

Memorandum

To: File

CC:

From: DeAnne Rietz, SWCA; Chris Garrett, SWCA

Date: December 27, 2012

Re: Summary of References Used in the Analysis of Seeps/Springs/Riparian Section

The purpose of this memo is to document and summarize the references received from cooperating agencies, including Pima County, USGS, USFWS, AGRD, and USEPA for use in the analysis in the Seeps, Springs, and Riparian Section of the Rosemont Copper EIS.

On June 28, 2012, a meeting was held with these cooperators, as well as SWCA and Coronado Forest specialists and decision makers, in order to discuss possible methodologies and approaches for mapping riparian areas as well as analyzing impacts to those riparian areas from changes in groundwater levels. Meeting minutes are described elsewhere. The various data sources suggested during this meeting and in subsequent correspondence with Pima County were considered by the Forest for use in the Seeps, Springs, and Riparian section. This memo documents how these sources were considered.

Selected references are included at the end of this memorandum.

Mapping Sources Considered

Forest Service mapping: Habitat mapping conducted by the Coronado was the initial starting point for investigating sources to map riparian areas. This source is sufficient for the direct disturbance on-site, but because it only maps habitat within the Forest Service boundary, it is not sufficient to assess long distance effects on riparian habitat due to groundwater drawdown.

On- and off-site mapping by Westland Resources: Westland Resources (contracted by Rosemont Copper) has conducted on-site and off-site mapping, based on field observations and aerial photographic analysis. On-site mapping is primarily concerned with the area of direct disturbance around the proposed mine. Off-site mapping was conducted along the entire length of Davidson Canyon. This data source has a high level of detail of the number and type of vegetative species present, but as with the Forest Service mapping, is limited in coverage and is not sufficient to assess long distance effects due to groundwater drawdown.

General habitat maps/GIS coverage: The State of Arizona maintains GIS coverage of general habitat types. These polygons were found to be too generalized, and not sufficiently detailed to describe impacts to individual washes or streams of interest, including Barrel Canyon, Davidson Canyon, Empire Gulch, and Cienega Creek.

Pima County riparian mapping: Pima County has conducted riparian mapping for the entire county, in part to support the Sonoran Desert Conservation Plan. This mapping effort is based on aerial photographic analysis, and depicts four classes of xeroriparian habitat, as well as mesoriparian, and hydroriparian habitat. This is the most detailed coverage available, and the only detailed coverage that extends beyond the immediate project site. The coverage ends at the Santa Cruz/Pima County line to the south, but this turns out to be the approximate extent of the 5-foot drawdown contour, so this is not a critical deficiency in the coverage.

In an August 6, 2012 email, Julia Fonseca (Environmental Planning Manager at Pima County) forwarded the following links to websites relating to Pima County riparian habitats and habitat mapping, as agreed to during the June 28, 2012 meeting. These were provided for further understanding of the process by which the maps were developed and important riparian areas designated.

- <http://www.pima.gov/cmo/sdcp/reports/d25/129MAPRE.PDF>
This 2002 study provided the background information on mapping techniques that were the basis for map revisions to the Pima County 1994 Watercourse and Riparian Habitat Protection and Mitigation Requirements Ordinance and associated riparian classification maps. New updated riparian classification maps were presented to the Board in 2003 for adoption.
- <http://www.pima.gov/cmo/sdcp/reports/d9/009PIM.PDF>
This website document contains a 2000 report from Pima County Flood Control District examining the strength and weaknesses of previous riparian vegetation mapping efforts and a pilot study that document work conducted on riparian mapping in Pima County prior to 2000 and in support of the Sonoran Desert Conservation Plan. The pilot study reported on the GIS gap analysis of existing riparian maps and the development of the vegetation classification system which was based on the biome concept hierarchical. Also contained in this web document is a summary of follow-on riparian mapping and GIS work to be performed by an outside contractor.
- <http://www.pima.gov/cmo/sdcp/reports/d7/012SDC.PDF>
This is the final study from Harris Environmental Group following the May 2000 pilot study titled "The Sonoran Desert Conservation Plan Riparian Vegetation Mapping and Classification". This contains vegetation mapping of over 320,000 acres of riparian areas across all of Pima County not under federal or Indian jurisdiction that did not previously have GAP status as protected land. GIS data from this study was used in combination with satellite imagery to update the classification of hydromesoriparian and xeroriparian vegetation under Pima County's riparian habitat mitigation ordinance.
- <http://www.pima.gov/cmo/sdcp/reports/d9/006LAN.PDF>
This website contains the April 2000 report to Pima County documenting the land cover data assessment efforts. This mapping task was part of the Sonoran Desert Conservation Plan efforts to consolidate land cover into one map as a tool for future bio-planning efforts and to develop and adopt a standard classification system.

