (***Figure 1***). All of the sites are associated with perennial or intermittent aquatic resources, contain or have the potential to support high value mesoriparian and hydroriparian habitats, and provide regional conservation benefit. The San Pedro River mitigation sites are associated with existing Corps-approved mitigation projects that have been developed in support of previous Corps permitting efforts at the Ray Mine and are contiguous with or near other conservation properties that have been established by the Bureau of Reclamation, the Salt River Project and the Arizona Game and Fish Department (***Figure 3***). While the proposed mitigation measures will not create xeroriparian habitat similar to the habitats associated with the ephemeral drainages that will be impacted by the Project, the habitats within mitigation sites that will be preserved, enhanced, and restored are rarer within the regional landscape, have higher productivity and higher wildlife value. ***Table 2*** provides a brief summary of these five off-site mitigation properties.

[2] NRCS Rapid Watershed Assessment of the Middle Gila River HUC-8 has not been completed (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_064841.pdf; accessed August 27, 2014).

Table 2. Summary of Offsite Mitigation Areas

Mitigation Site	Acreage	Description
Site A PZ Ranch Northeastern Mesquite Bosque (Preservation)	29.8	Adjacent to an existing Corps mitigation site (***Figures 3 and 4***) and is included within the fenced boundary of that mitigation site. Active management of this site through proposed preservation efforts will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict ORV access to this site to enhance its riparian habitat values. The existing bosque habitat is second growth and was likely part of an earlier agricultural operation or the mesquite had been harvested for fuel wood or other purpose. Mesquite bosque habitats were once relatively common and widespread along Arizona's larger rivers and streams but mature bosque habitat has become relatively rare. The preservation and active management of this site will facilitate the development and maintenance of this habitat.
Site B PZ Ranch Southern Mesquite Field (Restoration)	28.2	Former agricultural field on the east bank of the San Pedro River. This field is within an existing Corps mitigation site. In 1993 the field was planted with containerized mesquite. The portion of this field included here represents excess mitigation area not needed for the original project. The functional values of this site have increased as indicated by a measurable increase in vegetative cover (***Figures 5a and 5b***). The restoration area is part of the San Pedro River riparian corridor and is contiguous with other Corps mitigation sites and conservation areas managed by the Bureau of Reclamation (***Figure 3***). .
Site C PZ Ranch Northwestern Mesquite Field (Restoration)	25.8	Adjacent to an existing Corps mitigation site on the west bank of the San Pedro River (***Figures 3 and 6***) and included within the fenced boundary of that mitigation site. Active management of this site will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict ORV access to this site to enhance its riparian habitat values. The site is vegetated by patches of native mesquite and an understory of native forbs and shrubs mixed with weedy forbs (***Figure 6***). Portions of the site have been associated with prior agricultural practices, and it appears as if fuel wood harvesting has occurred at some point in the past. Proposed restoration activities will include the control of weedy plant species (principally tamarisk), planting native mesquite trees, and seeding with native plant species. These activities will restore the functional values of the site as a riparian buffer for the San Pedro River.
Site D San Pedro River Active Floodplain (Preservation)	14.1	Area within the active floodplain of the San Pedro River adjacent to an existing Corps mitigation site on the west bank of the San Pedro River (***Figures 3 and 6***). The dominant vegetation is tamarisk, although cottonwoods are also present. The site will be actively managed to exclude livestock and ORV traffic to enhance its riparian value.
Site E Gila River Channel and Riparian Buffer (Preservation and Restoration)	124.9	Straddles a perennial reach of the Gila River (***Figure 7***). A significant portion of the existing riparian vegetation was destroyed by the Shipman Fire in July 2013. Prior to the fire, the site was dominated by tamarisk. As the site recovers from the fire, tamarisk will again become the dominant riparian species, resulting in riparian habitat with lower functioning value than that offered by riparian habitat dominated by native species. Planned activities include (1) Active management and enhancement of 11.4 acres of the site that includes the active channel of Gila River and immediately adjacent areas to preclude grazing and other activities such as wood harvesting and ORV use and control of tamarisk within and along the river channel. (2) Active restoration of the remaining 113.5 acres of riparian habitat will include site preparation to remove tamarisk stumps and control resprouting and establishment of tamarisk, seeding with native trees and shrubs, and active management to control grazing, ORV use and other activities incompatible with the restoration of this site.

3. MITIGATION RATIO-SETTING CHECKLIST METHODS AND RESULTS

The MRSC procedure includes completion of a checklist to determine the amount of acreage or credits necessary as compensatory mitigation (ACOE 12501-SPD). The checklist comprises a 10-step process that allows for a functional analysis of impacted waters and proposed mitigation parcels, establishes baseline mitigation ratios, and authorizes adjustment of those ratios based on specified criteria.

3.1. IDENTIFICATION AND CLASSIFICATION OF WATERS (STEP 1)

Step one within the MRSC checklist is the identification and classification of impacted waters and proposed mitigation sites. In order to assess the functions of waters within the Ripsey Wash impact areas, impacted drainages were grouped into three different classes (***Figure 2***):

Ephemeral Class 1 – This class consists of very large, wide, ephemeral drainages, which within the Project footprint are limited to the main channel of Ripsey Wash. Drainages within this class have a median width of 180 feet (ft) and an average width of 167 ft.

Ephemeral Class 2 – This class consists of relatively smaller drainages in comparison with Ephemeral Class 1. Ephemeral Class 2 drainages within the Ripsey Wash site include the larger tributaries of Ripsey Wash and another unnamed ephemeral channel that drains toward the Gila River. Drainages within this class have a median width of 35 ft and an average width of 60 ft.

Ephemeral Class 3 – This class consists of headwaters and relatively smaller drainages in comparison to Ephemeral Class 2 drainages. Ephemeral Class 3 drainages within the Ripsey Wash are in the upper parts of the watershed and may drain into Class 2 or Class 1 ephemeral drainages. Drainages within this class have a median width of 6 ft and an average width of 10 ft. The total amount of impacted waters was calculated and determined to be 134.36 acres, all of which are ephemeral waters. Anticipated areas of impact for each of these classes are presented in ***Table 3***.

Table 3. Impacts to Waters by Impacted Drainage Class

Impacted Drainage Class	Direct Impacts	Dewatered Drainages	Total
Ephemeral Class 1	65.0	3.03	68.03
Ephemeral Class 2	45.38	0.52	45.90
Ephemeral Class 3	19.85	0.58	20.43
Total	**130.23**	**4.13**	**134.36**

For impacts to ephemeral waters associated with the Project, offsite mitigation actions will provide functional gain through the active management, enhancement, and restoration of rare and valuable riparian zones adjacent to major intermittent and perennial systems, the San Pedro and Gila Rivers.

Each mitigation parcel was scored as a whole unit with the exception of Gila River Site E, which was split into two separate sections based on mitigation actions focusing on preservation of the Gila River active channel and restoration of Gila River riparian buffer. The parcels selected for mitigation are adjacent to

major water features with either intermittent (San Pedro River) or perennial (Gila River) surface water flows. Functional scoring for these sites consists primarily of an evaluation of the functional gain that the mitigation sites would provide upon achievement of mitigation success.

3.2. QUALITATIVE IMPACT-MITIGATION COMPARISON (STEP 2)

WestLand Resources, Inc. conducted a detailed qualitative functional assessment of the Ripsey Wash Tailings Storage Facility impacted waters and the proposed mitigation sites (***Appendix A***), a brief summary of which is provided, below.

A set of 11 hydrologic, chemical, and biotic functions was developed for this purpose (***Table 4***).

Table 4. Functions Evaluated in the Comparison of Ripsey Wash Impacted Areas and Proposed Mitigation Sites

Hydrologic Functions
Hydrologic Connectivity
Subsurface Flow and Groundwater Recharge
Energy Dissipation
Sediment Transport/ Regulation
Chemical Functions
Elements, Compounds, and Particulate Cycling
Organic Carbon Export/Sequestration
Biotic Functions
Aquatic Invertebrate Fauna
Presence of Fish and Fish Habitat Structure
Riparian/Wetland Vegetation Structure
Age Class Distribution of Wooded Riparian or Wetland Vegetation
Native/Non-native Vegetation Species

Scoring for these 11 functions was conducted based on available data, published literature, field data collected within planned impact areas and mitigation lands, aerial photos, and planned mitigation activities. The categories were scored qualitatively on a six-rank scale: none, low, low-moderate, moderate, moderate-high and high. Based on this scale a numeric score was assigned as identified in ***Table 5***.

Table 5. Numeric Scores assigned to the Qualitative Functional Score

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

Table 6 provides the functional scoring of the three classes of waters that would be impacted by the Project and the projected functional scoring at the proposed mitigation sites upon achievement of mitigation success. A report describing the functional assessment methods and findings is attached in ***Appendix A***.

Based on this functional assessment, the mitigation ratio for each impacted drainage class and mitigation site was adjusted from the starting 1:1 ratio (***Table 7***). The MRSC worksheets in ***Appendix B*** provide the comparison of functional scores and rationale for the mitigation ratio adjustments.

Table 6. Functional Assessment Scoring for Impacted Drainage Classes and Mitigation Sites

Functions	Impact Drainage Classes			Mitigation Sites upon Achievement of Mitigation Success Criteria					
	Ephemeral Class 1	Ephemeral Class 2	Ephemeral Class 3	San Pedro River Site A (Preservation)	San Pedro River Site B (Restoration)	San Pedro River Site C (Restoration)	San Pedro River Site D (Preservation)	Gila River Site E (Preservation)	Gila River Site E (Restoration)
Hydrologic Functions									
Hydrologic Connectivity	4	4	3	4	3	4	4	5	4
Subsurface Flow/Groundwater Recharge	2	2	1	3	2	3	4	5	4
Energy Dissipation	3	2	1	4	3	4	4	5	4
Sediment Transport/ Regulation	3	2	1	5	4	5	5	4	5
Chemical Functions									
Elements, Compounds, and Particulate Cycling	3	2	1	3	3	3	3	5	4
Organic Carbon Export/Sequestration	2	2	1	4	3	3	4	5	4
Biotic Functions									
Aquatic Invertebrate Fauna	0	0	0	0	0	0	0	3	0
Presence of Fish and Fish Habitat Structure	0	0	0	0	0	0	0	3	0
Riparian/Wetland Vegetation Structure	2	2	1	5	2	3	5	5	5
Age Class Distribution of Woody Riparian or Wetland Vegetation	4	3	3	4	3	4	4	5	4
Native/Non-native Vegetation Species	5	5	5	4	5	3	1	3	3
Total Numeric Score	**28**	**24**	**17**	**36**	**28**	**32**	**34**	**48**	**37**

Table 7. Mitigation Baseline Ratios Based on the Functional Assessment of Impacted Drainage Classes and Mitigation Sites

Site	Ephemeral Class 1 Feature Mitigation Ratio	Ephemeral Class 2 Feature Mitigation Ratio	Ephemeral Class 3 Feature Mitigation Ratio
San Pedro River Site A (Mesquite Bosque Preservation)	1:1.1	-	-
San Pedro River Site B (Mesquite Field Restoration)	1:1	-	-
San Pedro River Site C (Mesquite Field Restoration)	1:1.1	-	-
San Pedro River Site D (Active Floodplain Preservation)	1:1.1	-	-
Gila River Site E (preservation)	1:2	1:2	-
Gila River Site E (restoration)	-	1:1.5	1:2.25

Note: The order in which mitigation credits were applied was from highest functionally scoring impacted drainage class (Ephemeral Class 1) to lowest functionally scoring impacted drainage class (Ephemeral Class 3) starting with San Pedro River Site A and then sequentially working through each mitigation site from A to E, as needed, until the mitigation credits needed were fully applied. Because of this sequential process, not all the mitigation ratios developed were used. For instance, baseline mitigation ratios were developed for all drainage classes for San Pedro River Site A, but those mitigation credits were only applied to Ephemeral Class 1 drainage impacts.

3.3. QUANTITATIVE IMPACT-MITIGATION COMPARISON (STEP 3)

Steps 2 and 3 of the MRSC are mutually exclusive, and provide a comparison of the impact and mitigation sites based on a set of defined functional values. Step 2 is qualitative comparison (used in this analysis and described above) and Step 3 is a quantitative comparison. In order to proceed using Step 3, the MRSC requires an accepted method for conducting the assessment quantitatively. In most cases, this requires a published peer-reviewed assessment manual that is appropriate for the region and the aquatic functions present within all considered sites. Currently, there is no Corps-approved assessment method for Desert Southwest. Therefore, this analysis will use the qualitative assessment in Step 2 and omit Step 3.

3.4. MITIGATION SITE LOCATION (STEP 4)

Step 4 in the MRSC is a ratio adjustment based on the location of a mitigation site with respect to the impact site. This is generally determined based on whether both sites are located within the same watershed as defined by the appropriate HUC. There is no defined standard HUC level for use in completing the MRSC. For this project, the Corps has indicated a preference for using the HUC-6 designation.

The mitigation sites along the San Pedro River (Mitigation Sites A, B, C, and D) are located in a watershed outside of the impacted HUC-6 watershed. Therefore, the ratios for those mitigation sites have been adjusted by +1.

Mitigation Site E is located within the impacted HUC-6 watershed. Therefore, there is no ratio adjustment required due to site location.

3.5. NET LOSS OF AQUATIC RESOURCE SURFACE AREA (STEP 5)

Per the MRSC instructions, credit can only be given for this step if establishment or re-establishment of aquatic features is to be completed by proposed mitigation actions. Net loss of aquatic resources is scored with a modification of +0 for establishment mitigation and +1 for all remaining mitigation types.

No aquatic resource establishment is proposed at any of the mitigation sites; therefore, an adjustment of +1 is added to the mitigation ratio for all mitigation sites.

3.6. TYPE CONVERSION (STEP 6)

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

The Project is expected to result in the permanent impact of 134.36 acres of ephemeral waters. The proposed project will not adversely impact any special aquatic sites including wetlands. Three defined classes of impacted waters at Ripsey Wash consist of ephemeral desert washes that supported less than 20 percent cover from riparian and wetland species with vegetation densities that were typically between 0.245 and 0.364 m^3/m^2, indicating that these areas are xeroriparian or upland with relatively sparse vegetation and temporary flow regimes. While these features play an important role in desert ecology, they are more common and provide less functional value when compared to the riparian areas along the San Pedro and Gila Rivers offered by the proposed mitigation sites.

The proposed mitigation sites provide opportunities for restoration, enhancement, preservation, and long-term management along the San Pedro and Gila Rivers. Within existing preservation and restoration sites (San Pedro Sites A, B, and D)[3] and within future restoration or enhancement sites (San Pedro Site C and Gila River Site E), upon achievement of the mitigation success criteria, the proposed mitigation would provide dense riparian habitat which is both rare and important within Arizona.

Due to the rare and regionally significant habitat provided by the proposed mitigation, a ratio adjustment of -2 is applied to all mitigation sites.

[3] San Pedro Mitigation Sites A, B, and D are sites that have already been restored or actively managed and no future mitigation actions, other than continued active management and long term protection, are planned. These sites are available to Asarco for use as mitigation, and their application as mitigation for the Ripsey Wash Tailings Storage Facility will cause the continued and ongoing management of these lands and prevent agricultural type conversion, fuel wood harvesting, and other vegetation removal activities from being conducted within these areas.

The existing bosque habitat within San Pedro River Mitigation Site A is second growth and was likely part of an earlier agricultural operation or the mesquite had been harvested for fuel wood or other purpose. Mesquite bosque habitats were once relatively common and widespread along Arizona's larger rivers and streams, but mature bosque habitat has become relatively rare. The preservation and active management of this site, adjacent to a large block of existing conservation lands (***Figure 3***), will facilitate the development and maintenance of this habitat San Pedro River Mitigation Site B consists of the restoration of a former agricultural field with native vegetation plantings consisting largely of mesquite (***Figure 5***). This field is within an existing Corps mitigation site. In 1993, the field was planted with containerized mesquite. The portion of this field included here represents excess mitigation area not needed for the original project. The functional values of this site have increased as indicated by a measurable increase in vegetative cover (***Figures 5a and 5b***). The restoration area is part of the San Pedro River riparian corridor and is contiguous with other Corps mitigation sites and conservation areas managed by the Bureau of Reclamation (***Figure 3***).

San Pedro River Mitigation Site C is also adjacent to an existing Corps mitigation site on the west bank of the San Pedro River (***Figure 3***). Active management of this site will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict ORV access to this site to enhance its riparian habitat values. The site is vegetated by patches of native mesquite and an understory of native forbs and shrubs mixed with weedy forbs (***Figure 6***). Portions of the site have been associated with prior agricultural practices and it appears as if fuel wood harvesting has occurred at some point in the past. Proposed restoration activities will include the control of weedy plant species (principally tamarisk), planting native mesquite trees, and seeding with native plant species. These activities will enhance the functional values of the site as a riparian buffer for the San Pedro River.

San Pedro Mitigation Site D consists of dense and contiguous riparian habitat within the active floodplain of the San Pedro River within a large block of existing conservation lands (***Figures 3 and 6***). The dominant vegetation is tamarisk, although cottonwoods are also present. The site will be actively managed to exclude livestock and ORV traffic to enhance its riparian value. The preservation of riparian forest within Site D will improve overall watershed functions as part of the larger conservation block.

Planned activities within Gila River Site E include active management and enhancement of 11.4 acres of the site that includes the active channel of Gila River and active restoration of 113.5 acres of riparian habitat to include site preparation to remove tamarisk stumps and control resprouting and establishment of tamarisk, seeding with native trees and shrubs, and active management to control grazing, ORV use and other activities incompatible with the restoration of this site. The restoration of riparian forest and preservation of the river itself within Site E will provide the continuation of the benefits and functionality of the riparian habitat and the Gila River. The restoration of riparian forest within Site E will restore the benefits of riparian habitat lost in the 2013 Shipman Fire and actively promote the exclusion of non-native vegetation adjacent to the Gila River, thereby improving overall watershed and habitat functions.

3.7. RISK AND UNCERTAINTY (STEP 7)

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

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

Because Asarco's proposed mitigation activities are permittee-responsible mitigation, a ratio adjustment of + 0.3 was applied to all sites.

San Pedro Mitigation Sites A, B, and D provide existing functional gain and do not require further mitigation actions. These sites would be managed along with a large tract of conservation area that has an existing management program to ensure the long-term protection of the mitigation lands. These sites are actively managed and protected with existing fencing. The application of these areas as mitigation for the Ripsey Wash Tailings Storage Facility will cause the continued and ongoing management of these lands that will prevent agricultural type conversion, fuel wood harvesting, and other vegetation removal activities from being conducted within these areas. Based on this, there is no additional risk or uncertainty associated with these sites.

San Pedro Mitigation Site C consists of a mitigation area within an active management plan. The planned mitigation actions are designed to continue to enhance and improve upon existing conditions. Additional vegetation plantings are anticipated to succeed based on the currently established vegetation and there is a low risk associated with the planned enhancement. This site is also fenced and would be managed along with a large tract of conservation area that has an existing management program to ensure the long term protection of the mitigation lands. The application of this area as mitigation for the Ripsey Wash Tailings Storage Facility will cause the continued and ongoing management of these lands that will prevent agricultural type conversion, fuel wood harvesting, and other vegetation removal activities from being conducted within these areas.

The active channel preservation actions at Gila River Site E consist of preservation of habitat that is already in place, therefore, there is no risk associated with the defined actions. This site would also be fenced and managed to ensure the long-term protection of the mitigation lands.

The riparian restoration actions at Gila River Site E are designed to replace the recently burned area and exotic invasive tamarisk with a mesquite bosque. Vegetation seedings are anticipated to succeed based on the adjacent established vegetation and the documented hardiness and germination success of mesquite tress. The low risk nature of the planned restoration and the planned implementation of an adaptive

management plan to enhance the success of the native vegetation growth and prevent regrowth of invasive tamarisk reduce the potential risk to minimal. This site would also be fenced and managed to ensure the long-term protection of the mitigation lands.

3.8. TEMPORAL LOSS (STEP 8)

Temporal loss associated with mitigation activities that begin after impacts are made and the amount of time it takes for a mitigation activity to reach full, functional potential are considered in this step. Ratio adjustments are applied based on the amount of time required for the planting, establishment, and growth of vegetation. The temporal adjustment to the mitigation ratio is .05 per month and generally assumes a 20-month time-frame (adjustment of +1) for herbaceous growth, a 40-month time frame (adjustment of +2) for woody shrubs, and a 60-month (adjustment of +3) or 5 year time frame for tree species.

San Pedro Mitigation Sites A, B, and D provide preservation and/or mitigation that is the result of previously implemented preservation and/or restoration actions (but are not the result of actions that the Applicant was legally required to take). The planned mitigation activities within approximately 11.4 acres of active channel within Gila River Site E include preservation and no plantings for restoration purposes are proposed. Therefore, there is no temporal loss associated with these sites and no ratio adjustment is applied.

San Pedro Site C, and Gila River Site E (restoration) include mitigation actions such as planting or seeding, and a ratio adjustment is applied based on the time it is expected to take for the new trees to mature and reach full functional benefit within the system. Based on this, there is a +3 ratio adjustment for these sites based on the estimated time for the planted trees to mature (60 months or 5 years).

3.9. FINAL MITIGATION RATIO (STEP 9)

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

Step 9 of the MRSC is the calculation of final mitigation scoring ratios from Steps 2-8 in the MRSC. The mitigation ratios for each impact class and mitigation site were compiled and are summarized in ***Table 8.***

Table 8. Final Mitigation Ratios Per Impacted Drainage Class and Mitigation Site

Site	Ephemeral Class 1 Feature Mitigation Ratio	Ephemeral Class 2 Feature Mitigation Ratio	Ephemeral Class 3 Feature Mitigation Ratio
Site A (Preservation)	1.2:1	-	-
Site B (Restoration)	1.3:1	-	-
Site C (Restoration)	3.9:1	-	-
Site D (Preservation)	1.2:1	-	-
Site E (Preservation)	1:1	1:1	-
Site E (Restoration)	-	2.2:1	1.5:1

Note 1: When the mitigation ratio was less than 1:1, a ratio of 1:1 was used in the final mitigation credit calculation based on MRSC instructions.

Note 2: The order in which mitigation credits were applied was from highest functional scoring impacted drainage class (Ephemeral Class 1) to lowest functional scoring impacted drainage class (Ephemeral Class 3) starting with San Pedro River Site A and then sequentially working through each mitigation site from A to E, as needed, until the mitigation credits needed were fully applied.

3.10. FINAL COMPENSATORY MITIGATION SUMMARY (STEP 10)

The total acres of impacted areas by drainage class are applied to the number of mitigation credits provided based on the final mitigation ratios. ***Table 9*** summarizes the application of the MRSC derived mitigation ratios to the mitigation sites in a sequential fashion. The order in which mitigation credits were applied was from highest functionally scoring impacted drainage class (Ephemeral Class 1) to lowest functionally scoring impacted drainage class (Ephemeral Class 3) starting with San Pedro River Site A and then sequentially working through each mitigation site from A to E, as needed, until all of the functional impacts for each drainage class was mitigated.

Table 9. Final Mitigation Credits Applied by Impact Drainage Class and Mitigation Site

Impact Drainage Class	Impact Acres	Mitigation Site	Mitigation Acres Available	Mitigation Ratio	Mitigation Credits at Site for selected Class	Mitigation Credits Used	Mitigation Credits Remaining	Remaining Impact Acres
Ephemeral Class 1	68.03	Site A (Preservation)	29.8	1.2:1	24.8	24.8	0.0	43.20
		Site B (Restoration)	28.2	1.3:1	21.69	21.69	0.0	21.50
		Site C (Restoration)	25.8	3.9:1	6.62	6.62	0.0	14.89
		Site D (Preservation)	14.1	1.2:1	11.75	11.75	0.0	3.14
		Site E (Preservation)	11.4	1:1	11.4	3.14	8.26	0.0
Ephemeral Class 2	45.90	Site E (Preservation)	8.26	1:1	8.26	8.26	0.0	37.64
		Site E (Restoration)	113.5	2.2:1	51.57	37.64	13.93	0.0
Ephemeral Class 3	20.43	Site E (Restoration)	30.65	1.5:1	20.43	20.43	0.0	0.0

FIGURES

Pinal County
Photo Source: NAIP, 2013

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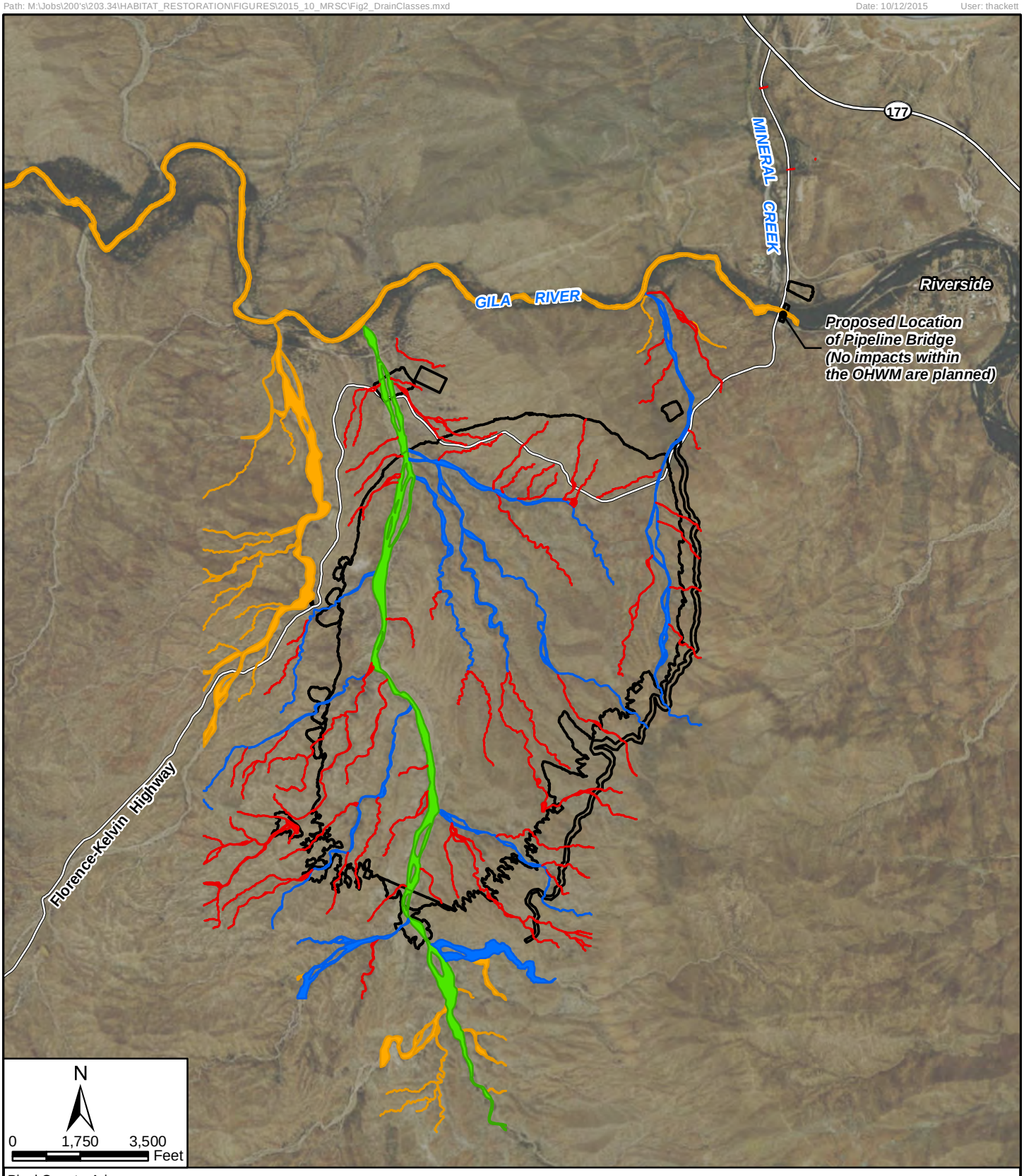
N

0 2 4 Miles

ASARCO LLC

Ripsey Wash Tailings Storage Facility
Mitigation Ratio-Setting Checklist

LOCATION MAP
Figure 1



Pinal County, Arizona,
Photo Source: NAIP, 2013

LEGEND

- Ripsey Wash Alternative 3 Tailings Storage Facility Footprint
- Ephemeral Class 1 (Ripsey Wash)
- Ephemeral Class 2
- Ephemeral Class 3
- No Classification Assigned (No Impacts Proposed)

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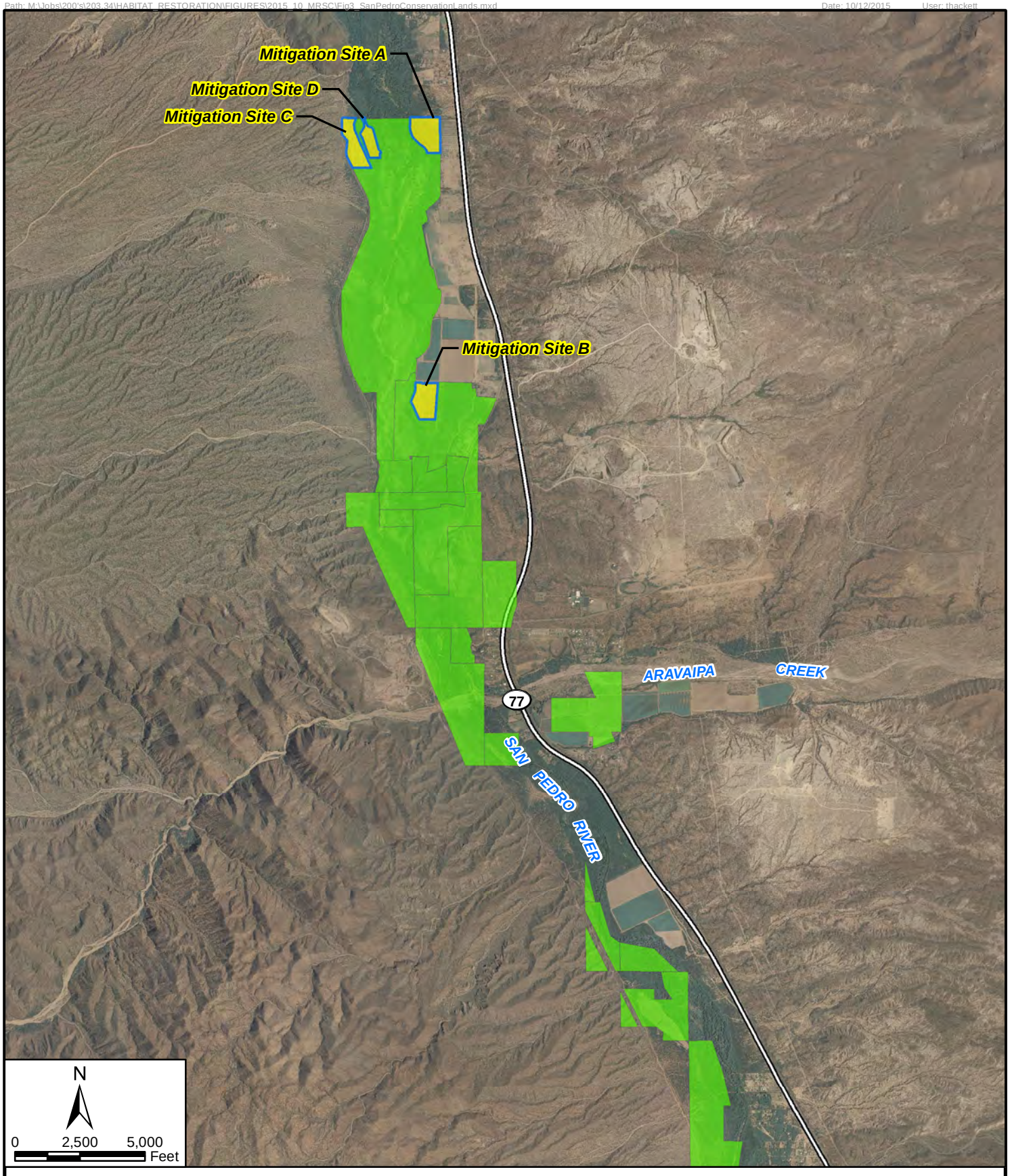
RIPSEY WASH PROJECT AREA
IMPACTED DRAINAGE CLASSIFICATIONS

Figure 2



Pinal County
Photo Source: NAIP, 2010

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LEGEND

- Mitigation Site Location
- Existing Conservation Lands

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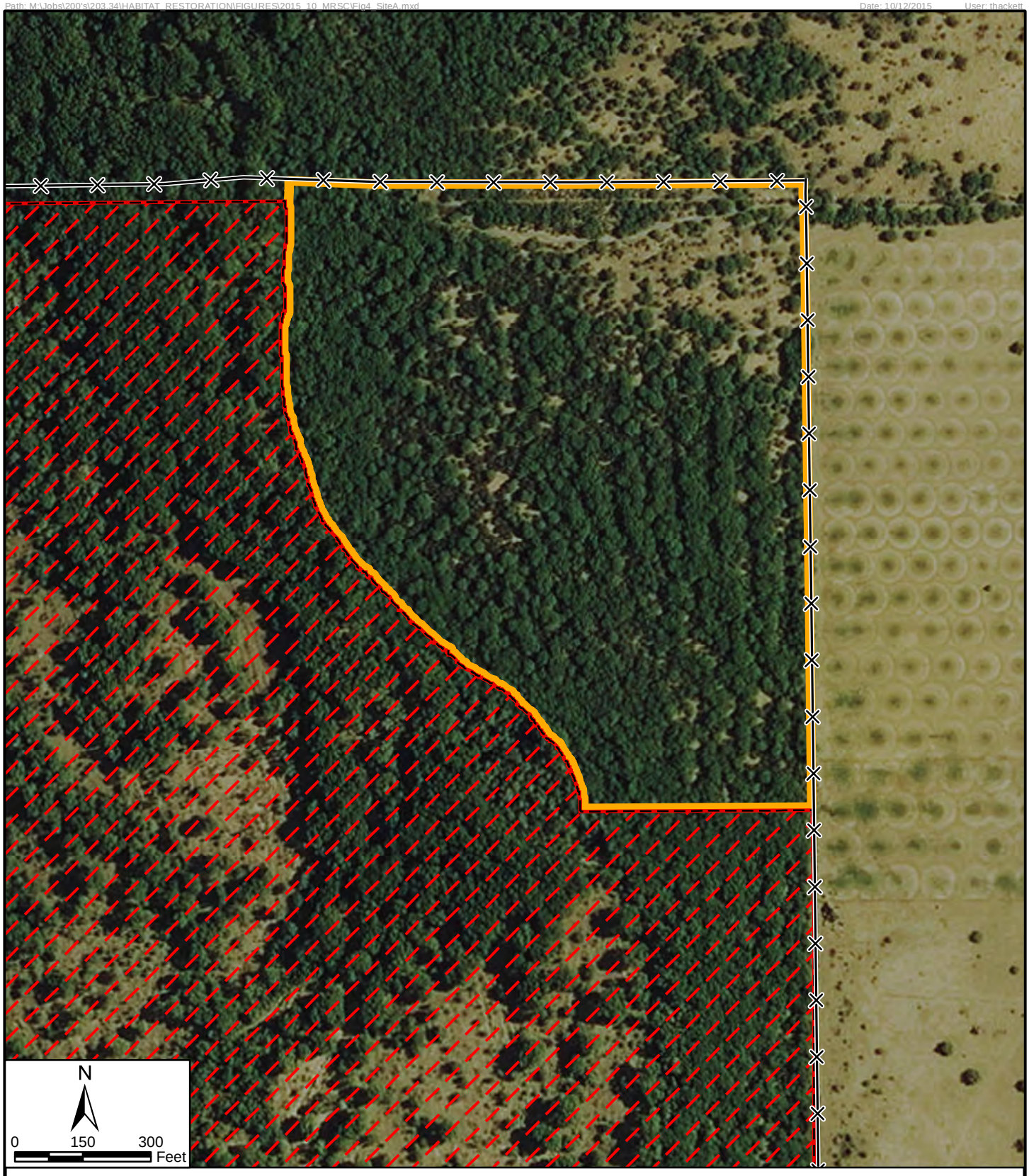
Mitigation Ratio-Setting Checklist

CONSERVATION LANDS
ALONG THE LOWER
SAN PEDRO RIVER
Figure 3



T6S, R16E, Portion of Section 21,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site A (Mesquite Bosque Preservation)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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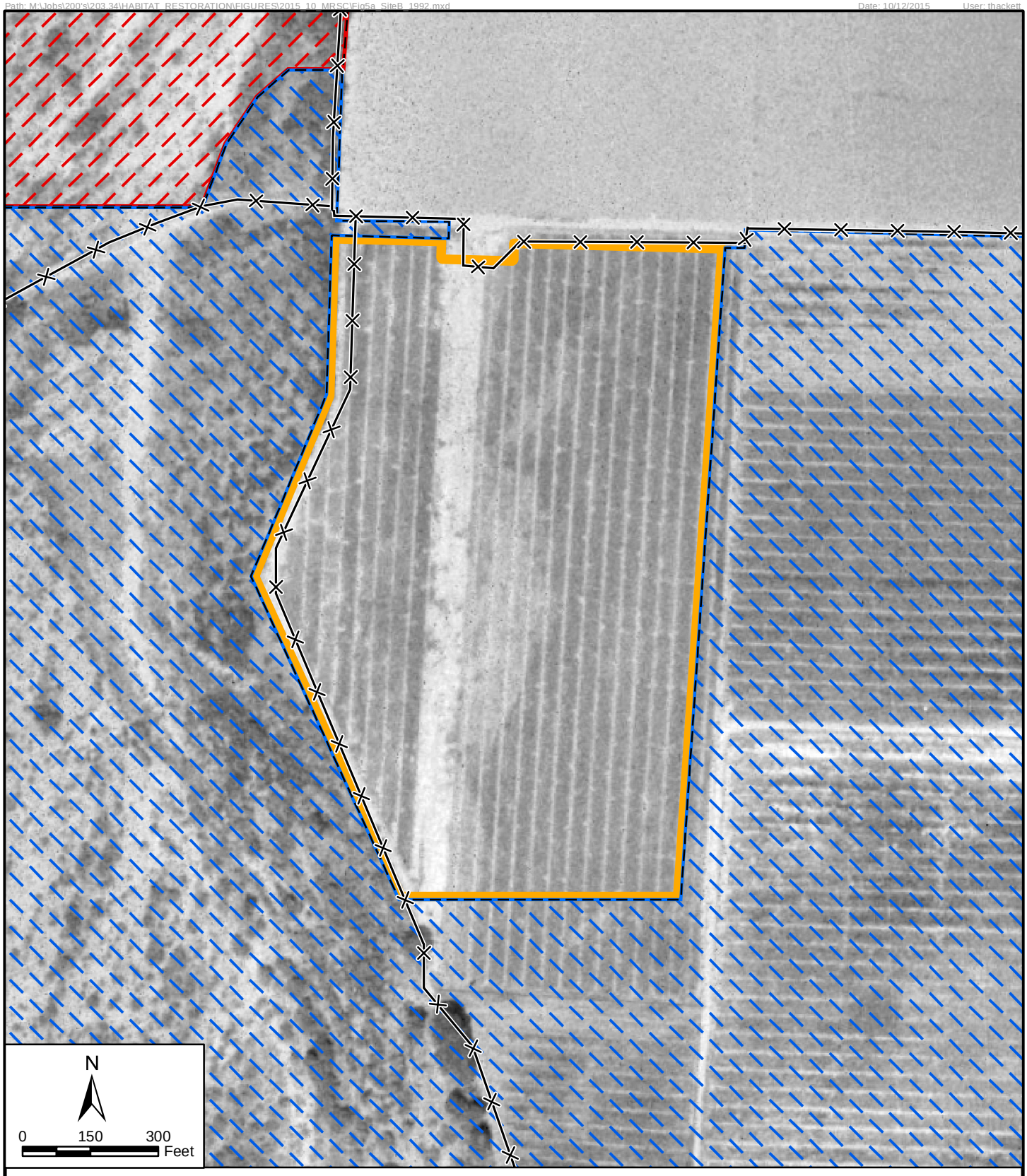
Ripsey Wash Tailings Storage Facility
Mitigation Ratio-Setting Checklist

SAN PEDRO RIVER SITE A (PRESERVATION)

Figure 4



T6S, R16E, Portion of Section 33,
Pinal County, Arizona,
Photo Source: USGS DOQQ, 1992

LEGEND

- Site B (Mesquite Field Restoration)
- PZ-1 Mitigation Lands (Corps File No. 1990-400-8400-RJD)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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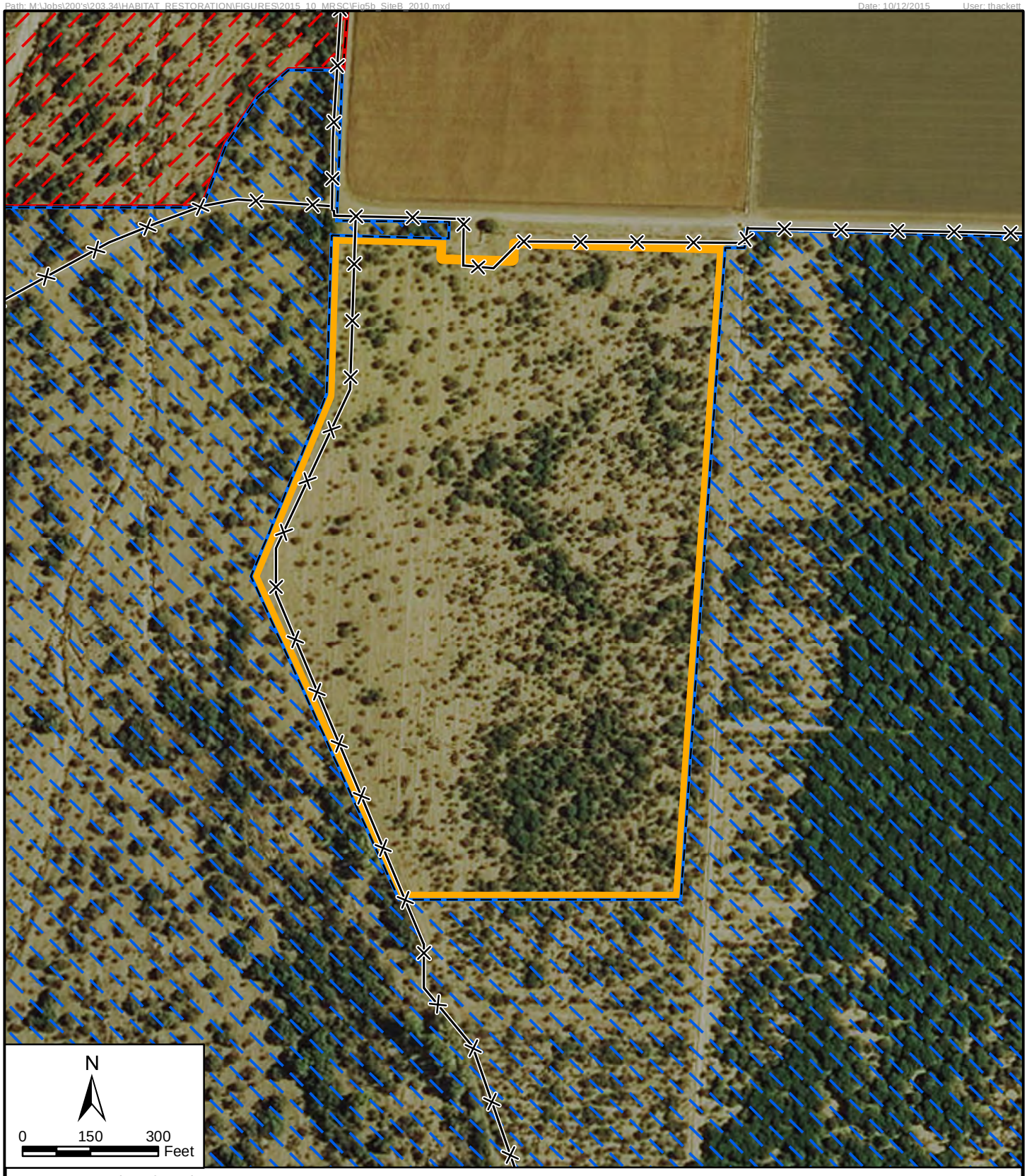
Ripsey Wash Tailings Storage Facility
Mitigation Ratio-Setting Checklist