- <http://www.pima.gov/cmo/sdcp/reports/d20/096OVE.PDF>
This website contains the Biological Reserve Design Process report that was provided to Pima County and the 2001 Pima County overview. The report documents the procedure used to create the biological reserve preferred alternative for the Sonoran Desert Conservation Plan.
- <http://www.pima.gov/cmo/sdcp/reports/d7/010PIM.PDF>
This pdf is a 2000 study prepared by Pima County Flood Control staff (Danforth and Fonseca) reporting on the effectiveness of the Riparian Habitat Mitigation Ordinance and future recommendations for improvement on the Ordinance. Recommendations of the study included suggestions for improving riparian mapping and extending riparian protection. The attached memo from the County Administrator called for the formulation of specific proposals for Board consideration aimed to strengthen the Riparian Protection Element of the Sonoran Desert Conservation Plan.
- <http://www.pima.gov/cmo/sdcp/reports/d7/009RIP.PDF>
This website contains the plf of the 2000 report on the Riparian Protection, Management, and Restoration Element of the Sonoran Desert Conservation Plan. The report looks at past and existing riparian conditions in terms of habitat and watercourse functions and processes. Evaluations are presented on the current management of riparian habitat and threats to the resource.
- <http://www.pima.gov/cmo/sdcp/reports/d7/002GIS.PDF>
This 2000 Pima Association of Governments' report documents their GIS coverage of perennial and intermittent streams and areas of shallow groundwater that was completed as part of the Sonoran Desert Conservation Plan. The report provides the methodology used to create the GIS layers and the metadata associated with the coverages.

National Wetland Inventory mapping: The National Wetlands Inventory is maintained by the USFWS, and can be accessed online (<http://www.fws.gov/wetlands/Wetlands-Mapper.html>) although not all areas have been fully digitized. However, the area in question has been digitized and is available.

Although not a complete source of riparian mapping—for instance xeroriparian washes are not mapped in the NWI, the NWI was reviewed for other useful inclusions. The major wetland areas identified throughout the areas were associated with stock ponds (coded as Palustrine with Unconsolidated Bottom), Empire Gulch, Davidson Canyon, and Cienega Creek (all coded as Riverine Intermittent Streambed). A large number of wetland areas were also delineated along the margins of Cienega Creek and coded as Palustrine Scrub Shrub.

Stock ponds are of marginal importance for the riparian analysis, as most of these in the area are not expected to be impacted unless in the immediate area of direct impact. More to the point, the riverine areas occurring in the NWI are already encompassed by the Pima County riparian mapping along these watercourses.

BLM Wetland Inventory: BLM also has partially mapped wetland areas within the Las Cienegas National Conservation Area, but as of the meeting on June 28, 2012, this mapping was considered incomplete. Based on verbal descriptions, it is believed that this mapping would also largely be encompassed by the

Pima County riparian mapping and NWI data. The partial results of the BLM wetland inventory were not obtained or incorporated into the riparian mapping.

Conclusions for Riparian Mapping: The sources for riparian mapping are fully described in the EIS as well as the Forest Service decision as to which sources are most appropriate. To summarize, the Pima County riparian mapping was selected as the most appropriate source, with further reliance on any field observations conducted by Westland Resources as well as Pima Association of Governments to help field verify the Pima County classifications and identify the types of species present. The NWI and BLM wetland inventories were not incorporated, as these areas were already covered by the Pima County mapping. Forest Service mapping was not incorporated, as it did not provide any higher level of detail than that existing with the Pima County mapping.

Riparian Impact Sources Considered

Based on public comments received on the October 2011 Draft EIS, the Forest Service decided to change the riparian analysis approach. Whereas in the DEIS the analysis consisted primarily of acres of potential impact, for the revised EIS it was desired that a more "functional" assessment of impacts to riparian vegetation be included. In other words, an analysis of how changing water levels would be expected to actually impact different types of riparian species.

Numerous methodologies, techniques, and data sources were suggested by cooperating agencies.

Arizona Department of Environmental Quality Stream Ecosystem Monitoring: ADEQ provided documentation for how the agency conducts field monitoring and assessment of stream ecosystems. This was informative for several portions of the EIS analysis, including potential impacts to Outstanding Arizona Waters, but did not provide any techniques or information that would help form the causal link between groundwater drawdown and riparian health or survival.

Rapid Assessment Techniques: Various cooperators and Forest specialists suggested researching the various rapid assessment techniques used throughout the West for the functional assessment of stream ecosystems. As with the ADEQ monitoring techniques, these methodologies were informative, particularly for identifying the various vegetation parameters that could be considered for potential impacts by groundwater drawdown. However, these techniques generally also did not help form the causal link between groundwater drawdown and riparian health or survival.

Natural Resources Conservation Service Ecological Site Descriptions: The Ecological Site Descriptions, maintained in a database by the NRCS and accessible online (<http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>) were in fact used in the EIS in the Soils and Revegetation section, in order to help establish the baseline Affected Environment of the project area. However, the available guidance is aimed largely at mapping exercises and describing or identifying certain types of habitat, and also do not help form the causal link between groundwater drawdown and riparian health or survival.

USGS San Pedro Studies: During the June 28, 2012 meeting, the USGS presented a summary of the numerous studies on the San Pedro River aimed at exploring the links between groundwater, surface water, and riparian vegetation. The most comprehensive and useful of these was a report titled ""Hydrologic Requirements of and Consumptive Ground-Water Use by Riparian Vegetation along the San

Pedro River, Arizona". This study was fundamentally useful for establishing causal links with statistical significance between riparian vegetation and hydrology, and in fact formed one of the primary sources for undertaking the riparian impact assessment in the EIS.

Additional Literature Search: Numerous other sources in literature were identified that speak to the response of riparian vegetation to changes in surface water or groundwater hydrology. These include the following: Lite 2004, Capon 2003, Busch and Smith 1995, Lite and Stromberg 2005, Elmore et al 2003, Horton and Clark 2001, and Scott et al 1999. These sources were reviewed and concepts incorporated into the analysis as appropriate.

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