SAN PEDRO RIVER SITE B (RESTORATION) (1992)
Figure 5a



T6S, R16E, Portion of Section 33,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site B (Mesquite Field Restoration)
- PZ-1 Mitigation Lands (Corps File No. 1990-400-8400-RJD)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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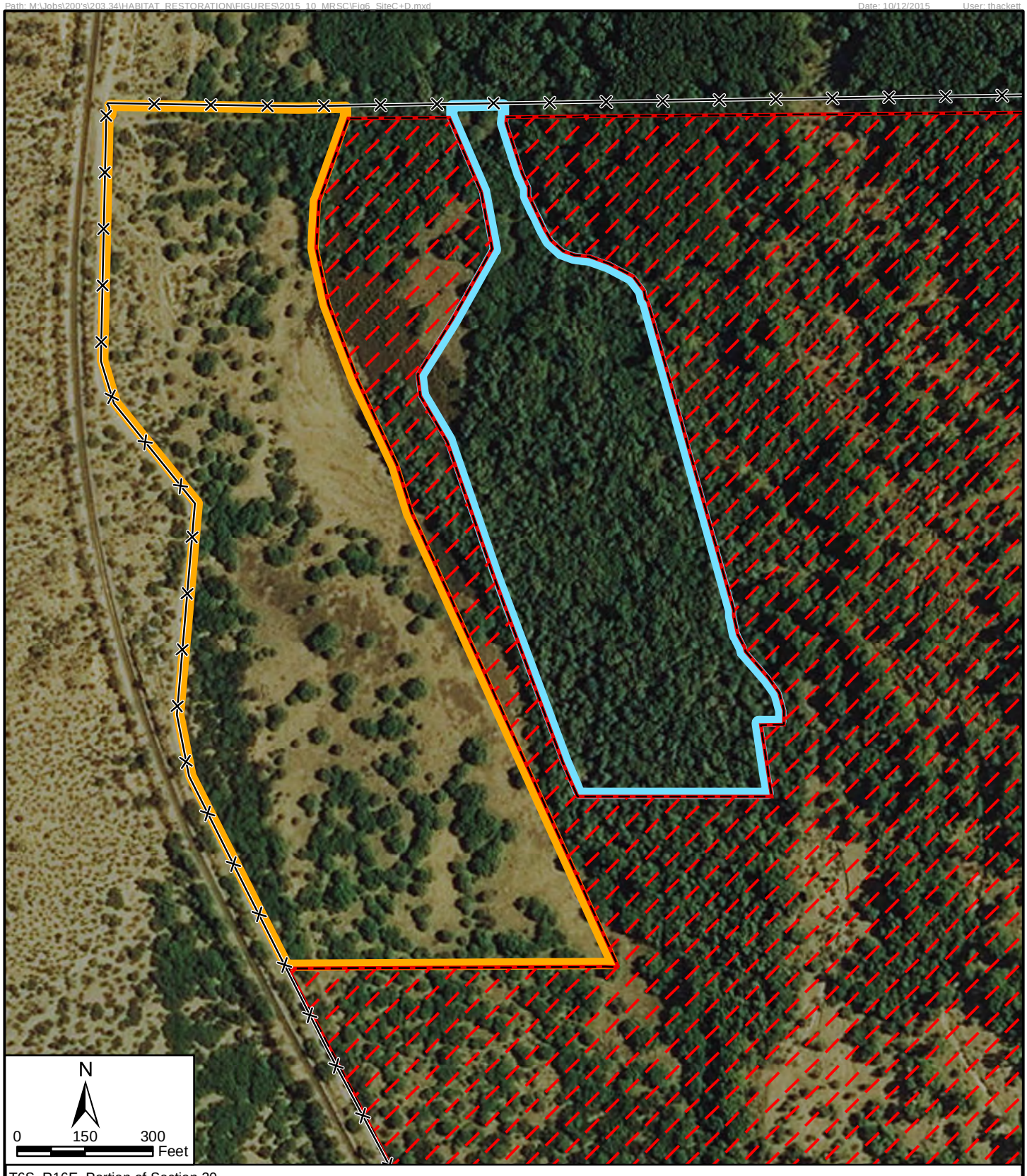
Mitigation Ratio-Setting Checklist

SAN PEDRO RIVER SITE B (RESTORATION) (2013)

Figure 5b



T6S, R16E, Portion of Section 20,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site C (Mesquite Field Restoration)
- Site D (Active Floodplain Preservation)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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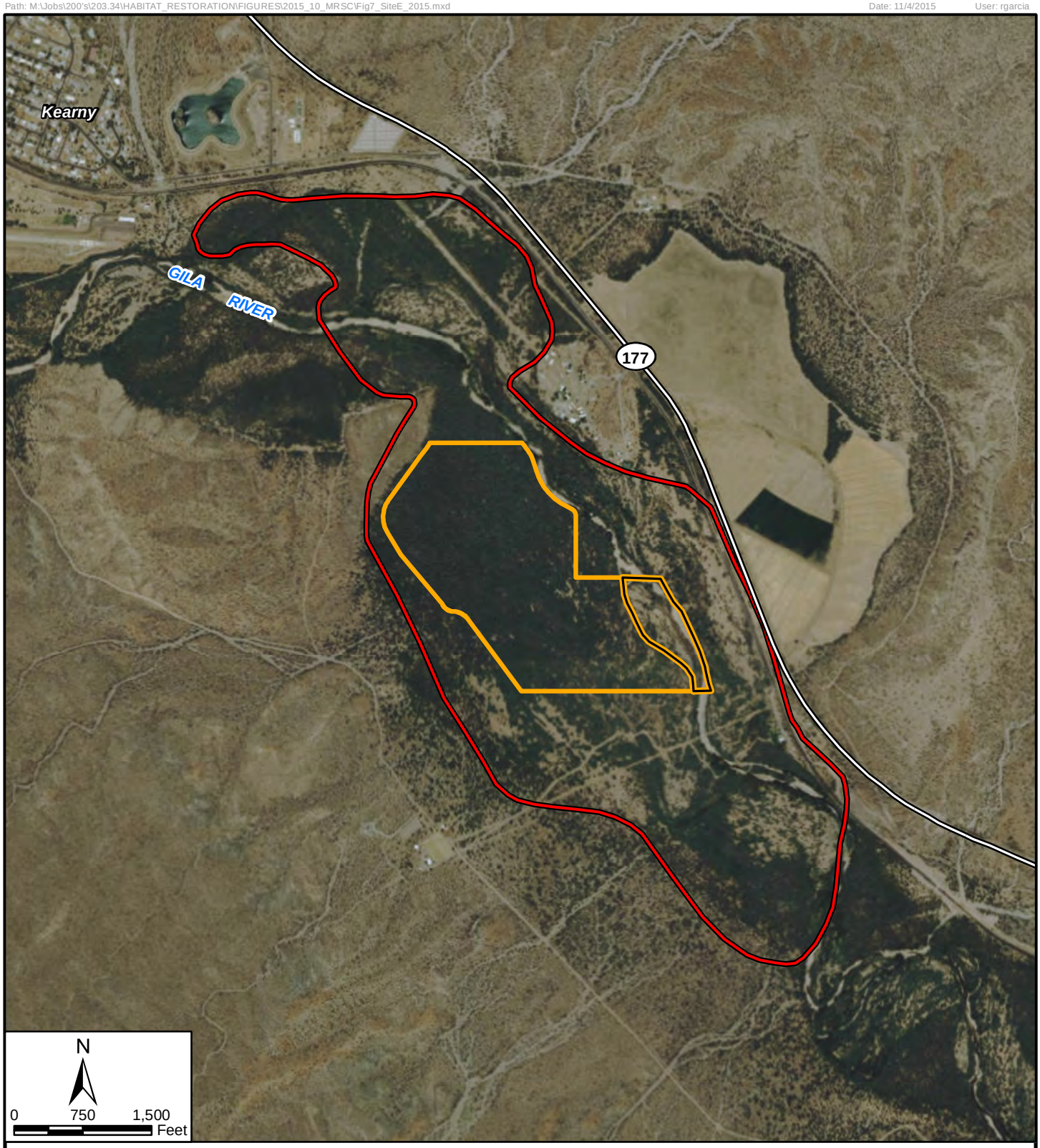
Ripsey Wash Tailings Storage Facility Mitigation Ratio-Setting Checklist

SAN PEDRO SITE C (RESTORATION) &
SAN PEDRO SITE D (PRESERVATION)

Figure 6



T4S, R14E, Portion of Sections 7, 17, 18, 20, 21 & 29,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

*Fire Perimeter Source: PDF of "Shipman Fire AZ-A15-130795 Vicinity Map"
(AZ State Forestry Division, 7/10/2013).

*Vicinity Map PDF: Downloaded from http://inciweb.nwcg.gov/incident/map/3502/0/30745/

LEGEND

- Site E (Gila River Riparian Buffer Restoration)
- Site E (Gila River Active Channel Preservation)
- Shipman Fire (7/10/2013)

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Mitigation Ratio-Setting Checklist

GILA RIVER SITE E
(PRESERVATION & RESTORATION)
Figure 7

Path: M:\Jobs\200's\203.34\HABITAT_RESTORATION\FIGURES\2015_10_MRSC\Fig8_OverviewMap_MitigationSites_HUC6.mxd Date: 10/12/2015 User: thackett

N

15 0 15 Miles

1 in = 15 miles

Watershed Boundary Dataset: Downloaded from Geospatial Data Gateway (https://gdg.sc.egov.usda.gov/)

Base Map: ESRI Online, World Topo Map

Legend

- Ripsey Wash Tailings Storage Facility Footprint
- Ripsey Mitigation Site

Watershed Boundary Dataset

6-digit HU (HUC-6)

- Middle Gila Basin (150501)
- San Pedro-Willcox Basin (150502)

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Ripsey Wash Tailings Storage Facility Mitigation Ratio-Setting Checklist

RIPSEY MITIGATION SITES WITH HUC-6 WATERSHED MAPPING

Figure 8

APPENDIX A

RIPSEY WASH TAILINGS STORAGE FACILITY FUNCTIONAL ASSESSMENT OF IMPACTED WATERS AND PROPOSED MITIGATION SITES

RIPSEY WASH TAILINGS STORAGE FACILITY

FUNCTIONAL ASSESSMENT OF IMPACTED WATERS AND PROPOSED MITIGATION SITES

ASARCO LLC

Prepared for:

U.S. ARMY CORPS OF ENGINEERS

Prepared by:

WestLand Resources, Inc.
Engineering and Environmental Consultants

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On behalf of:

ASARCO LLC – RAY OPERATIONS
P.O. Box 640
Kearny, Arizona 85137

Revised November 5, 2015
Project No. 203.25
Corps File No. SPL-2011-1005-MWL

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TABLES

FIGURES

(*follow text*)

1. INTRODUCTION AND BACKGROUND

ASARCO LLC (Asarco or the Applicant) has identified the need for additional tailings storage to support ongoing mining operations at the Ray Mine in Pinal County, Arizona (***Figure 1***). The construction of a tailings storage facility (the Project) will require the discharge of fill material to surface drainage features that are considered waters of the United States (waters of the U.S. or waters) by the US Army Corps of Engineers (Corps).

Asarco has identified the Ripsey Wash Tailings Storage Facility (TSF) as its proposed action in its Clean Water Act (CWA) Section 404 permit application to the Corps (Corps File No. SPL-2011-1005-MWL). As part of CWA Section 404 individual permit requirements for discharge into waters, a mitigation plan must be prepared in accordance with the Corps' and the U.S. Environmental Protection Agency's (EPA) *Final Rule for Compensatory Mitigation for Losses of Aquatic Resources* (33 C.F.R. Part 332 and 40 C.F.R. Part 230; published in 73 Fed. Reg. 19594-19705 (April 10, 2008)), hereinafter referred to as the 2008 Mitigation Rule. The fundamental objective of the 2008 Mitigation Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters authorized through the issuance of a CWA Section 404 permit. The South Pacific Division of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation ratios.

Asarco has coordinated with the Corps to identify potential mitigation opportunities for the Project. Following review and approval (or modification, as appropriate) by the Corps of the concepts contained in Asarco's Ripsey Wash Tailings Storage Facility Conceptual Mitigation Plan (submitted under separate cover), a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed. An analysis and comparison of the functional loss from jurisdictional impacts and functional gains provided by proposed mitigation areas is a key element in the MRSC process.

The purpose of this report is to support the MRSC document for the development of the Conceptual Mitigation Plan. This report is presented in three sections: ***Section 1*** presents the document purpose and organization; ***Section 2*** describes the methods used in the qualitative functional assessment of impacted waters and proposed mitigation areas; and ***Section 3*** provides the results of the functional assessment of impacted waters and proposed mitigation areas.

2. METHODS USED FOR FUNCTIONAL ASSESSMENT

2.1. DRAINAGE CLASSIFICATION OF IMPACTED WATERS

The development of the Ripsey Wash TSF Project included a substantial effort to avoid and minimize impacts to waters of the United States as outlined in the 404(b)(1) alternatives analysis prepared for the project.[1] ***Table 1*** summarizes unavoidable impacts to waters of the U.S. that would result from construction

[1] WestLand Resources, Inc. 2014. Alternatives Screening and Clean Water Act Section 404(b)(1) Alternatives Analysis. Prepared for Corps File No. SPL-2011-1005-MWL. Dated July 17, 2015.

of the Project. The Project is expected to result in the direct impact to 130.23 acres of ephemeral waters. An additional 4.13 acres of ephemeral waters will be cut off from upstream flows. The proposed project will not adversely impact any special aquatic sites including wetlands.

Table 1. Ripsey Wash Tailings Storage Facility Project Impacts to Waters

Impact Type	Acreage
Direct impacts to ephemeral flows	130.23
Dewatered ephemeral flows	4.13
Total	**134.36**

In order to conduct functional assessment of the impacted waters, impacted drainages were grouped into three different classes (***Figure 2***):

Ephemeral Class 1 – This class consists of very large, wide, ephemeral drainages, which within the Project footprint are limited to the main channel of Ripsey Wash. Drainages within this class have a median width of 180 feet (ft) and an average width of 167 ft.

Ephemeral Class 2 – This class consists of relatively smaller drainages in comparison with Ephemeral Class 1. Ephemeral Class 2 drainages within the Ripsey Wash site include the larger tributaries of Ripsey Wash and another unnamed ephemeral channel that drains toward the Gila River. Drainages within this class have a median width of 35 ft and an average width of 60 ft.

Ephemeral Class 3 – This class consists of headwaters and relatively smaller drainages in comparison to Ephemeral Class 2 drainages. Ephemeral Class 3 drainages within the Ripsey Wash are in the upper parts of the watershed and may drain into Class 2 or Class 1 ephemeral drainages. Drainages within this class have a median width of 6 ft and an average width of 10 ft.

2.2. MITIGATION SITE SELECTION OVERVIEW

The 2008 Mitigation Rule identifies general classes of compensatory mitigation and identifies clear preference among these classes; specifically noting that Mitigation Banking and then In Lieu Fee Mitigation are preferred over applicant sponsored, on-site, or off-site mitigation. As a general matter, in-kind mitigation is preferred over out-of-kind mitigation. Asarco considered these general classes of compensatory mitigation from a watershed perspective when developing this conceptual mitigation plan.

There are currently no mitigation banks established in Arizona and no approved In-Lieu-Fee mitigation projects within the Hydrologic Unit Code (HUC)-6 watershed associated with the Project.

The development of the Project design included a substantial effort to avoid and minimize impacts to waters. A number of onsite mitigation measures were incorporated into the Project design to address water quality and quantity functions. These measures include the construction of a detention dam, diversion channel, and piping infrastructure to route any runoff from undisturbed areas above the TSF around the facility; the installation of energy dissipaters at the outfall locations of the diversion channel and piping;

and the installation of monitoring and pump-back wells downstream from seepage-collection points and reclaim ponds.

The Project entails active mining operations requiring the diversion of upstream flows around the TSF and the Project area contains only ephemeral drainage channels with no potential for improvement through restoration. Therefore, no onsite mitigation opportunities exist and habitat functions that will be lost through the development of the Project will be mitigated offsite. The identification of offsite compensatory mitigation options was made after a review of various options within the watershed.

We are aware of no watershed planning efforts for the HUC-6 or HUC-8 watersheds that contain the Project that identify specific compensatory mitigation goals for aquatic resources. We have reviewed the Arizona Non-point Education for Municipal Officials (NEMO) website for watershed plans[2] for the Middle Gila to gain perspective on the nature of the resources within the watershed, looked at previous Corps mitigation projects associated with the Ray Mine, and reviewed general conservation efforts along the Gila and the San Pedro Rivers to inform site selection and plan development.

Asarco has identified four sites located along the San Pedro River (Sites A-D) and one in the Gila River (Site E) that are relatively close to the Project (9 – 29 river miles upstream) to compensate for unavoidable project impacts to waters of the United States (***Figure 1***). All of the sites are associated with perennial or intermittent aquatic resources, contain or have the potential to support high value mesoriparian and hydroriparian habitats, and provide regional conservation benefit. The San Pedro River mitigation sites are associated with existing Corps-approved mitigation projects that have been developed in support of previous Corps permitting efforts at the Ray Mine and are contiguous with or near other conservation properties that have been established by the Bureau of Reclamation, the Salt River Project, and the Arizona Game and Fish Department (***Figure 3***). While the proposed mitigation measures will not create xeroriparian habitat similar to the habitats associated with the ephemeral drainages that will be impacted by the Project, the habitats within mitigation sites that will be preserved, enhanced, and restored are rarer within the regional landscape, have higher productivity and higher wildlife value. ***Table 2*** provides a brief summary of these five off-site mitigation properties.

These mitigation sites occupy highly-valuable and rare areas within the Gila River watershed and the proposed mitigation actions will help to maintain or restore natural functions along large intermittent or perennial streams and their associated riparian buffers.

Each mitigation parcel was scored as a whole unit with the exception of Site E, which was split into two separate sections based on mitigation actions focusing on preservation of the Gila River active channel and restoration of Gila River riparian buffer. Functional scoring was based on the condition of the site upon achievement of mitigation success.

[2] NRCS Rapid Watershed Assessment of the Middle Gila River HUC-8 has not been completed (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_064841.pdf; accessed August 27, 2014).

Table 2. Summary of Offsite Mitigation Areas

Mitigation Site	Acreage	Description
Site A PZ Ranch Northeastern Mesquite Bosque (Preservation)	29.8	Adjacent to an existing Corps mitigation site (***Figures 3 and 4***) and is included within the fenced boundary of that mitigation site. Active management of this site through proposed preservation efforts will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict ORV access to this site to enhance its riparian habitat values. The existing bosque habitat is second growth and was likely part of an earlier agricultural operation or the mesquite had been harvested for fuel wood or other purpose. Mesquite bosque habitats were once relatively common and widespread along Arizona's larger rivers and streams but mature bosque habitat has become relatively rare. The preservation and active management of this site will facilitate the development and maintenance of this habitat.
Site B PZ Ranch Southern Mesquite Field (Restoration)	28.2	Former agricultural field on the east bank of the San Pedro River. This field is within an existing Corps mitigation site. In 1993 the field was planted with containerized mesquite. The portion of this field included here represents excess mitigation area not needed for the original project. The functional values of this site have increased as indicated by a measurable increase in vegetative cover (***Figures 5a and 5b***). The restoration area is part of the San Pedro River riparian corridor and is contiguous with other Corps mitigation sites and conservation areas managed by the Bureau of Reclamation (***Figure 3***).
Site C PZ Ranch Northwestern Mesquite Field (Restoration)	25.8	Adjacent to an existing Corps mitigation site on the west bank of the San Pedro River (***Figures 3 and 6***) and included within the fenced boundary of that mitigation site. Active management of this site will exclude cattle from the site, restrict fuel wood and other wood harvesting, and restrict ORV access to this site to enhance its riparian habitat values. The site is vegetated by patches of native mesquite and an understory of native forbs and shrubs mixed with weedy forbs (***Figure 6***). Portions of the site have been associated with prior agricultural practices, and it appears as if fuel wood harvesting has occurred at some point in the past. Proposed restoration activities will include the control of weedy plant species (principally tamarisk), planting native mesquite trees, and seeding with native plant species. These activities will restore the functional values of the site as a riparian buffer for the San Pedro River.
Site D San Pedro River Active Floodplain (Preservation)	14.1	Area within the active floodplain of the San Pedro River adjacent to an existing Corps mitigation site on the west bank of the San Pedro River (***Figures 3 and 6***). The dominant vegetation is tamarisk, although cottonwoods are also present. The site will be actively managed to exclude livestock and ORV traffic to enhance its riparian value.
Site E Gila River Channel and Riparian Buffer (Preservation and Restoration)	124.9	Straddles a perennial reach of the Gila River (***Figure 7***). A significant portion of the existing riparian vegetation was destroyed by the Shipman Fire in July 2013. Prior to the fire, the site was dominated by tamarisk. As the site recovers from the fire, tamarisk will again become the dominant riparian species, resulting in riparian habitat with lower functioning value than that offered by riparian habitat dominated by native species. Planned activities include (1) Active management and enhancement of 11.4 acres of the site that includes the active channel of Gila River and immediately adjacent areas to preclude grazing and other activities such as wood harvesting and ORV use, and control of tamarisk within and along the river channel. (2) Active restoration of the remaining 113.5 acres of riparian habitat will include site preparation to remove tamarisk stumps and control resprouting and establishment of tamarisk, seeding with native trees and shrubs, and active management to control grazing, ORV use and other activities incompatible with the restoration of this site.

2.3. FUNCTIONAL SCORING OF DRAINAGE CLASSES WITHIN THE RIPSEY WASH IMPACTED AREAS AND PROPOSED MITIGATION SITES

Impacted jurisdictional waters at the Ripsey Wash site were grouped into three different classes: Ephemeral Class 1, Ephemeral Class 2, and Ephemeral Class 3 (***Figure 2***). All of these drainage classes were evaluated for each of the functions described below.

A list of 11 hydrologic, chemical, and biotic functions was developed to provide an assessment of the functions within each drainage class (***Table 3***). These functions are consistent with those identified in the South Pacific Division's *Standard Operating Procedure for the Determination of Mitigation Ratios* (12501-SPD, October 2013).

Table 3. Functions Evaluated in the Ripsey Wash Assessment of Waters of the U.S.

Hydrologic Functions
Hydrologic Connectivity
Subsurface Flow and Groundwater Recharge
Energy Dissipation
Sediment Transport/ Regulation
Chemical Functions
Elements, Compounds, and Particulate Cycling
Organic Carbon Export/Sequestration
Biotic Functions
Aquatic Invertebrate Fauna
Presence of Fish and Fish Habitat Structure
Riparian/Wetland Vegetation Structure
Age Class Distribution of Wooded Riparian or Wetland Vegetation
Native/Non-native Vegetation Species

Scoring for the 11 functions was conducted based on available data, published literature, field data collected within potential waters, general field observations, and aerial photography. The drainage classes were scored qualitatively on the following six category scale: none, low, low-moderate, moderate, moderate-high and high. Based on this scale, a numeric score was assigned as identified in ***Table 4***.

Table 4. Numeric Scores assigned to the Qualitative Functional Scoring

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

2.3.1. Hydrologic Functions

Hydrologic Connectivity

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

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

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

Subsurface Flow and Groundwater Recharge

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

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

Energy Dissipation

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

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

Sediment Transport Regulation

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

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

2.3.2. Chemical Functions

Elements, Compounds, and Particulate Cycling

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

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

Organic Carbon Export/Sequestration

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

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

2.3.3. Biotic Functions

Aquatic Invertebrate Fauna

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

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

Presence of Fish and Fish Habitat Structure

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

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

Riparian/Wetland Vegetation Structure

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

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

None (0) = concrete or artificially lined wash
Low (1) = TVV (< 0.25)
Low-Moderate (2) = TVV (0.26 to 0.50)
Moderate (3) = TVV (0.51 to 0.75)
Moderate-High (4) = TVV (0.76 to 1.0)
High (5) = TVV (> 1.0)

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

For restoration mitigation sites an estimate of the anticipated TVV upon achieving mitigation success was used. For San Pedro River mitigation sites where no future restoration activities are proposed, existing vegetation data were used where available.

Age Class Distribution of Woody Riparian or Wetland Vegetation

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

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

Native/Non-native Woody Vegetation Species

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

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

For restoration mitigation sites, estimates were based on anticipated conditions at each site upon achievement of mitigation success.

3. RESULTS

The results for the functional assessment are listed by impacted drainage class or proposed mitigation site in the following sections.

3.1. IMPACTS TO WATERS PER DRAINAGE CLASSIFICATION

The total amount of impacted waters was calculated and determined to be 134.36 acres. There are direct impacts resulting in loss to 130.23 acres of waters. There are a further 4.13 acres of impacted waters that will be cut off from upstream ephemeral flows. For the purposes of evaluating functional loss within the impacted waters, it was determined that there were three separate functional categories. The functional categories were based on the size of the drainage. Ephemeral Class 1 represents the main stem of Ripsey Wash. Ephemeral Class 2 represents moderate and large-sized tributaries to Ripsey Wash, and Ephemeral Class 3 represents all remaining tributaries to the Ripsey Wash main stem not included in Class 2. Anticipated areas of impact for each of these classes are present in ***Table 5***.

Table 5. Impacts to Waters by Impacted Drainage Class

Impacted Drainage Class	Direct Impacts	Dewatered Drainages	Total
Ephemeral Class 1	65.0	3.03	68.03
Ephemeral Class 2	45.38	0.52	45.90
Ephemeral Class 3	19.85	0.58	20.43
Total	**130.23**	**4.13**	**134.36**

The proposed mitigation parcels consist of five sites. Each mitigation parcel was scored as a whole unit with the exception of Site E, which was split into two separate sections based on mitigation actions focusing on preservation in one area and restoration in another. The parcels selected for mitigation are adjacent to major water features. Functional scoring for these sites consists primarily of the evaluation of the functions that healthy riparian zones will provide to these adjacent water courses.

3.2. FUNCTIONAL SCORING OF IMPACTED DRAINAGE CLASSES AND PROPOSED MITIGATION SITES

Table 6 provides a summary of the functional scoring of three classes of waters that would be impacted by the Project, and the anticipated functional scoring at the proposed mitigation sites upon achievement of mitigation success.

The drainage classes impacted by the Project and the mitigation sites were scored qualitatively, as described above. ***Tables 7 - 9*** provide a more detailed rationale behind the scores for each function within each impacted drainage class at Ripsey Wash. ***Tables 10 - 15*** provide the rationale behind the scores for each function within the proposed mitigation sites. Scoring was based on a combination of field data collected during surveys conducted specifically for functional assessment, field data collection for other resource surveys, and general knowledge and familiarity with the site from several WestLand environmental specialists and biologists who have spent time on the Ripsey Wash site and the proposed mitigation sites.

Table 6. Functional Scoring for Impact Area and Mitigation Sites

Functions	Impact Drainage Classes			Mitigation Sites upon Achievement of Mitigation Success Criteria					
	Ephemeral Class 1	Ephemeral Class 2	Ephemeral Class 3	San Pedro River Site A (Preservation)	San Pedro River Site B (Restoration)	San Pedro River Site C (Restoration)	San Pedro River Site D (Preservation)	Gila River Site E (Preservation)	Gila River Site E (Restoration)
Hydrologic Functions									
Hydrologic Connectivity	4	4	3	4	3	4	4	5	4
Subsurface Flow/Groundwater Recharge	2	2	1	3	2	3	4	5	4
Energy Dissipation	3	2	1	4	3	4	4	5	4
Sediment Transport/ Regulation	3	2	1	5	4	5	5	4	5
Chemical Functions									
Elements, Compounds, and Particulate Cycling	3	2	1	3	3	3	3	5	4
Organic Carbon Export/Sequestration	2	2	1	4	3	3	4	5	4
Biotic Functions									
Aquatic Invertebrate Fauna	0	0	0	0	0	0	0	3	0
Presence of Fish and Fish Habitat Structure	0	0	0	0	0	0	0	3	0
Riparian/Wetland Vegetation Structure	2	2	1	5	2	3	5	5	5
Age Class Distribution of Woody Riparian or Wetland Vegetation	4	3	3	4	3	4	4	5	4
Native/Non-native Vegetation Species	5	5	5	4	5	3	1	3	3
Total Numeric Score	**28**	**24**	**17**	**36**	**28**	**32**	**34**	**48**	**37**

3.2.1. Ephemeral Class 1– Ripsey Wash Main Channel

Ephemeral Class 1 waters consist of Ripsey Wash, a large ephemeral stream with xeroriparian vegetation. ***Table 7*** provides the rationale for the functional scores that were given to the Ripsey Wash main channel.

Table 7. Ephemeral Class 1 Impacts Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4	Large channels are capable of transporting high volumes of water. Class 1 features and their upstream tributaries are ephemeral, indicating that while there is the potential to transport large amounts of water to downstream receiving waters, the primary limiting factor is rainfall not transport capacity. Ripsey Wash lacks any major impediments to flow to the Gila River which increases its hydrologic connectivity score.
Subsurface Flow/Groundwater Recharge	2	Water flow through the loose alluvial soils in broad channels provides a moderate amount of subsurface flow and potential to replenish deeper groundwater aquifers through channel infiltration. The lack of permanent or intermittent flow, coupled with evaporation and evapotranspiration, prevent a higher score. Xeroriparian vegetation indicates that while lateral subsurface flow potential may exist, that flow is likely temporary and the result of precipitation events.
Energy Dissipation	3	Ripsey Wash is a large channel with loose alluvium capable of reducing flow intensities through evaporation and channel infiltration. The lack of channel sinuosity and the lack of dense upland or riparian vegetation limit this score.
Sediment Transport/Regulation	3	Ripsey Wash is a broad ephemeral channel capable of retaining and depositing large amounts of sediment to downstream features when active flows are present. However, the lack of characteristics, such as channel sinuosity and dense riparian habitat, limit its ability to regulate excessive sediment loads.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3	Ripsey Wash is a broad channel with loose alluvium having the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses when active flows are present. However, it is ephemeral with limited riparian and upland vegetation reducing the ability of the system to cycle nutrients.
Organic Carbon Export/Sequestration	2	Ripsey Wash is a broad channel with the potential to store organic matter in subsurface soils and to provide downstream pulses when active flows are present. However, it is ephemeral and upstream waters are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. Furthermore, the lack of significant riparian buffer, coupled with sparse upland vegetation, limit the ability of the system to generate or export significant amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	0	Ripsey Wash does not contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0	Ripsey Wash does not contain any permanent or intermittent waters, and channel characteristics were not assessed for fish habitat suitability. Flow events within the ephemeral system will not result in the temporary presence of fish species.

Table 7. Ephemeral Class 1 Impacts Functional Scoring Summary

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	2	Vegetation at sample sites along Ripsey Wash produced vegetation volumes averaging between 0.26 and 0.5 m^3/m^2 which indicates a score of "low-moderate" or "2"."
Age Class Distribution of Woody Riparian or Wetland Vegetation	4	A vegetation assessment of Ripsey Wash indicated the presence of seedling, sapling, mature, and senescent age classes within the riparian vegetation. Wetland vegetation was absent.
Native/Non-native Vegetation Species	5	Vegetation sampling along Ripsey Wash indicated an average of less than 5 to 10% of woody vegetation consisted of non-native species, resulting in a score of "high" or "5" for this function.
Total Score	**28**	

3.2.2. Ephemeral Class 2 – Larger Ephemeral Washes

Ephemeral Class 2 drainages within the Ripsey Wash site include the larger tributaries of Ripsey Wash and another unnamed ephemeral channel that drain to the Gila River. ***Table 8*** provides the rationale for the functional scores that were given to Ephemeral Class 2 drainages within the Ripsey Wash site.

Table 8. Ephemeral Class 2 Impacts Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4	Ephemeral Class 2 channels are capable of transporting low to moderate volumes of water. Class 2 features, along with downstream and upstream features, are ephemeral indicating transport capacity is limited to precipitation events. The lack of any major impediments to flow will give this class a hydrologic connectivity score of "moderate-high" or "4."
Subsurface Flow/Groundwater Recharge	2	Water flow through the loose alluvial soils in Ephemeral Class 2 channels likely provides a low to moderate amount of subsurface flow and potential to replenish deeper groundwater aquifers through channel infiltration. The lack of permanent or intermittent flow, coupled with evaporation and evapotranspiration, prevent a higher score. Limited xeroriparian vegetation indicates that while lateral subsurface flow potential may exist that flow is likely temporary and the result of precipitation events.
Energy Dissipation	2	While Ephemeral Class 2 features have moderately-sized channels with loose alluvium capable of reducing flow intensities through evaporation and channel infiltration, the lack of a well-developed floodplain, coupled with limited riparian vegetation, restrict this to a score of "low-moderate" or "2."
Sediment Transport/Regulation	2	Ephemeral Class 2 features are moderately-sized ephemeral channels capable of retaining and transporting sediment to downstream features when active flows are present. However, the reduced channel size and limited riparian habitat restrict the ability of Class 2 features to regulate excessive sediment loads. The lack of perennial flow, reduced channel size, and the limited extent of riparian habitat restrict this function to a score of "low-moderate" or "2."
Chemical Functions		
Elements, Compounds, and Particulate Cycling	2	Ephemeral Class 2 features consist of moderately-sized channels with loose alluvium having the potential to store and mix nutrients and particles in subsurface soils and to provide downstream pulses when active flows are present. However, Class 2 features are ephemeral with limited riparian and upland vegetation, reducing the ability of the system to cycle nutrients.
Organic Carbon Export/Sequestration	2	Ephemeral Class 2 features consist of moderately-sized channels with the potential to store organic matter in subsurface soils and to provide downstream pulses when active flows are present. However, Class 2 features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. Furthermore, the lack of significant riparian buffer, coupled with sparse upland vegetation, limits the ability of the system to generate or export significant amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	0	No Ephemeral Class 2 features contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.

Table 8. Ephemeral Class 2 Impacts Functional Scoring Summary

Function	Score	Explanation
Presence of Fish and Fish Habitat Structure	0	Class 2 features do not contain any permanent or intermittent waters, and channel characteristics were not assessed for fish habitat suitability. Flow events within the ephemeral system will not result in the temporary presence of fish species.
Riparian/Wetland Vegetation Structure	2	Vegetation at sample sites along Ephemeral Class 2 features produced vegetation volumes averaging between 0.26 and 0.5 m^3/m^2 which indicates a score of "low-moderate" or "2."
Age Class Distribution of Woody Riparian or Wetland Vegetation	3	A vegetation assessment of Ephemeral Class 2 features indicated the average presence of three age classes within the riparian vegetation. Wetland vegetation was absent. The presence of three ages classes, coupled with the absence of wetland vegetation, indicates a score for this function of "moderate" or "3".
Native/Non-native Vegetation Species	5	Vegetation sampling along Ephemeral Class 2 features indicated an average of less than 5 to 10% of woody vegetation consisted of non-native species resulting in a score of "high" or "5" for this function.
Total Score	**24**	

3.2.3. Ephemeral Class 3 – Smaller Ephemeral Washes

The smaller ephemeral washes and headwaters within the Ripsey Wash site were designated as Ephemeral Class 3 drainages. This class includes the headwater areas and smaller tributaries to Class 1 and Class 2 Ephemeral Washes. ***Table 9*** provides the functional scores that were given to Ephemeral Class 3 drainages within the Ripsey Wash site.

Table 9. Ephemeral Class 3 Impacts Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	3	Ephemeral Class 3 features consist of small ephemeral channels. The channels are capable of transporting small volumes of water. Class 3 features, along with downstream and upstream features, are ephemeral, indicating transport capacity is limited to precipitation events.
Subsurface Flow/Groundwater Recharge	1	Water flow through the loose alluvial soils in Ephemeral Class 3 channels likely provides a limited amount of subsurface flow and potential to replenish deeper groundwater aquifers. The lack of permanent or intermittent flow, coupled with evaporation and evapotranspiration, prevent a higher score. Limited xeroriparian vegetation indicates that while lateral subsurface flow potential may exist that flow is likely temporary and the result of precipitation events.
Energy Dissipation	1	Ephemeral Class 3 features have channels with loose alluvium capable of reducing some flow intensities through evaporation and channel infiltration. However, the small channel size and lack of a well-developed floodplain, coupled with sparse riparian vegetation, restrict this function to a score of "low" or "1."
Sediment Transport/Regulation	1	Ephemeral Class 3 features are small ephemeral channels capable of retaining and transporting sediment to downstream features when active flows are present. However, the small channel size and minimal riparian vegetation restrict the ability of Class 3 features to regulate excessive sediment loads.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	1	Ephemeral Class 3 features consist of small channels with loose alluvium having limited potential to store and mix nutrients and particles in subsurface soils and later provide downstream pulses when active flows are present. Ephemeral Class 3 features are ephemeral with sparse riparian and upland vegetation reducing the ability of the system to cycle nutrients.
Organic Carbon Export/Sequestration	1	Ephemeral Class 3 features consist of small channels with limited potential to store organic matter in subsurface soils or provide downstream pulses of carbon when active flows are present. Ephemeral Class 3 features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. The minimal amount of riparian buffer, coupled with sparse upland vegetation, limit the ability of the system to generate or export significant amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	0	No Ephemeral Class 3 features contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.

Table 9. Ephemeral Class 3 Impacts Functional Scoring Summary

Function	Score	Explanation
Presence of Fish and Fish Habitat Structure	0	Ephemeral Class 3 features do not contain any permanent or intermittent waters, and channel characteristics were not assessed for fish habitat suitability. Flow events within the ephemeral system will not result in the temporary presence of fish species.
Riparian/Wetland Vegetation Structure	1	Vegetation at sample sites along Ephemeral Class 3 features produced vegetation volumes that were split between areas that contained between 0.26 and 0.5 m^3/m^2 and areas that contained below 0.25 m^3/m^2. These vegetation volumes indicate a score of "low" or "1" for this function.
Age Class Distribution of Woody Riparian or Wetland Vegetation	3	A vegetation assessment of Ephemeral Class 3 features indicated the average presence of three age classes within the riparian vegetation. Wetland vegetation was absent. The presence of three ages classes, coupled with the absence of wetland vegetation, indicates a score for this function of "moderate" or "3."
Native/Non-native Vegetation Species	5	Vegetation sampling along Ephemeral Class 3 features indicated an average of less than 5 to 10% of woody vegetation consisted of non-native species resulting in a score of "high" or "5" for this function.
Total Score	**17**	

3.2.4. San Pedro River Mitigation Site A

This site is a 29.8 acre former agricultural field on the east bank of the San Pedro River (***Figure 3***). Since 1999, it has been actively managed to preserve an existing mesquite bosque. The bosque provides highly valuable and rare riparian habitat buffer for the San Pedro River. The goal of this mitigation area is to continue to preserve the mesquite bosque that provides a riparian buffer for the San Pedro River. ***Table 10*** provides the rationale for the functional scores.

Table 10. San Pedro River Mitigation Site A Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation limits overland sheet flow and reduces heavy erosion common in agricultural fields, thereby providing additional protection for the stream banks in the adjacent San Pedro River. The density of riparian vegetation and distance to the adjacent aquatic feature provide for a functional rating of "moderate-high" or "4." Management actions at this site will exclude anthropogenic and grazing disturbances and will prevent degradation of the riparian area. The removal of disturbance factors is expected to provide a modest increase in the health of the riparian system resulting in additional protection of the integrity of the adjacent channel
Subsurface Flow/Groundwater Recharge	3	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation allows for increased infiltration allowing more surface water in the shallow aquifer and enhances lateral movement between the surface, root zone, and the adjacent channel of the San Pedro River, which may also enhance the potential for groundwater recharge. The density of riparian vegetation and distance to the adjacent aquatic feature provide for a functional rating of "moderate" or "3." Management actions at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system resulting in additional infiltration and increased lateral flow.
Energy Dissipation	4	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation limits overland sheet flow and reduces heavy erosion common in agricultural fields, thereby providing additional protection for the stream banks in the adjacent San Pedro River. The density of riparian vegetation and distance to the adjacent aquatic feature provide for a functional rating of "moderate-high" or "4." Management actions at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the health of the riparian system resulting in additional protection of the integrity of the adjacent channel.

Table 10. San Pedro River Mitigation Site A Functional Scoring Summary

Function	Score	Explanation
Sediment Transport/Regulation	5	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation limits overland sheet flow and reduces heavy erosion common in agricultural fields, thereby providing enhanced regulation of sediment transport across the site and into the river. The density of riparian vegetation and proximity to the adjacent San Pedro River provide for a functional rating of "high" or "5" for sediment transport and regulation. Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system, resulting in additional regulation of sediment transport into the adjacent channel.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Dense riparian enhances the sequestration and subsequent release of elements, compounds, and particulates, and may enhance the denitrification process. The density of riparian vegetation and proximity to the San Pedro River provide for a functional rating of "moderate" or "3." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement to the health of the riparian system, resulting in improved nutrient cycling and reduction in potentially harmful levels of nitrogen in runoff.
Organic Carbon Export/Sequestration	4	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation is capable of producing and exporting significantly higher amounts of organic carbon than typical desert upland vegetation. The density of riparian vegetation and proximity to the San Pedro River provide for a functional rating of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system resulting in additional generation, deposition, and export of organic carbon to the adjacent San Pedro River.
Biotic Functions		
Aquatic Invertebrate Fauna	0	Site A does not contain permanent or intermittent waters, although it is close to the intermittent channel of the San Pedro River. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events but are not indicative of a stable prey community for aquatic feeding species. Improvements to Site A are expected to have negligible direct effects on aquatic invertebrate fauna.
Presence of Fish and Fish Habitat Structure	0	Site A does not contain any permanent or intermittent waters, although it is close to the intermittent channel of the San Pedro River. Improvements to Site A are expected to have negligible direct effects on the presence and species diversity of fish or fish habitat structure in the San Pedro River.

Table 10. San Pedro River Mitigation Site A Functional Scoring Summary

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	5	Site A consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. The density of riparian vegetation at Site A exceeds 1 m^3/m^2, providing for a functional score of "high" or "5." Management actions at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the density and volume of riparian vegetation.
Age Class Distribution of Woody Riparian or Wetland Vegetation	4	Site A consists of dense riparian vegetation with a robust age-class distribution. A vegetation assessment of this site indicated the presence of seedling, sapling, mature, and senescent age classes within the riparian vegetation. Wetland vegetation was not present. The presence of all four ages classes, coupled with the absence of wetland vegetation, indicates a score for this function of "moderate-high" or "4." Management actions at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to allow the riparian vegetation to exist with a stable and complete age structure.
Native/Non-native Vegetation Species	4	An assessment of the riparian vegetation for Site A indicates low densities of non-native species such as tamarisk. Low densities of exotic species result in a score of "moderate-high" or "4" for this function. Management actions at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to increase the sustainability of the riparian vegetation and reduce the chances of encroachment from non-native species.
Total Score	**36**	

3.2.5. San Pedro River Mitigation Site B

This site is a 28.2 acre former agricultural field on the east bank of the San Pedro River. Since 1993, it has been actively managed (including a period of planting and irrigation). From 1993 to 2008, the percent cover of this field increased from 0 percent native cover to approximately 47 percent native cover. Vegetation within the field consists of native mesquite with an understory of native forbs and shrubs mixed with weedy forbs. The functional values of this site have increased as indicated by a measurable increase in vegetative cover (***Figures 4a and 4b***). The field provides riparian habitat buffer for the San Pedro River. The goal of this mitigation area is to preserve mesquite plantings and other native vegetation that provides a riparian buffer for the San Pedro River. ***Table 11*** provides the rationale for the functional scores.

Table 11. San Pedro River Mitigation Site B Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	3	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest densities at this site, but lower densities than at Site A. The increase in riparian vegetation at Site B increases hydrologic connectivity of the region to the adjacent San Pedro River through increased surface storage and infiltration to the shallow groundwater aquifer that will supply water to river. The density of riparian vegetation and distance to the active channel of the San Pedro River provide for a functional score of "moderate" or "3." The conversion of agricultural land to the present riparian system has increased surface storage, and infiltration rates for water into and through the shallow aquifer.
Subsurface Flow/ Groundwater Recharge	2	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest densities at this site. The increase in riparian vegetation at Site B will increase infiltration and allow additional water into the shallow water aquifer. The increased infiltration capacity provided by the additional root mass will also allow for increased subsurface flow through the riparian area supporting vegetation and reaching the San Pedro River. Increased infiltration will also enhance the potential for recharge into deeper groundwater aquifers. The relatively low density of restored riparian vegetation provides for a functional score of "low-moderate" or "2." The conversion of agricultural land to the present riparian system has increased subsurface flow by allowing a more permanent and stable vegetation and root structure to develop. The increase in vegetation increases infiltration and lateral movement capability within the soil.

Table 11. San Pedro River Mitigation Site B Functional Scoring Summary

Function	Score	Explanation
Energy Dissipation	3	Site B consists of moderately-dense riparian vegetation and is located within the floodplain of the intermittently flowing San Pedro River. The riparian vegetation provides increased overland roughness, additional depressional storage, and increased surface infiltration. These factors all aid in the regulation of overland flow in the area. The reduction in peak flow intensity reduces potential erosional damage and excessive sedimentation loads to the adjacent San Pedro River. Compared with Site A, the lower density of restored riparian vegetation and greater distance to the main channel of the San Pedro River provides for a functional score of "moderate" or "3." Prior to mitigation activities, Site B consisted of agricultural fields. Management actions have resulted in the restoration of some riparian vegetation, and increased surface roughness and infiltration allow for increased energy dissipation.
Sediment Transport/Regulation	4	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest amounts at this site. The increase in riparian vegetation at Site B has provided enhanced regulation of sediment through the system. Riparian vegetation provides a regulatory mechanism that actively affects sediment mobility and flow magnitudes. Compared with Site A, the lower density of riparian vegetation and greater distance to the San Pedro River support a functional score of "moderate-high" or "4" for this site. The conversion of agricultural land to the present riparian system significantly reduced the amount of sediment generated by this site. Restoration to riparian vegetation has also provided additional sediment capture and storage for this site reducing excessive sediment pulses from adjacent agricultural activities.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest densities at this site. The increase in riparian vegetation at Site B provides for the enhanced sequestration of nutrients which can be released to the San Pedro River during flood events and through subsurface travel. The increased riparian vegetation also aids in the denitrification process which can prevent excessive nitrogen levels from reaching that lead to eutrophication and hypoxia in the adjacent San Pedro River. The moderate density of riparian vegetation and distance to the adjacent aquatic feature provide for a functional score of "moderate" or "3" at this site. The restoration of riparian vegetation may result in enhanced nutrient cycling and reduction in potentially harmful levels of elements and compounds in runoff from both the previous agricultural actions on site and from current adjacent agricultural practices.
Organic Carbon Export/Sequestration	3	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest densities at this site. Riparian vegetation is capable of producing and exporting significantly higher amounts of organic carbon than typical desert upland vegetation. The moderate density of riparian vegetation provides for a functional rating of "moderate" or "3." The increase in riparian vegetation at Site B supplies additional sources of organic carbon that are available to adjacent San Pedro River.

Table 11. San Pedro River Mitigation Site B Functional Scoring Summary

Function	Score	Explanation
Biotic Functions		
Aquatic Invertebrate Fauna	0	Site B does not contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events but are not indicative of a stable prey community for aquatic feeding species. Improvements to Site B are expected to have negligible direct effects on aquatic invertebrate fauna.
Presence of Fish and Fish Habitat Structure	0	Site B does not contain any permanent or intermittent waters. Improvements to Site B are expected to have negligible direct effects on the presence or species diversity of fish or fish habitat structure.
Riparian/Wetland Vegetation Structure	2	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest densities at this site adjacent to the intermittently flowing San Pedro River. The extent and density of riparian vegetation directly affect the ability of the riparian area to perform the functions defined within this paper. The density of riparian vegetation is also important in determining the overall quality of the riparian system. The average density of riparian vegetation at Site B* is 0.25-0.50 m^3/m^2, providing for a functional score of "low-moderate" or "2." The restoration of riparian vegetation has resulted increased riparian woody vegetation volume which was previously not present on this site when active agricultural practices were ongoing.
Age Class Distribution of Woody Riparian or Wetland Vegetation	3	The mitigation actions at Site B have resulted in the restoration of riparian vegetation to modest densities at this site. A vegetation assessment of this feature indicated the presence of seedling, sapling, and mature classes within the riparian vegetation. Wetland vegetation was not present. The presence of three ages classes, coupled with the absence of wetland vegetation, indicates a score for this function of "moderate" or "3". The restoration at Site B has resulted in a riparian community of moderate density that is approaching a stable age structure with three of four age classes present and common on the site.
Native/Non-native Vegetation Species	5	The mitigation actions at Site B have resulted in the restoration of native riparian vegetation to modest densities at this site. An assessment of the riparian vegetation for Site B indicates minimal densities of non-native species such as tamarisk. This results in a score of "high" or "5" for this function.
Total Score	**28**	

3.2.6. San Pedro River Mitigation Site C

This site is on the west bank of the San Pedro River and is currently vegetated by native mesquite and an understory of native forbs and shrubs mixed with weedy forbs (***Figure 5***). This 25.8 acre field is experiencing some erosion from previous grading work. Activities will include the control of weedy plant species, planting native mesquite trees, and seeding for native plant species. These activities will restore the functional values of the site as a riparian buffer for the San Pedro River. ***Table 12*** provides the rationale for the functional scores.

Table 12. San Pedro River Mitigation Site C Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4	The planned mitigation at Site C consists of significantly increasing the density of riparian vegetation throughout the site. The increase in riparian vegetation will provide increased overland roughness, additional depressional storage, and increased surface infiltration. These factors will aid in the reduction of overland flow in the area lowering peak flow intensity and erosional damage. The projected increase in riparian vegetation will remove existing gaps in woody riparian vegetation and create a homogenous and highly-functional riparian zone. The projected increase in riparian vegetation provides for a functional score of "moderate-high" or "4." The riparian vegetation currently at Site C is patchy and has areas where woody riparian densities are low. The mitigation actions are projected to increase the volume and density of existing riparian vegetation.
Subsurface Flow/Groundwater Recharge	3	The mitigation actions at Site C will result in the restoration of riparian vegetation at this site. The increase in riparian vegetation at Site C will increase infiltration and allow additional water into the shallow water aquifer. The increased infiltration capacity provided by the additional root mass will also allow for increased subsurface flow through the riparian area supporting vegetation and reaching the San Pedro River. The increased infiltration will allow additional water to pass through the vadose zone into deeper groundwater aquifers. The projected density of riparian vegetation and increased subsurface water movement provides for a functional score of "moderate" or "3." The enhancement in the density and volume of the current riparian system will increase subsurface flow by increasing the vegetation and root structure within the site. The increase in riparian vegetation, particularly in areas within the site that have very low densities, will increase infiltration and lateral movement capability within the soil.

Table 12. San Pedro River Mitigation Site C Functional Scoring Summary

Function	Score	Explanation
Energy Dissipation	4	The planned mitigation at Site C consists of significantly increasing the density of riparian vegetation throughout the site. The increase in riparian vegetation will provide increased overland roughness, additional depressional storage, and increased surface infiltration. These factors will aid in the reduction of overland flow in the area lowering peak flow intensity and erosional damage. The projected increase in riparian vegetation will remove existing gaps in woody riparian vegetation and create a homogenous and highly-functional riparian zone. The projected increase in riparian vegetation provides for a functional score of "moderate-high" or "4." The riparian vegetation currently at Site C is patchy and has areas where woody riparian densities are low. The mitigation actions are projected to increase the volume and density of existing riparian vegetation. The increase in vegetation will provide a continuous dense riparian block with increased surface roughness and infiltration. These changes will result in an increase in the ability of the site to directly attenuate flood flows to and from the San Pedro.
Sediment Transport/Regulation	5	The mitigation actions at Site C will result in the restoration of riparian vegetation at this site. The increase in riparian vegetation at Site C will provide enhanced regulation of sediment through the system. Riparian vegetation provides a regulatory mechanism that actively affects sediment mobility and flow magnitudes. The increased density of riparian vegetation and proximity to the adjacent aquatic feature support a functional score of "high" or "5" for this site. The anticipated increase in riparian vegetation at Site C will result in additional sediment capture and storage for this site, reducing excessive sediment pulses from adjacent uplands.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3	The mitigation actions at Site C will result in the restoration of riparian vegetation to moderate densities at this site. The anticipated increase in riparian vegetation at Site C will allow for enhanced sequestration of nutrients which can be released to the San Pedro River during flood events and through subsurface travel. The increased riparian vegetation also aids in the denitrification process which can prevent excessive nitrogen levels that lead to eutrophication and hypoxia from reaching the adjacent San Pedro River. The moderate density of riparian vegetation and distance to the adjacent aquatic feature provide for a functional score of "moderate" or "3" at this site. The anticipated increase in riparian vegetation at Site C will result in increased nutrient cycling and reduction in potentially harmful levels of elements and compounds in runoff.
Organic Carbon Export/Sequestration	3	The mitigation actions at Site C will result in the restoration of riparian vegetation to moderate amounts at this site. The moderate density of riparian vegetation provides for a functional rating of "moderate" or "3." The anticipated increase in riparian vegetation at Site C will supply additional sources of organic carbon that are available to the adjacent San Pedro River.

Table 12. San Pedro River Mitigation Site C Functional Scoring Summary

Function	Score	Explanation
Biotic Functions		
Aquatic Invertebrate Fauna	0	Site C does not contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species. Improvements to Site C are expected to have negligible direct effects on aquatic invertebrate fauna.
Presence of Fish and Fish Habitat Structure	0	Site C does not contain any permanent or intermittent waters. Improvements to Site C are expected to have negligible direct effects on the presence and species diversity of fish or fish habitat structure.
Riparian/Wetland Vegetation Structure	2	The mitigation actions at Site C are projected to result in the restoration of riparian vegetation to relatively dense conditions at this site. The anticipated density of riparian vegetation at Site C is expected to exceed 0.5 m^3/m^2, providing for a functional score of "moderate" or "3." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the density and volume of riparian vegetation.
Age Class Distribution of Woody Riparian or Wetland Vegetation	4	The mitigation actions at Site C will increase the amount of riparian vegetation throughout the site, increasing recruitment and overall habitat diversity. The increase in riparian vegetation and habitat structure at Site C and increased natural recruitment will allow for a functional score of "moderate-high" or "4." The restoration at Site C is projected to result in a riparian community with a stable age structure consisting of all four age classes. Wetland vegetation is not expected to be present.
Native/Non-native Vegetation Species	3	The mitigation actions at Site C will focus on the increase of native riparian species. The establishment of native species and the anticipated low to moderate long-term invasion potential of non-natives allows for a functional score of "moderate" or "3." The mitigation actions are designed to promote the increase of native vegetation and to minimize the encroachment of non-native species at this site.
Total Score	**32**	

3.2.7. San Pedro River Mitigation Site D

This 14.1 acre site is within the active floodplain of the San Pedro River (***Figure 5***). The dominant vegetation is tamarisk, although cottonwoods are also present. The site will be preserved by means of active management to exclude livestock. ***Table 13*** provides the rationale for the functional scores.

Table 13. San Pedro River Mitigation Site D Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4	Site D consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation limits overland sheet flow and reduces heavy erosion common in agricultural fields, thereby providing additional protection for the stream banks in the adjacent San Pedro River. The density of riparian vegetation and proximity to the adjacent aquatic feature provide for a functional rating of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system, resulting in additional protection of the integrity of the adjacent channel.
Subsurface Flow/Groundwater Recharge	4	Site D consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation allows for increased infiltration, allowing more surface water in the shallow aquifer, and enhances lateral movement between the surface, root zone, and the adjacent channel of the San Pedro River. The increased infiltration also allows additional water to pass through the vadose zone into deeper groundwater aquifers. The density of riparian vegetation and minimal proximity to the active channel of the San Pedro River provide for a functional rating of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the health of the riparian system, resulting in additional infiltration and increased lateral flow.
Energy Dissipation	4	Site D consists of dense riparian vegetation and is located within the floodplain of the intermittently flowing San Pedro River. The dense riparian vegetation provides increased overland roughness, additional depressional storage, and increased surface infiltration. These factors all aid in the reduction of overland flow in the area. The reduction in peak flow intensity reduces potential erosional damage and excessive sedimentation loads in the adjacent San Pedro River. The density of riparian vegetation provides for a functional score of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the health and density of the riparian system resulting in increases to surface roughness and the ability of the site to attenuate flood flows.

Table 13. San Pedro River Mitigation Site D Functional Scoring Summary

Function	Score	Explanation
Sediment Transport/Regulation	5	Site D consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. This dense vegetation limits overland sheet flow and reduces heavy erosion, thereby reducing sediment transport to the adjacent San Pedro River. The density of riparian vegetation and proximity to the adjacent aquatic feature provide for a functional rating of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system resulting in additional sediment capture and storage for this site, reducing overland erosion from adjacent agricultural activities.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3	Site D consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. Riparian vegetation aids in the sequestration of nutrients which can be released to the San Pedro River during flood events and through subsurface travel. Riparian vegetation is also a critical component in the denitrification process, which can prevent excessive nitrogen levels that lead to eutrophication and hypoxia from reaching the adjacent San Pedro River. The density of riparian vegetation and proximity to the adjacent aquatic feature provide for a functional rating of "moderate" or "3." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the health of the riparian system resulting in increased nutrient cycling and reduction in potentially harmful levels of nitrogen in runoff.
Organic Carbon Export/Sequestration	4	Site D consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. The density of riparian vegetation and proximity to the adjacent aquatic feature provide for a functional rating of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health and density of the riparian system, resulting in additional deposition and export of organic carbon to the adjacent San Pedro River.
Biotic Functions		
Aquatic Invertebrate Fauna	0	Although it is adjacent to the intermittent San Pedro River, Site D does not contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic feeding species. Improvements to Site D are expected to have negligible direct effects on aquatic invertebrate fauna.
Presence of Fish and Fish Habitat Structure	0	Site D does not contain any permanent or intermittent waters. Improvements to Site D are expected to have negligible direct effects on the presence and species diversity of fish or fish habitat structure.

Table 13. San Pedro River Mitigation Site D Functional Scoring Summary

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	5	Site D consists of dense riparian vegetation adjacent to the intermittently flowing San Pedro River. The density of riparian vegetation at Site D exceeds 1 m^3/m^2, providing for a functional score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the density and volume of riparian vegetation.
Age Class Distribution of Wooded Riparian or Wetland Vegetation	4	Site D consists of dense riparian vegetation with a robust age-class distribution. A vegetation assessment of this feature indicated the presence of seedling, sapling, mature, and senescent age classes within the riparian vegetation. Wetland vegetation was not present. The presence of all four ages classes, coupled with the absence of wetland vegetation, indicates a score for this function of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to allow the riparian vegetation to exist with a stable and complete age structure.
Native/Non-native Vegetation Species	1	An assessment of the riparian vegetation for Site D indicates high densities of non-native species with tamarisk dominant throughout the site, resulting in a score of "low" or "1" for this function. Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to enhance the potential for establishment of native species.
Total Score	**34**	

3.2.8. Gila River Site E (Preservation)

Site E is located on the Gila River, southeast of the town of Kearny. Mitigation consists of the preservation of 11.4 acres of active perennial channel and floodplain of the Gila River. (***Figure 6***). ***Table 14*** provides the rationale for the functional scoring of this site.

Table 14. Gila River Mitigation Site E (preservation) Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	5	Site E (preservation) includes a section of the Gila River. The Gila River is a broad perennial feature with dense riparian vegetation within the site, providing significant hydrologic connectivity and receiving a functional score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area and river channel. The removal of disturbance factors is expected to provide a modest increase in the hydrologic connectivity through increasing the health of the riparian system.
Subsurface Flow/Groundwater Recharge	5	Site E (preservation) includes a section of the Gila River. The Gila River is a broad perennial feature with dense riparian vegetation within the site, providing significant amounts of surface infiltration, lateral flow, and groundwater recharge. This function has a score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system, resulting in additional infiltration and increased lateral flow.
Energy Dissipation	5	Site E (preservation) includes a section of the Gila River. The Gila River is a broad perennial feature with dense riparian vegetation within the site. The large channel, with a high degree of channel roughness and floodplain containing dense riparian vegetation, has significant potential to attenuate flood flows and reduce peak flow intensities. This function has a score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health and density of the riparian system, resulting in improvement in the ability of the site to attenuate flood flows.
Sediment Transport/Regulation	4	Site E (preservation) includes a section of the Gila River. The Gila River is a broad perennial feature with dense riparian vegetation. The channel size and perennial flow regime have the potential to deliver sediment downstream year-round. The adjacent riparian habitat has the potential to regulate moderate amounts of excessive sediment pulses. This function has a score of "moderate-high" or "4." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system, resulting in additional sediment capture and storage for this site, reducing overland erosion from adjacent agricultural activities.

Table 14. Gila River Mitigation Site E (preservation) Functional Scoring Summary

Function	Score	Explanation
Chemical Functions		
Elements, Compounds, and Particulate Cycling	5	Site E (preservation) includes a section of the Gila River. The Gila River is a broad perennial feature with dense riparian vegetation within the site, providing significant element and compound cycling through the river channel and riparian buffer. This function has a score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the health of the riparian system, resulting in increased nutrient cycling and reduction in potentially harmful levels of nitrogen in runoff.
Organic Carbon Export/Sequestration	5	Site E (preservation) includes a section of the Gila River. The Gila River is a broad perennial feature with dense riparian vegetation within the site, providing significant organic carbon generation and export through the river channel and riparian buffer. This function score has a score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest increase in the health and density of the riparian system, resulting in additional deposition and export of organic carbon to the adjacent San Pedro River.
Biotic Functions		
Aquatic Invertebrate Fauna	3	Site E (preservation) includes a section of the Gila River. The Gila River within this site contains aquatic invertebrate fauna and is estimated to support a diversity of at least 3 orders. The lack of adjacent backwater pools and shallow, slow moving features restricts the species that will be present and limits the functional score to "moderate" or "3." The active management at this site will prevent harmful disturbances from activities such as grazing that have the potential to negatively impact the diversity of invertebrate fauna.
Presence of Fish and Fish Habitat Structure	3	Site E (preservation) includes a section of the Gila River. The current bed and bank structure, along with riparian vegetation, provide good quality fish habitat. The perennial nature of the watercourse supports the presence of native and non-native fish species resulting in a functional score of "moderate" or "3." The active management at this site will prevent harmful disturbances from activities, such as grazing, that have the potential to negatively impact fish populations and fish habitat structure. Management actions are expected to enhance riparian vegetation, improve bank stability, and reduce sediment runoff, increasing the overall habitat conditions.
Riparian/Wetland Vegetation Structure	5	Woody riparian vegetation at this feature is estimated to have a volume of over 1 m^3/m^2, indicating a functional score of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to provide a modest enhancement in the density and volume of riparian vegetation.

Table 14. Gila River Mitigation Site E (preservation) Functional Scoring Summary

Function	Score	Explanation
Age Class Distribution of Woody Riparian or Wetland Vegetation	5	A vegetation assessment of Site E (preservation) indicated the presence of seedling, sapling, mature, and senescent age classes within the riparian vegetation. Wetland vegetation was also present. The presence of all four ages classes, coupled with the presence of wetland vegetation, indicates a score for this function of "high" or "5." Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to allow the riparian vegetation to exist with a stable and complete age structure.
Native/Non-native Vegetation Species	3	An assessment of the riparian vegetation for this site indicates the presence of non-native tamarisk with moderate densities, resulting in a score of "moderate" or "3" for this function. Active management at this site will exclude anthropogenic and grazing disturbances and will prevent degradation to the riparian area. The removal of disturbance factors is expected to increase the sustainability of the riparian vegetation and reduce the potential of encroachment from non-native species.
Total Score	**48**	

3.2.9. Gila River Site E (Restoration)

Site E is located on the Gila River, southeast of the town of Kearny (***Figure 6***). A designated restoration area within Site E encompasses 113.5 acres of the riparian corridor. Riparian vegetation on a significant portion of this site was destroyed by fire in 2013. Prior to the fire, the site was dominated by exotic tamarisk. There is a concern that, as the site recovers from the fire, tamarisk will again become the dominant riparian species, resulting in riparian habitat with lower functioning value than that offered by riparian habitat dominated by native species. The remaining tamarisk will be removed from the site and the site will be seeded with native vegetation. ***Table 15*** provides the rationale for the functional scoring of this site.

Table 15. Gila River Mitigation Site E (restoration) Functional Scoring Summary

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4	The mitigation actions at Site E will restore riparian vegetation within an area that has recently been cleared of woody vegetation as the result of the Shipman fire in 2013. Site E is adjacent to the perennial Gila River. The restoration of riparian vegetation will provide increased overland roughness, additional depressional storage, and increased surface infiltration. These factors will aid in the reduction of overland flow in the area lowering peak flow intensity and erosional damage. The projected increase in riparian vegetation will create a structurally homogenous and highly-functional riparian zone. The projected increase in riparian vegetation provides for a functional score of "moderate-high." The mitigation actions at Site E will restore riparian vegetation to the burned area. The increase in riparian vegetation at Site E will increase hydrologic connectivity of the region to the adjacent Gila River through increased surface storage and infiltration to the shallow groundwater aquifer that will supply water promoting additional base-flow to river.
Subsurface Flow/Groundwater Recharge	4	The mitigation actions at Site E will restore riparian vegetation within an area that has recently been cleared of woody vegetation as the result of the Shipman fire in 2013. Site E is adjacent to the perennial Gila River. The restoration of riparian vegetation at Site E will increase infiltration and allow additional water into the shallow water aquifer. The increased infiltration capacity provided by the additional root mass will also allow for increased subsurface flow through the riparian area supporting vegetation and reaching the Gila River. The increased infiltration will also allow additional water to pass through the vadose zone into deeper groundwater aquifers. The projected final density of riparian vegetation provides for a functional score of "moderate-high." The restoration of the riparian system will increase subsurface flow by increasing the vegetation and root structure within the site. The restoration of riparian vegetation in an area severely degraded by the 2013 fire will enhance infiltration, lateral movement capability within the soil, and groundwater recharge.

Table 15. Gila River Mitigation Site E (restoration) Functional Scoring Summary

Function	Score	Explanation
Energy Dissipation	4	The mitigation actions at Site E will restore riparian vegetation within an area that has recently been cleared of woody vegetation as the result of the Shipman fire in 2013. Site E is adjacent to the perennial Gila River. The restoration of riparian vegetation will provide increased overland roughness, additional depressional storage, and increased surface infiltration. These factors will aid in the reduction of overland flow in the area, lowering peak flow intensity and erosional damage. The projected density of riparian vegetation following mitigations will create a homogenous and highly-functional riparian zone. The projected increase in riparian vegetation provides for a functional score of "moderate-high." The reduction in peak flow intensity and flow volumes provided by the restored riparian vegetation will reduce potential erosional damage and excessive sedimentation loads to the adjacent Gila River. The current sparseness of vegetation within the burned area will provide minimal flood dissipation and allow excessive erosion of the loose topsoil at Site E.
Sediment Transport/Regulation	5	The 2013 wildfire, resulting in the destruction of woody vegetation at Site E (restoration), has limited the ability of the area to regulate sediment transport to the adjacent Gila River. The reduction of vegetation limits the ability of the area to reduce damaging overland flows and prevents the trapping and deposition of sediment from overland flows. The lack of herbaceous ground cover and living root mass from herbaceous and woody plants also increases the amount of erosional loss within the site itself. The proposed mitigation will restore a dense and fully functioning riparian area within the floodplain of the adjacent perennial Gila River. The significant increase in riparian vegetation supports a functional score of "high" or "5" for this site. The proposed mitigation at Site E (restoration) will restore both woody and herbaceous cover and restore the ability of this riparian area to regulate sediment transport to the adjacent Gila River. This function is currently minimal with the vegetative die-off following the fire.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	4	The mitigation actions at Site E will restore riparian vegetation within an area that has recently been cleared of vegetation as the result of the Shipman fire in 2013. Site E is adjacent to the perennial Gila River. The mitigation actions at Site E (restoration) will result in the restoration of dense riparian vegetation to the area degraded by the fire. The anticipated restoration of riparian vegetation at Site E (restoration) will increase sequestration of nutrients which can be released to the Gila River during flood events and through subsurface travel. The restored riparian vegetation will also aid in the denitrification process, which can prevent excessive nitrogen levels that lead to eutrophication and hypoxia from reaching the adjacent Gila River. The high density of riparian vegetation and proximity to an aquatic feature provide for a functional score of "moderate-high" or "4" at this site. The anticipated increase in riparian vegetation at Site E (restoration) will result in increased nutrient cycling and reduction in potentially harmful levels of elements and compounds in runoff.

Table 15. Gila River Mitigation Site E (restoration) Functional Scoring Summary

Function	Score	Explanation
Organic Carbon Export/Sequestration	4	The mitigation actions at Site E will restore riparian vegetation within an area that has recently been cleared of woody vegetation as the result of the Shipman fire in 2013. Site E is adjacent to the perennial Gila River. The mitigation actions are projected to restore dense riparian vegetation and provide for a functional score of "moderate-high." This restoration of riparian vegetation in the recently burned area will greatly increase the amount of carbon available to the adjacent Gila River.
Biotic Functions		
Aquatic Invertebrate Fauna	0	Although this is adjacent to the Gila River, Site E (restoration) does not contain permanent or intermittent waters. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species. Improvements to Site B are expected to have negligible direct effects on aquatic invertebrate fauna.
Presence of Fish and Fish Habitat Structure	0	Site E (restoration) does not contain any permanent or intermittent waters. Improvements to Site E are expected to have negligible direct effects on the presence and species diversity of fish or fish habitat structure.
Riparian/Wetland Vegetation Structure	5	The 2013 wildfire has reduced vegetative volume to minimal amounts with low levels of recruitment post fire and regrowth primarily occurring at the base of top-killed species. The restoration of Site E following the wildfire will result in an increase vegetation volume that is anticipated to exceed 1 m^3/m^2, providing for a functional rating of "high" or "5." The improvement over the current post-fire conditions that removed almost of the vegetation at this site will result in an enhancement of the riparian system.
Age Class Distribution of Wooded Riparian or Wetland Habitat	4	The mitigation actions at Site E will restore riparian vegetation with a stable and robust age-class within an area that has recently been cleared of woody vegetation as the result of the Shipman fire in 2013. The proposed mitigation is expected to produce an age class structure containing the seedling, sapling, and mature age classes within the riparian vegetation. The senescent age class will develop over time. Wetland vegetation is not anticipated to persist in significant amounts at this site. The eventual presence of all four ages classes, coupled with the absence of wetland vegetation, indicates a score for this function of "moderate-high" or "4." The restoration actions at Site E will consist of the establishment of vegetation that will have a high probability of success based on depth-to-water, rainfall, and soil characteristics. The usage of plants that prefer the conditions present at the site will ensure that the new riparian vegetation will have increased survivability, will recruit new individuals, and will inhibit invasion from exotic species. These actions will result in stable riparian community with a robust age structure including mature trees and new recruits.

Table 15. Gila River Mitigation Site E (restoration) Functional Scoring Summary

Function	Score	Explanation
Native/Non-native Vegetation Species	3	The mitigation actions at Site E (restoration) will focus on the restoration of native riparian species with active management of non-native woody species. The establishment of native species and active management are expected to limit encroachment of woody exotics. However, the areas surrounding Site E (restoration) contain significant densities of non-native species and limit this score to "moderate" or "3." Prior to the burn at Site J, there were significant amounts of non-native vegetation present. The fire removed herbaceous vegetation and either killed or top-killed woody vegetation throughout the site. Restoration actions at Site E will restore native riparian vegetation and minimize the recruitment of exotics from adjacent areas. The reintroduction of native plants through seeding and the active management to discourage the encroachment of invasive species will improve the previous species composition of vegetation which was dominated by non-native tamarisk.
Total Score	**37**	

FIGURES

Pinal County
Photo Source: NAIP, 2013

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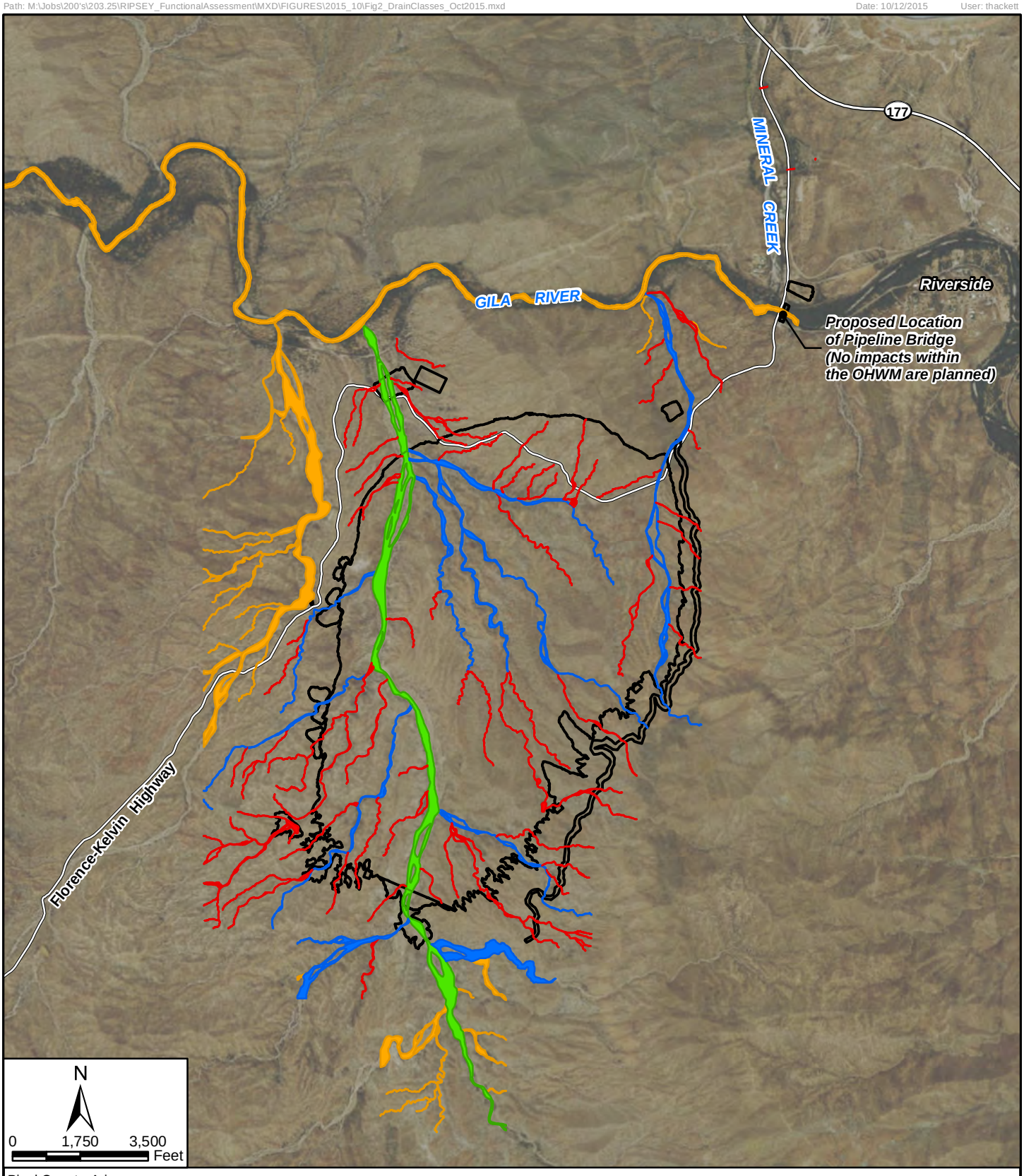
ASARCO LLC

Ripsey Wash Tailings Storage Facility
Functional Assessment of Impacted Waters and Proposed Mitigation Sites

LOCATION MAP
Figure 1



Pinal County, Arizona,
Photo Source: NAIP, 2013

LEGEND

- Ripsey Wash Alternative 3 Tailings Storage Facility Footprint
- Ephemeral Class 1 (Ripsey Wash)
- Ephemeral Class 2
- Ephemeral Class 3
- No Classification Assigned (No Impacts Proposed)

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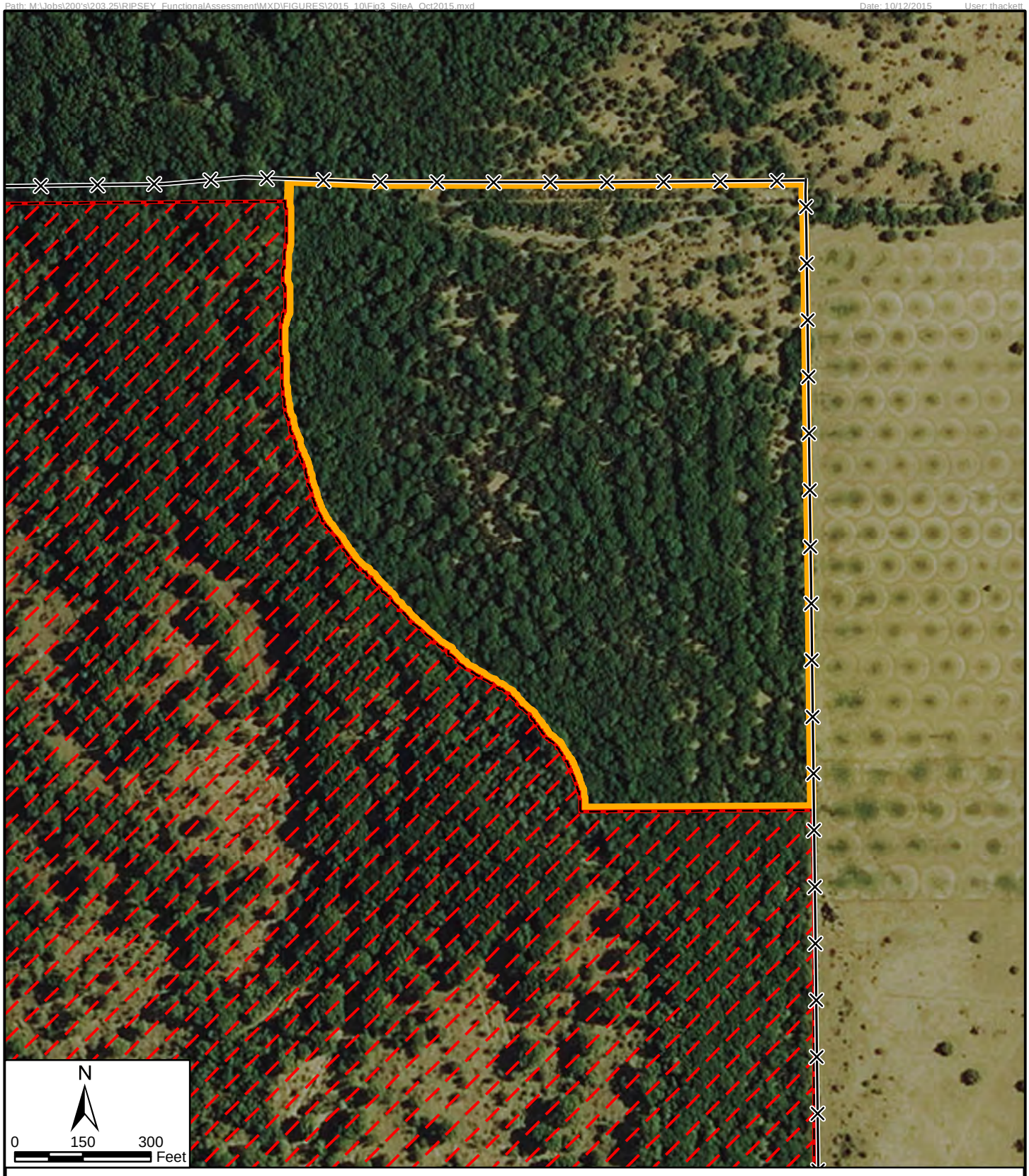
Ripsey Wash Tailings Storage Facility Functional Assessment of Impacted Waters and Proposed Mitigation Sites

RIPSEY WASH PROJECT AREA
IMPACTED DRAINAGE CLASSIFICATIONS

Figure 2



T6S, R16E, Portion of Section 21,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site A (Mesquite Bosque Preservation)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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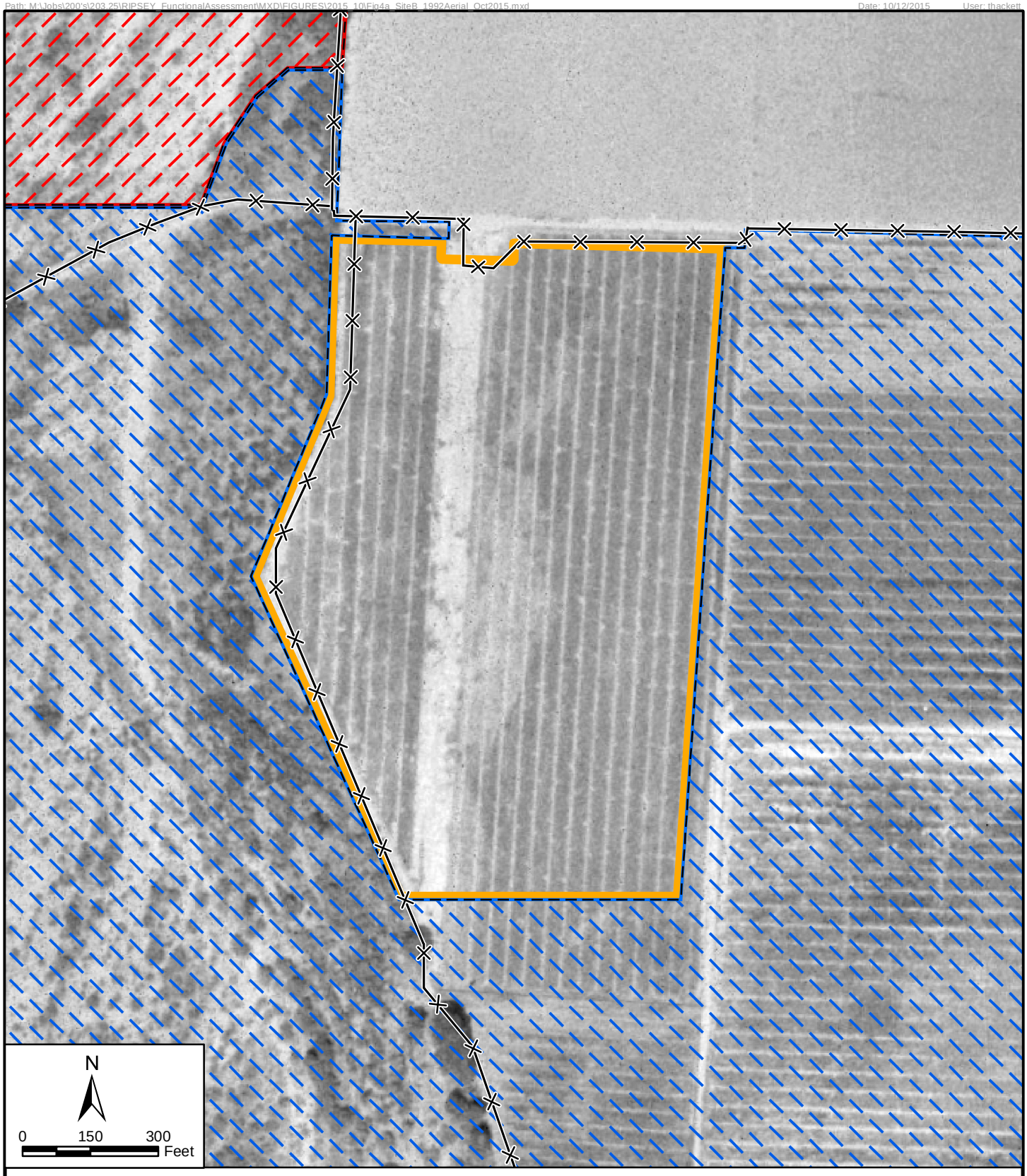
Ripsey Wash Tailings Storage Facility Functional Assessment of Impacted Waters and Proposed Mitigation Sites

SAN PEDRO SITE A (PRESERVATION)

Figure 3



T6S, R16E, Portion of Section 33,
Pinal County, Arizona,
Photo Source: USGS DOQQ, 1992

LEGEND

- Site B (Mesquite Field Restoration)
- PZ-1 Mitigation Lands (Corps File No. 1990-400-8400-RJD)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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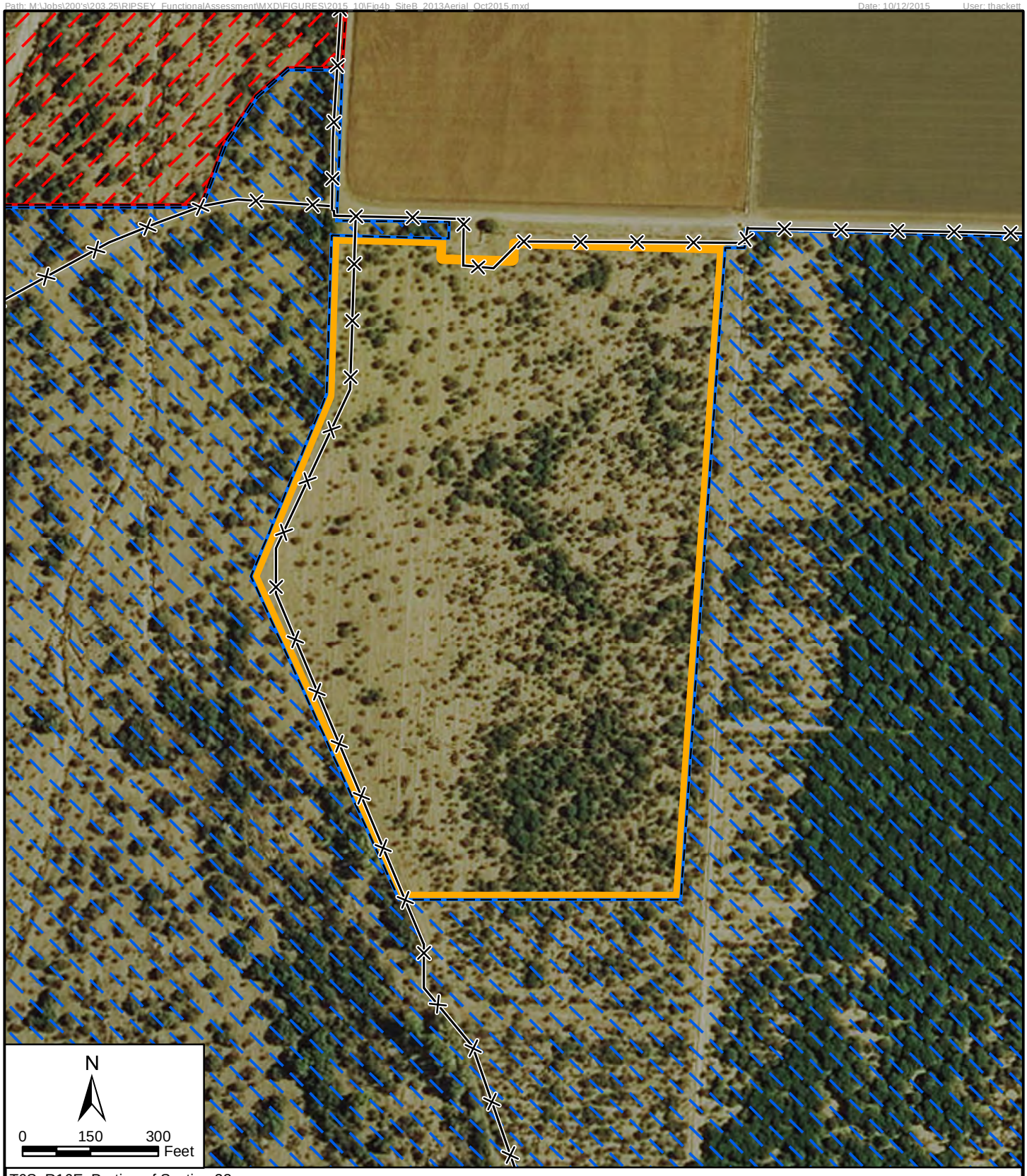
Functional Assessment of Impacted Waters and Proposed Mitigation Sites

SAN PEDRO SITE B (RESTORATION) (1992)

Figure 4a



T6S, R16E, Portion of Section 33,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site B (Mesquite Field Restoration)
- PZ-1 Mitigation Lands (Corps File No. 1990-400-8400-RJD)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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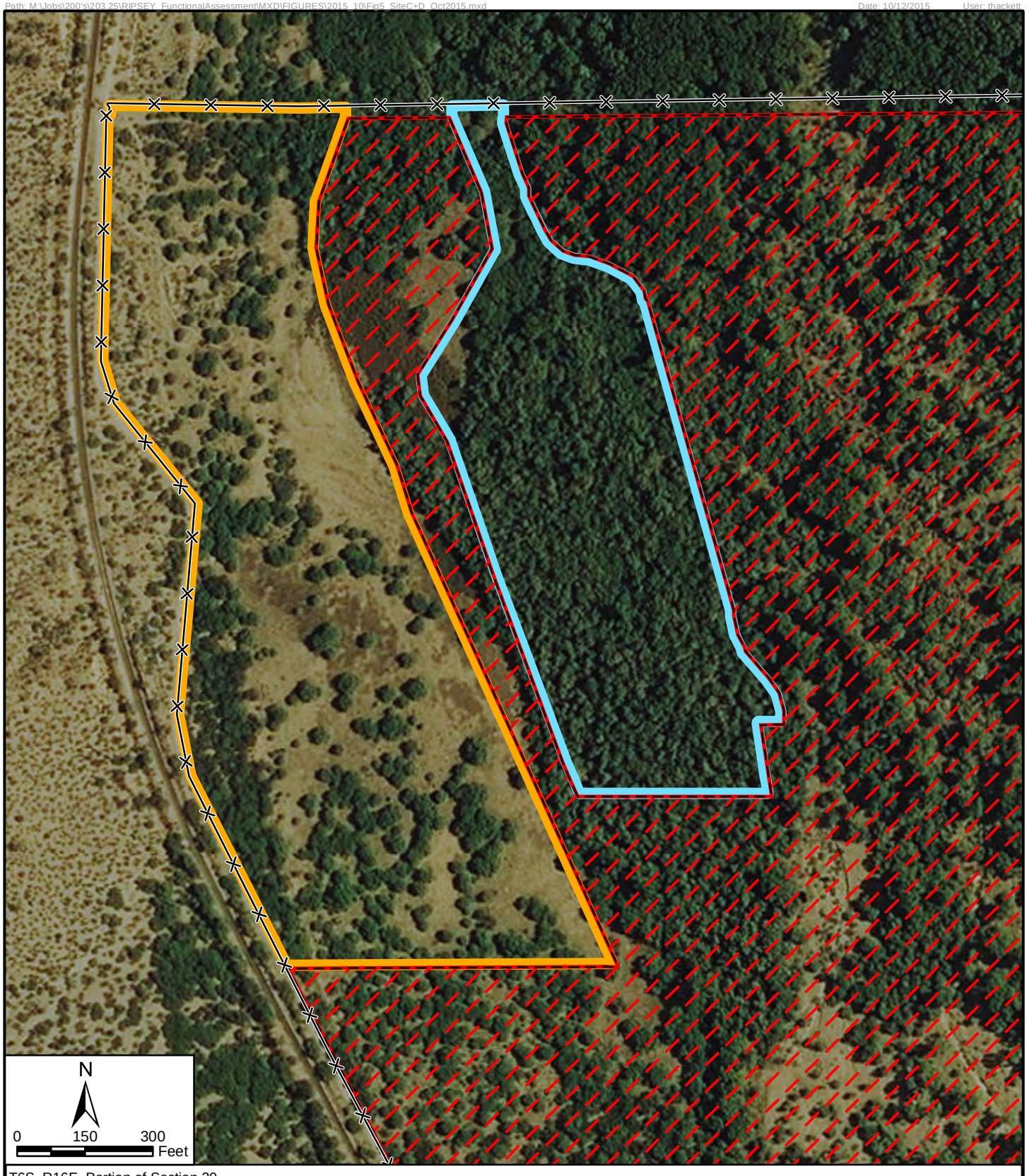
SAN PEDRO SITE B (RESTORATION) (2013)

Figure 4b

Path: M:\Jobs\200's\203.25\RIPSEY_FunctionalAssessment\MXD\FIGURES\2015_10\Fig5_SiteC+D_Oct2015.mxd Date: 10/12/2015 User: thackett



T6S, R16E, Portion of Section 20,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

LEGEND

- Site C (Mesquite Field Restoration)
- Site D (Active Floodplain Preservation)
- PZ-2 Mitigation Lands (Corps File No. 904-0084-MB)
- Existing Fence

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Ripsey Wash Tailings Storage Facility Functional Assessment of Impacted Waters and Proposed Mitigation Sites

SAN PEDRO SITE C (RESTORATION) &
SAN PEDRO SITE D (PRESERVATION)

Figure 5

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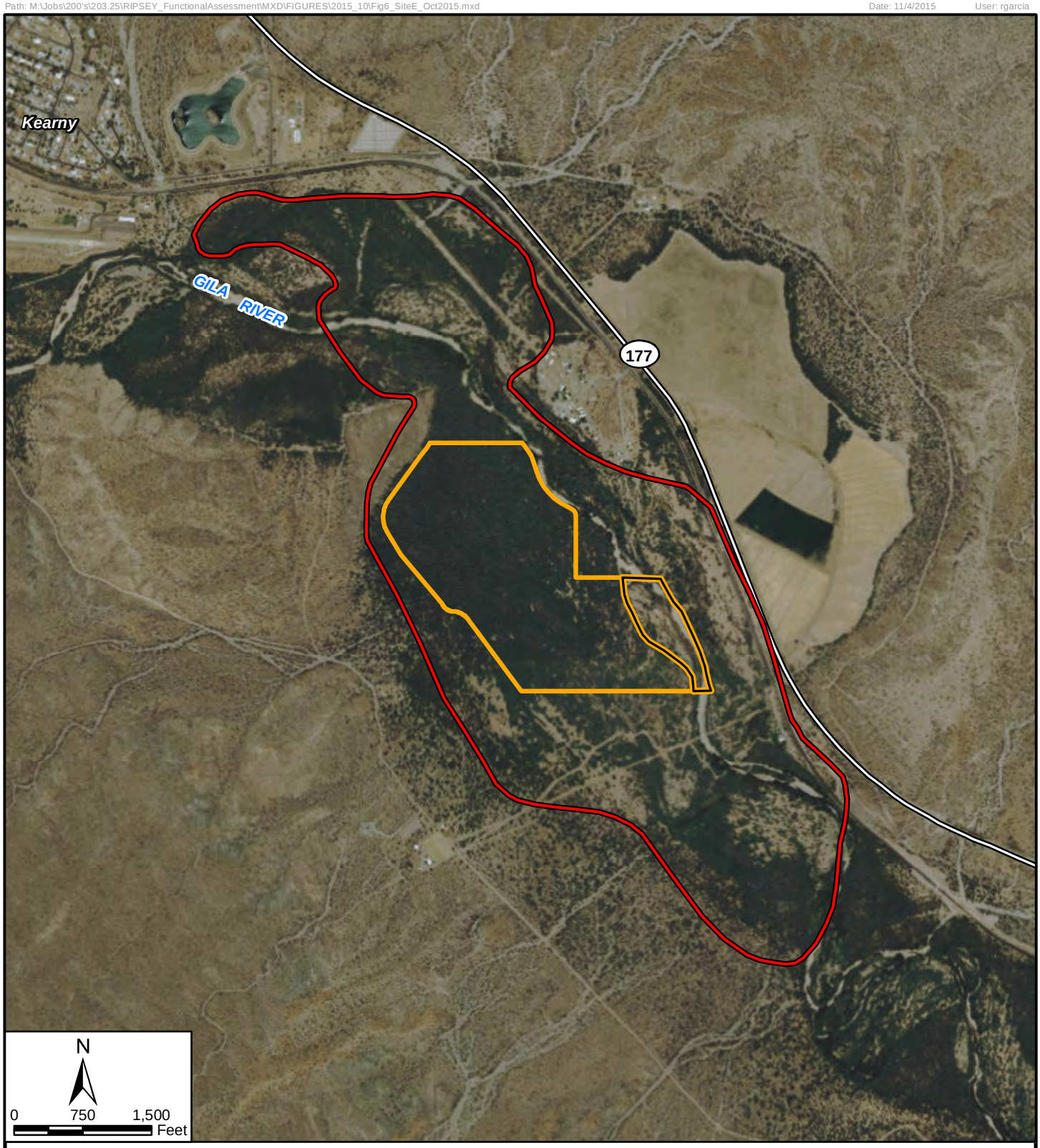

T4S, R14E, Portion of Sections 7, 17, 18, 20, 21 & 29,
Pinal County, Arizona,
Photo Source: NAIP (6/7/2013)

*Fire Perimeter Source: PDF of "Shipman Fire AZ-A15-130795 Vicinity Map" (AZ State Forestry Division, 7/10/2013).

*Vicinity Map PDF: Downloaded from http://inciweb.nwcg.gov/incident/map/3502/0/30745/

LEGEND

- Site E (Gila River Riparian Buffer Restoration)
- Site E (Gila River Active Channel Preservation)
- Shipman Fire (7/10/2013)

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Ripsey Wash Tailings Storage Facility Functional Assessment of Impacted Waters and Proposed Mitigation Sites

GILA RIVER SITE E
(PRESERVATION & RESTORATION)
Figure 6

APPENDIX B

MITIGATION RATIO-SETTING CHECKLIST WORKSHEETS

EPHEMERAL CLASS 1 IMPACTS MRSC

1	Date: 8/28/2014		Corps File No.:	SPL-2011-1005-MWL		Project Manager:	MWL														
	Impact Site Name:	**Ephemeral Class 1**	ORM Resource Type:			River/Stream				Hydrology:		Ephemeral									
	Impact Cowardin or HGM type:	Riverine	Impact area :	68.03	acres	Impact distance:						16,280	linear feet								
		Mitigation Sites																			
		San Pedro Site A				**San Pedro Site B**				**San Pedro Site C**				**San Pedro Site D**				**Gila River Site E**			
		Mitigation Site Name:	San Pedro Site A- Mesquite Bosque			Mitigation Site Name:	San Pedro Site B- Mesquite Field			Mitigation Site Name:	San Pedro Site C- Mesquite Field			Mitigation Site Name:	San Pedro Site D- Active Floodplain			Mitigation Site Name:	Gila River Site E Active Channel		
		Mitigation Type:	Preservation			Mitigation Type:	Restoration			Mitigation Type:	Restoration			Mitigation Type:	Preservation			Mitigation Type:	Preservation		
		ORM Resource Type:				ORM Resource Type:				ORM Resource Type:				ORM Resource Type:				ORM Resource Type:			
		Cowardin/HGM type:	Riverine			Cowardin/HGM type:	Riverine			Cowardin/HGM type:	Riverine			Cowardin/HGM type:	Riverine			Cowardin/HGM type:	Riverine		
		Hydrology:	Intermittent			Hydrology:	Intermittent			Hydrology:	Intermittent			Hydrology:	Intermittent			Hydrology:	Perennial		
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**			Starting ratio:	**1.0 : 1.0**			Starting ratio:	**1.0 : 1.0**			Starting ratio:	**1.0 : 1.0**			Starting ratio:	**1.0 : 1.0**		
		Ratio adjustment:	**-0.10**			Ratio adjustment:	**0.00**			Ratio adjustment:	**-0.10**			Ratio adjustment:	**-0.10**			Ratio adjustment:	**-1.00**		
		Baseline ratio:	**1.00 :**	**1.10**		Baseline ratio:	**1.00 :**	**1.00**		Baseline ratio:	**1.00 :**	**1.10**		Baseline ratio:	**1.00 :**	**1.10**		Baseline ratio:	**1.00 :**	**2.00**	
		PM justification: See qualitative sheet for adjustment				PM justification: See qualitative sheet for adjustment				PM justification: See qualitative sheet for adjustment				PM justification: See qualitative sheet for adjustment				PM justification: See qualitative sheet for adjustment			
3	**Quantitative impact-mitigation comparison**:	NA	**:**			NA	**:**			NA	**:**			NA	**:**			NA	**:**		
4	**Mitigation site location**:	Ratio adjustment:	**1**			Ratio adjustment:	**1**			Ratio adjustment:	**1**			Ratio adjustment:	**1**			Ratio adjustment:	**0**		
		PM justification: Not within the HUC 6 or smaller watershed				PM justification: Not within same HUC 6 or smaller watershed				PM justification: Not within same HUC 6 or smaller watershed				PM justification: Not within same HUC 6 or smaller watershed				PM justification: Not within same HUC 6 or smaller watershed			
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**			Ratio adjustment:	**1**			Ratio adjustment:	**1**			Ratio adjustment:	**1**			Ratio adjustment:	**1**		
		PM justification: No aquatic resources to be established				PM justification: No aquatic resources to be established				PM justification: No aquatic resources to be established				PM justification: No aquatic resources to be established				PM justification: No aquatic resources to be established			
6	**Type conversion:**	Ratio adjustment:	**-2**			Ratio adjustment:	**-2**			Ratio adjustment:	**-2**			Ratio adjustment:	**-2**			Ratio adjustment:	**-2**		
		PM justification: Dense riparian vegetation adjacent to intermittent aquatic resource is a rare and valuable resource in Arizona				PM justification: Riparian vegetation adjacent to intermittent aquatic resource is a rare and valuable resource in Arizona				PM justification: Riparian vegetation adjacent to intermittent aquatic resource is a rare and valuable resource in Arizona				PM justification: Dense riparian vegetation adjacent to intermittent aquatic resource is a rare and valuable resource in Arizona				PM justification: Perennial aquatic resources and adjacent dense riparian habitat are a rare and valuable resource in Arizona			
7	**Risk and uncertainty**:	Ratio adjustment:	**0.3**			Ratio adjustment:	**0.3**			Ratio adjustment:	**0.3**			Ratio adjustment:	**0.3**			Ratio adjustment:	**0.3**		
		PM justification:				PM justification:				PM justification:				PM justification:				PM justification:			
8	**Temporal loss**:	Ratio adjustment:	**0**			Ratio adjustment:	**0**			Ratio adjustment:	**3**			Ratio adjustment:	**0**			Ratio adjustment:	**0**		
		PM justification:				PM justification:				PM justification: +3 adjustment for planted trees to mature				PM justification:				PM justification:			
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.00 :	1.10		Baseline ratio from 2 or 3:	1.00 :	1.00		Baseline ratio from 2 or 3:	1.00 :	1.10		Baseline ratio from 2 or 3:	1.00 :	1.10		Baseline ratio from 2 or 3:	1.00 :	2.00	
		Total adjustments (4-8):	0.3			Total adjustments (4-8):	0.3			Total adjustments (4-8):	3.3			Total adjustments (4-8):	0.3			Total adjustments (4-8):	-0.7		
		Final ratio:	**1.20 : 1.00**			Final ratio:	**1.30 : 1.00**			Final ratio:	**3.90 : 1.00**			Final ratio:	**1.20 : 1.00**			Final ratio:	**1.00 : 1.00**		
		to Resource type:	Project Manager:			to Resource type:	Project Manager:			to Resource type:	Project Manager:			to Resource type:	Project Manager:			to Resource type:	Project Manager:		
		Cowardin or HGM:	Ephemeral Class 1			Cowardin or HGM:	Ephemeral Class 1			Cowardin or HGM:	Ephemeral Class 1			Cowardin or HGM:	Ephemeral Class 1			Cowardin or HGM:	Ephemeral Class 1		
		Hydrology:				Hydrology:				Hydrology:				Hydrology:				Hydrology:			
		Total Acreage at Site	29.8	acres		Total Acreage at Site	28.2	acres		Total Acreage at Site	25.8	acres		Total Acreage at Site	14.1	acres		Total Acreage at Site	11.4	acres	
				linear feet				linear feet				linear feet				linear feet				linear feet	
		of Resource type:	0			of Resource type:	0			of Resource type:	0			of Resource type:	0			of Resource type:	0		
		Cowardin or HGM:	Riverine			Cowardin or HGM:	Riverine			Cowardin or HGM:	Riverine			Cowardin or HGM:	Riverine			Cowardin or HGM:	Riverine		
		Hydrology:	Intermittent			Hydrology:	Intermittent			Hydrology:	Intermittent			Hydrology:	Intermittent			Hydrology:	Perennial		
		Mitigation Credits:	24.83	acres		Mitigation Credits:	21.69	acres		Mitigation Credits:	6.62	acres		Mitigation Credits:	11.75	acres		Mitigation Credits:	11.40	acres	
				linear feet				linear feet				linear feet				linear feet				linear feet	
10	**Final compensatory mitigation requirements:**	Starting impact:	68.03	acres		Starting impact:	43.20	acres		Starting impact:	21.50	acres		Starting impact:	14.89	acres		Starting impact:	3.14	acres	
		Remaining impact:	43.20	acres		Remaining Impact:	21.50	acres		Remaining Impact:	14.89	acres		Remaining Impact:	3.14	acres		Remaining Impact:	-8.26	acres	
		Additional PM comments:				Additional PM comments:				Additional PM comments:				Additional PM comments:				Additional PM comments:			

Ripsey Wash - Ephemeral Class 1 Features

	Function	Score
Physical	Hydrologic Connectivity	Moderate-High (4)
	Subsurface Flow\Groundwater Recharge	Low-Moderate (2)
	Energy Dissipation	Moderate (3)
	Sediment Transport/Regulation	Moderate (3)
Chemical	Elements, Compounds, and Particulate Cycling	Moderate (3)
	Organic Carbon Export/Sequestration	Low-Moderate (2)
Biotic	Aquatic Invertebrate Fauna	None (0)
	Presence of Fish\Fish Habitat Structure	None (0)
	Riparian/Wetland Habitat Structure	Low-Moderate (2)
	Age Class Distribution of Wooded Riparian or Wetland Habitat	Moderate-High (4)
	Native/Non-native Vegetation Species	High (5)

San Pedro River Site A (Mesquite Bosque Preservation)

	Function	Functional Score of Class 1 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	3	↑	
	Energy Dissipation	3	4	↑	
	Sediment Transport/Regulation	3	5	↑↑	0
Chemical	Elements, Compounds, and Particulate Cycling	3	3	↔	
	Organic Carbon Export/Sequestration	2	4	↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	4	↔	
	Native/Non-native Vegetation Species	5	4	↓	-0.1
	Total	28	36		-0.10

Total Adjustment:	-0.10
PM Justification:	

San Pedro River Site B (Mesquite Field Restoration)

	Function	Functional Score of Class 1 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	3	↓	
	Subsurface Flow\Groundwater Recharge	2	2	↔	
	Energy Dissipation	3	3	↔	
	Sediment Transport/Regulation	3	4	↑	0
Chemical	Elements, Compounds, and Particulate Cycling	3	3	↔	
	Organic Carbon Export/Sequestration	2	3	↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	2	↔	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	3	↓	
	Native/Non-native Vegetation Species	5	5	↔	0
	Total	28	26		0.00

Total Adjustment:	0.00
PM Justification:	

San Pedro River Site C (Mesquite Field Restoration)

	Function	Functional Score of Class 1 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	3	↔	
	Energy Dissipation	3	4	↑	
	Sediment Transport/Regulation	3	5	↑↑	-0.1
Chemical	Elements, Compounds, and Particulate Cycling	3	3	↔	
	Organic Carbon Export/Sequestration	2	3	↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	3	↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	4	↔	
	Native/Non-native Vegetation Species	5	3	↓↓	0
	Total	28	32		-0.10

Total Adjustment:	-0.10
PM Justification:	

San Pedro River Site D (Active Floodplain Preservation)

	Function	Functional Score of Class 1 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	4	↑↑	
	Energy Dissipation	3	4	↑	
	Sediment Transport/Regulation	3	5	↑↑	-0.1
Chemical	Elements, Compounds, and Particulate Cycling	3	3	↔	
	Organic Carbon Export/Sequestration	2	4	↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	4	↔	
	Native/Non-native Vegetation Species	5	1	↓↓↓↓	0
	Total	28	34		-0.10

Total Adjustment:	-0.10
PM Justification:	

Gila River Site E (Active Channel Preservation)

	Function	Functional Score of Class 1 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	5	↑	
	Subsurface Flow\Groundwater Recharge	2	5	↑↑↑	
	Energy Dissipation	3	5	↑↑	
	Sediment Transport/Regulation	3	4	↑	-0.25
Chemical	Elements, Compounds, and Particulate Cycling	3	5	↑↑	
	Organic Carbon Export/Sequestration	2	5	↑↑↑	-0.25
Biotic	Aquatic Invertebrate Fauna	0	3	↑↑↑	
	Presence of Fish\Fish Habitat Structure	0	3	↑↑↑	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	5	↑	
	Native/Non-native Vegetation Species	5	3	↓↓	-0.5
	Total	28	48		-1.00

Total Adjustment:	-1.00
PM Justification:	

Gila River Site E (Riparian Restoration)

	Function	Functional Score of Class 1 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	4	↑↑	
	Energy Dissipation	3	4	↑	
	Sediment Transport/Regulation	3	5	↑↑	-0.1
Chemical	Elements, Compounds, and Particulate Cycling	3	4	↑	
	Organic Carbon Export/Sequestration	2	4	↑↑	-0.1
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	4	↔	
	Native/Non-native Vegetation Species	5	3	↓↓	-0.1
	Total	28	37		-0.30

Total Adjustment:	-0.30
PM Justification:	

EPHEMERAL CLASS 2 IMPACTS MRSC

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	Date: 8/29/14	Corps File No.:	SPL-2011-1005-MWL	Project Manager:	MWL				
	Impact Site Name:	**Ephemeral Class 2**	ORM Resource Type:	River/Stream		Hydrology:	Ephemeral		
	Impact Cowardin or HGM type:	Riverine	Impact area:	45.9	acres	Impact distance:	52,950	linear feet	

		Mitigation Sites			
		Gila River Site E		**Gila River Site E**	
		Mitigation Site Name:	Gila River Site E Active Channel	Mitigation Site Name:	Gila River Site E Riparian
		Mitigation Type:	Preservation	Mitigation Type:	Restoration
		ORM Resource Type:		ORM Resource Type:	
		Cowardin/HGM type:	Riverine	Cowardin/HGM type:	Riverine
		Hydrology:	Perennial	Hydrology:	Perennial
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**
		Ratio adjustment:	**-1.00**	Ratio adjustment:	**-0.50**
		Baseline ratio:	**1.00 : 2.00**	Baseline ratio:	**1.00 : 1.50**
		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	NA	:	NA	:
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**
		PM justification: Not within same HUC 6 or smaller watershed		PM justification: Not within same HUC 6 or smaller watershed	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**	Ratio adjustment:	**1**
		PM justification: No aquatic resources to be established		PM justification: No aquatic resources to be established	
6	**Type conversion:**	Ratio adjustment:	**-2**	Ratio adjustment:	**-2**
		PM justification: Perennial aquatic resources and adjacent dense riparian habitat are a rare and valuable resource in Arizona		PM justification: Dense native riparian vegetation adjacent to perennial aquatic resource is a rare and valuable resource in Arizona	
7	**Risk and uncertainty**:	Ratio adjustment:	**0.3**	Ratio adjustment:	**0.3**
		PM justification:		PM justification:	
8	**Temporal loss**:	Ratio adjustment:	**0**	Ratio adjustment:	**3**
		PM justification:		PM justification: +3 adjustment for planted trees to mature	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.00 : 2.00	Baseline ratio from 2 or 3:	1.00 : 1.50
		Total adjustments (4-8):	-0.7	Total adjustments (4-8):	2.3
		Final ratio:	**1.00 : 1.00**	Final ratio:	**2.20 : 1.00**
		to Resource type:	River/Stream	to Resource type:	45.9
		Cowardin or HGM:	Riverine	Cowardin or HGM:	0
		Hydrology:		Hydrology:	
		Total Acreage at Site	8.26 acres / linear feet	Total Acreage at Site	113.45 acres / linear feet
		of Resource type:	0	of Resource type:	0
		Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine
		Hydrology:	Perennial	Hydrology:	Perennial
		Mitigation Credits:	8.26 acres / linear feet	Mitigation Credits:	51.57 acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	45.90 acres	Starting impact:	37.64 acres
		Remaining Impact:	37.64 acres	Remaining Impact:	-13.93 acres
		Additional PM comments:		Additional PM comments:	

Ripsey Wash - Ephemeral Class 2 Features

	Function	Score
Physical	Hydrologic Connectivity	Moderate-High (4)
	Subsurface Flow\Groundwater Recharge	Low-Moderate (2)
	Energy Dissipation	Low-Moderate (2)
	Sediment Transport/Regulation	Low-Moderate (2)
Chemical	Elements, Compounds, and Particulate Cycling	Low-Moderate (2)
	Organic Carbon Export/Sequestration	Low-Moderate (2)
Biotic	Aquatic Invertebrate Fauna	None (0)
	Presence of Fish\Fish Habitat Structure	None (0)
	Riparian/Wetland Habitat Structure	Low-Moderate (2)
	Age Class Distribution of Wooded Riparian or Wetland Habitat	Moderate (3)
	Native/Non-native Vegetation Species	High (5)

San Pedro River Site A (Mesquite Bosque Preservation)

	Function	Functional Score of Class 2 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	3	↑	
	Energy Dissipation	2	4	↑↑	
	Sediment Transport/Regulation	2	5	↑↑↑	-0.15
Chemical	Elements, Compounds, and Particulate Cycling	2	3	↑	
	Organic Carbon Export/Sequestration	2	4	↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	4	↓	-0.15
	Total	24	36		-0.30

Total Adjustment:	-0.30
PM Justification:	

San Pedro River Site B (Mesquite Field Restoration)

	Function	Functional Score of Class 2 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	3	↓	
	Subsurface Flow\Groundwater Recharge	2	2	↔	
	Energy Dissipation	2	3	↑	
	Sediment Transport/Regulation	2	4	↑↑	-0.1
Chemical	Elements, Compounds, and Particulate Cycling	2	3	↑	
	Organic Carbon Export/Sequestration	2	3	↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	2	↔	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	3	↔	
	Native/Non-native Vegetation Species	5	5	↔	0
	Total	24	26		-0.10

Total Adjustment:	-0.10
PM Justification:	

San Pedro River Site C (Mesquite Field Restoration)

	Function	Functional Score of Class 2 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	3	↑	
	Energy Dissipation	2	4	↑↑	
	Sediment Transport/Regulation	2	5	↑↑↑	-0.1
Chemical	Elements, Compounds, and Particulate Cycling	2	3	↑	
	Organic Carbon Export/Sequestration	2	3	↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	3	↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	3	↓↓	0
	Total	24	32		-0.10

Total Adjustment:	-0.10
PM Justification:	

San Pedro River Site D (Active Floodplain Preservation)

	Function	Functional Score of Class 2 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	4	↑↑	
	Energy Dissipation	2	4	↑↑	
	Sediment Transport/Regulation	2	5	↑↑↑	-0.1
Chemical	Elements, Compounds, and Particulate Cycling	2	3	↑	
	Organic Carbon Export/Sequestration	2	4	↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	1	↓↓↓↓	-0.1
	Total	24	34		-0.20

Total Adjustment:	-0.20
PM Justification:	

Gila River Site E (Active Channel Preservation)

	Function	Functional Score of Class 2 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	5	↑	
	Subsurface Flow\Groundwater Recharge	2	5	↑↑↑	
	Energy Dissipation	2	5	↑↑↑	
	Sediment Transport/Regulation	2	4	↑↑	-0.5
Chemical	Elements, Compounds, and Particulate Cycling	2	5	↑↑↑	
	Organic Carbon Export/Sequestration	2	5	↑↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	3	↑↑↑	
	Presence of Fish\Fish Habitat Structure	0	3	↑↑↑	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	5	↑↑	
	Native/Non-native Vegetation Species	5	3	↓↓	-0.5
	Total	24	48		-1.00

Total Adjustment:	-1.00
PM Justification:	

Gila River Site E (Riparian Restoration)

	Function	Functional Score of Class 2 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	↔	
	Subsurface Flow\Groundwater Recharge	2	4	↑↑	
	Energy Dissipation	2	4	↑↑	
	Sediment Transport/Regulation	2	5	↑↑↑	-0.25
Chemical	Elements, Compounds, and Particulate Cycling	2	4	↑↑	
	Organic Carbon Export/Sequestration	2	4	↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	2	5	↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	3	↓↓	-0.25
	Total	24	37		-0.50

Total Adjustment:	-0.50
PM Justification:	

EPHEMERAL CLASS 3
IMPACTS MRSC

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	Date: 8/29/14	Corps File No.:	SPL-2011-1005-MWL	Project Manager:	MWL				
	Impact Site Name:	**Ephemeral Class 3**	ORM Resource Type:	River/Stream		Hydrology:	Ephemeral		
	Impact Cowardin or HGM type:	Riverine	Impact area :	20.43	acres	Impact distance:	92,895	linear feet	

		Mitigation Sites	
		Gila River Site E	
		Mitigation Site Name:	Gila River Site E Riparian Restoration
		Mitigation Type:	
		ORM Resource Type:	
		Cowardin/HGM type:	Riverine
		Hydrology:	Perennial
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**
		Ratio adjustment:	**-1.25**
		Baseline ratio:	**1.00 : 2.25**
		PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	NA	**:**
4	**Mitigation site location**:	Ratio adjustment:	**0**
		PM justification: Not within the HUC 6 or smaller watershed	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**
		PM justification: No aquatic resources to be established	
6	**Type conversion:**	Ratio adjustment:	**-2**
		PM justification: Dense riparian vegetation adjacent to intermittent aquatic resource is a rare and valuable resource in Arizona	
7	**Risk and uncertainty**:	Ratio adjustment:	**0.3**
		PM justification:	
8	**Temporal loss**:	Ratio adjustment:	**3**
		PM justification:	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.00 : 2.25
		Total adjustments (4-8):	2.3
		Final ratio:	**1.50 : 1.00**
		to Resource type:	River/Stream
		Cowardin or HGM:	Riverine
		Hydrology:	
		Total Acreage at Site	30.65 acres / linear feet
		of Resource type:	0
		Cowardin or HGM:	Riverine
		Hydrology:	Perennial
		Mitigation Credits:	20.43 acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	20.43 acres
		Remaining impact:	0.00 acres
		Additional PM comments:	

Ripsey Wash - Ephemeral Class 3 Features

Function	Score
Hydrologic Connectivity	Moderate (3)
Subsurface Flow\Groundwater Recharge	Low (1)
Energy Dissipation	Low (1)
Sediment Transport/Regulation	Low (1)
Elements, Compounds, and Particulate Cycling	Low (1)
Organic Carbon Export/Sequestration	Low (1)
Aquatic Invertebrate Fauna	None (0)
Presence of Fish\Fish Habitat Structure	None (0)
Riparian/Wetland Habitat Structure	Low (1)
Age Class Distribution of Wooded Riparian or Wetland Habitat	Moderate (3)
Native/Non-native Vegetation Species	High (5)

San Pedro River Site A (Mesquite Bosque Preservation)

	Function	Functional Score of Class 3 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	3	4	↑	
	Subsurface Flow\Groundwater Recharge	1	3	↑↑	
	Energy Dissipation	1	4	↑↑↑	
	Sediment Transport/Regulation	1	5	↑↑↑↑	-0.25
Chemical	Elements, Compounds, and Particulate Cycling	1	3	↑↑	
	Organic Carbon Export/Sequestration	1	4	↑↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	1	5	↑↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	4	↓	-0.25
	Total	17	36		-0.50

Total Adjustment:	-0.50
PM Justification:	

San Pedro River Site B (Mesquite Field Restoration)

	Function	Functional Score of Class 3 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	3	3	↔	
	Subsurface Flow\Groundwater Recharge	1	2	↑	
	Energy Dissipation	1	3	↑↑	
	Sediment Transport/Regulation	1	4	↑↑↑	-0.15
Chemical	Elements, Compounds, and Particulate Cycling	1	3	↑↑	
	Organic Carbon Export/Sequestration	1	3	↑↑	-0.15
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	1	2	↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	3	↔	
	Native/Non-native Vegetation Species	5	5	↔	0
	Total	17	26		-0.30

Total Adjustment:	-0.30
PM Justification:	

San Pedro River Site C (Mesquite Field Enhancement)

	Function	Functional Score of Class 3 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	3	4	↑	
	Subsurface Flow\Groundwater Recharge	1	3	↑↑	
	Energy Dissipation	1	4	↑↑↑	
	Sediment Transport/Regulation	1	5	↑↑↑↑	-0.25
Chemical	Elements, Compounds, and Particulate Cycling	1	3	↑↑	
	Organic Carbon Export/Sequestration	1	3	↑↑	-0.25
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	1	3	↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	3	↓↓	0
	Total	17	32		-0.50

Total Adjustment:	-0.50
PM Justification:	

San Pedro River Site D (Active Floodplain Preservation)

	Function	Functional Score of Class 3 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	3	4	↑	
	Subsurface Flow\Groundwater Recharge	1	4	↑↑↑	
	Energy Dissipation	1	4	↑↑↑	
	Sediment Transport/Regulation	1	5	↑↑↑↑	-0.25
Chemical	Elements, Compounds, and Particulate Cycling	1	3	↑↑	
	Organic Carbon Export/Sequestration	1	4	↑↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	1	5	↑↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	1	↓↓↓↓	-0.25
	Total	17	34		-0.50

Total Adjustment:	-0.50
PM Justification:	

Gila River Site E (Active Channel Preservation)

	Function	Functional Score of Class 3 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	3	5	↑↑	
	Subsurface Flow\Groundwater Recharge	1	5	↑↑↑↑	
	Energy Dissipation	1	5	↑↑↑↑	
	Sediment Transport/Regulation	1	4	↑↑↑	-0.5
Chemical	Elements, Compounds, and Particulate Cycling	1	5	↑↑↑↑	
	Organic Carbon Export/Sequestration	1	5	↑↑↑↑	0
Biotic	Aquatic Invertebrate Fauna	0	3	↑↑↑	
	Presence of Fish\Fish Habitat Structure	0	3	↑↑↑	
	Riparian/Wetland Habitat Structure	1	5	↑↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	5	↑↑	
	Native/Non-native Vegetation Species	5	3	↓↓	-1
	Total	17	48		-1.50

Total Adjustment:	-1.50
PM Justification:	

Gila River Site E (Riparian Restoration)

	Function	Functional Score of Class 3 Ephemeral Impact	Functional Score from Mitigation	Overall Functional Loss/Gain	Ratio Adjustment
Physical	Hydrologic Connectivity	3	4	↑	
	Subsurface Flow\Groundwater Recharge	1	4	↑↑↑	
	Energy Dissipation	1	4	↑↑↑	
	Sediment Transport/Regulation	1	5	↑↑↑↑	-0.5
Chemical	Elements, Compounds, and Particulate Cycling	1	4	↑↑↑	
	Organic Carbon Export/Sequestration	1	4	↑↑↑	-0.25
Biotic	Aquatic Invertebrate Fauna	0	0	↔	
	Presence of Fish\Fish Habitat Structure	0	0	↔	
	Riparian/Wetland Habitat Structure	1	5	↑↑↑↑	
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	↑	
	Native/Non-native Vegetation Species	5	3	↓↓	-0.5
	Total	17	37		-1.25

Total Adjustment:	-1.25
PM Justification:	

Pinal County
Photo Source: ESRI Online World Imagery
(Microsoft: May-20-2010)

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Tucson, Arizona 85712 (520) 206-9585

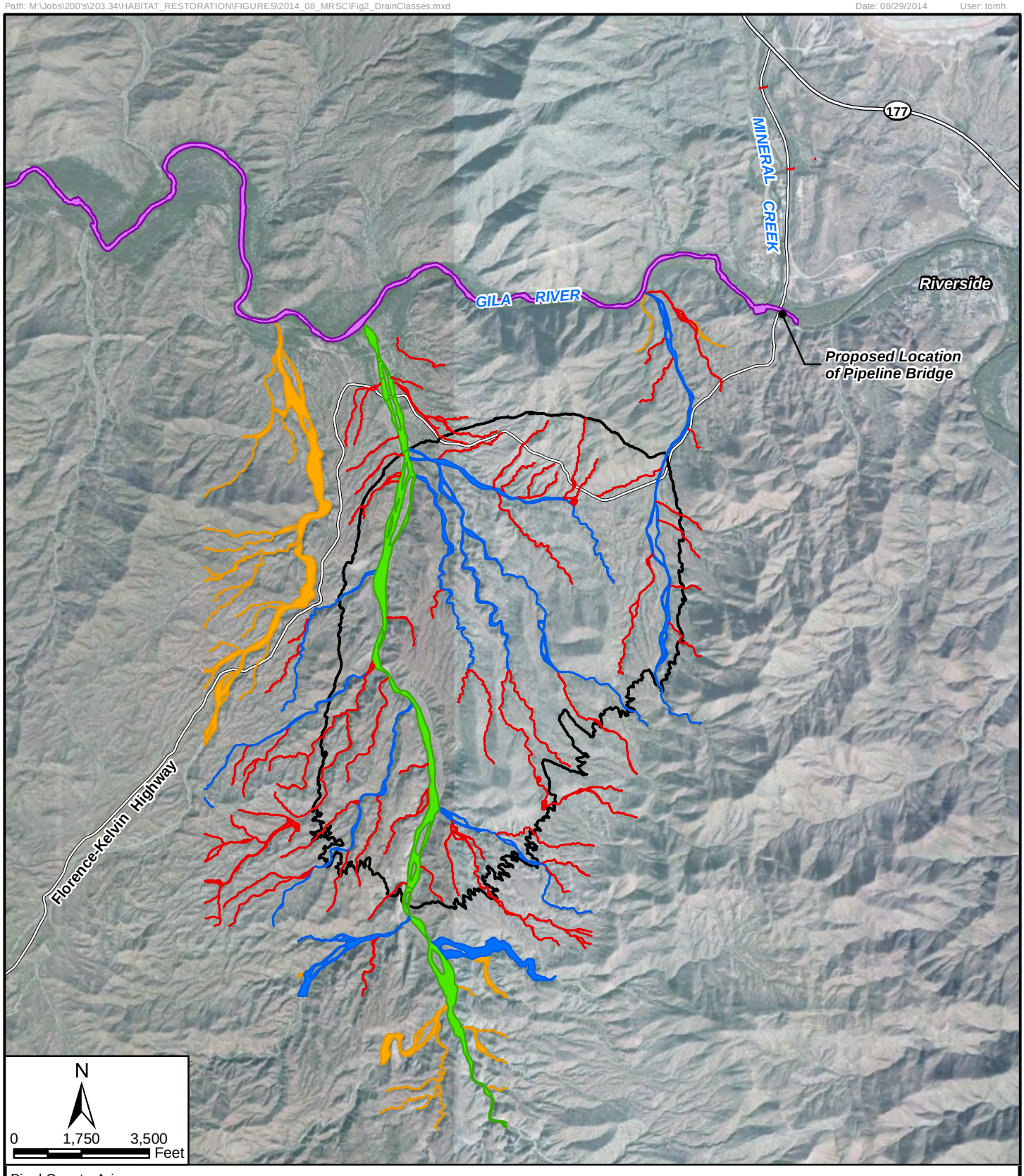
N

0 2 4 Miles

ASARCO LLC

Ripsey Wash Tailings Storage Facility
Mitigation Ratio-Setting Checklist

LOCATION MAP
Figure 1



Pinal County, Arizona,
Photo Source: ESRI Online World Imagery
(Microsoft: May-20-2010)

LEGEND

- Ripsey Wash Alternative 3 Tailings Storage Facility Footprint
- Perennial/Intermittent Class (Gila River)
- Ephemeral Class 1 (Ripsey Wash)
- Ephemeral Class 2
- Ephemeral Class 3
- No Classification Assigned (No Impacts Proposed)

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Ripsey Wash Tailings Storage Facility Mitigation Ratio-Setting Checklist

RIPSEY WASH PROJECT AREA
IMPACTED DRAINAGE CLASSIFICATIONS

Figure 2

Path: M:\Jobs\200's\203.25\HACKBERRY_FunctionalAssessment\MXD\FIGURES\2014_08\Fig2_ImpactsPerDrainFeature.mxd

HACKBERRY GULCH

KANE SPRING CANYON

GILA RIVER

177

Pinal County, Arizona
Image Source: ESRI Online World Imagery
(Microsoft: Nov-1-2010)

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N

0 750 1,500 Feet

LEGEND

- Hackberry Gulch Alternative 2 Tailings Storage Facility Footprint
- Wetland Class
- Ephemeral Class 2
- Ephemeral Class 3
- Perennial/Intermittent Class

ASARCO LLC

Hackberry Gulch Alternative 2
Functional Assessment of
Potential Waters of the U.S.

IMPACTS PER DRAINAGE CLASSIFICATION

Figure 2