SURVEY OF SURFACE WATER FEATURES IN THE RESOLUTION PROJECT AREA AND VICINITY

Resolution Copper



102 Magma Heights – Superior, Arizona 85173 Project Number: 807.132 04 01 March 2018





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I. INTRODUCTION

In 2015, Section 3003 of the National Defense Authorization Act for Fiscal Year 2015 authorized the exchange of lands between the federal government and Resolution Copper Mining, LLC (Resolution). In 2014, The United States Forest Service (USFS) accepted Resolution's General Plan of Operations (GPO) to conduct mining and mining related activities on National Forest System (NFS) lands located within Tonto National Forest (TNF) as administratively complete and sufficient to initiate USFS review under the National Environmental Policy Act (NEPA). On March 18, 2016, the Forest Service published a Notice of Intent in the federal register to initiate the NEPA review process.

WestLand Resources Inc. (WestLand) prepared a draft screening analysis to determine the potential for occurrence of special-status species and/or the presence of designated or proposed critical habitat within the footprint of these federal actions in support of USFS and Cooperative Agency review of these activities under NEPA (WestLand 2017). Special-status species reviewed for potential occurrence within the vicinity of the GPO project included species listed or proposed for listing under the Endangered Species Act (ESA) and species designated as sensitive by the TNF (USFS 2013). During screening, WestLand determined that seven special-status plant species had some potential to occur within the vicinity of the GPO project.

As part of continuing biological resources support for Resolution's GPO, WestLand conducted surveys for special-status plant species associated with water features that occur in the vicinity of the GPO (Study Area). The objective was to survey for special-status species with potential to occur in the Study Area, and to continue compiling baseline data on wetland and riparian plant species at a combination of lentic (ponds and stock tanks) and lotic (perennial and intermittent drainages, seeps, and springs) habitats (hereafter, "sites" and "reaches", respectively) (**Figure 1**).

Our usage of perennial, intermittent, and ephemeral is based on the Arizona Department of Environmental Quality's definitions. A perennial reach is "a stream with continuous flow, allowing for the possibility of perennial reaches interrupted by intermittent or ephemeral reaches". An intermittent reach "flows continuously only at certain times of the year, as when it receives water from a spring or from another surface source, such as melting snow". An ephemeral reach "has a channel that is at all times above the water table and flows only in direct response to precipitation" (Montgomery & Associates 2017c).

The seven special-status plant species associated with water features targeted for this survey are all designated as sensitive by the TNF, and include:

- Arizona alum root (*Heuchera glomerulata*);
- Arizona bugbane (*Cimicifuga arizonica*);
- Arizona giant sedge (*Carex ultra* (=*C. spissa* var. *ultra*);

- Aravaipa woodfern (Thelypteris puberula var. sonorensis);
- Chihuahuan sedge (*Carex chihuahuensis*);
- Fish Creek fleabane (*Erigeron piscaticus*); and
- Galiuro sage aka Aravaipa sage (*Salvia amissa*).

Surveys focused on riparian vegetation have previously been conducted within the Study Area. An initial baseline inventory conducted by WestLand identified and mapped sites and reaches along Devils Canyon and Upper Queen Creek, and described the vegetation present (WestLand 2003). Field surveys in 2008 described the plant species growing at sites and reaches along the perennial reach of Devils Canyon and included the reach of Queen Creek below the East Plant Site (WestLand 2010). During that survey, the special-status plant species Aravaipa woodfern was identified at several sites in

(acceleration) was not surveyed during this field effort due to weather related safety concerns). Surveys in 2011 focused on further documenting the riparian vegetation and recording physical and habitat variables associated with the sites in the Study Area (WestLand 2012b). In 2012, WestLand mapped the riparian vegetation along the perennial reach of Mineral Creek (WestLand 2012c). Other than Aravaipa woodfern, no other special-status species associated with water features were observed during these surveys.

In 2017, WestLand visited 37 locations, some of which had been previously surveyed, and others that had not. This report documents the observations recorded during the 2017 field survey. The following sections provide:

- A description of the Study Area (**Section 2**),
- A description of the survey methods (**Section 3**),
- Results of the survey (**Section 4**), and
- References cited within the text (**Section 5**).

2. STUDY AREA DESCRIPTION

The Study Area was composed of lands administered by TNF, the Arizona State Land Department (State Lands), and private lands owned by Resolution. The Study Area encompasses locations within the GPO footprint including:

- East Plant Site (**Figure 2**), and
- the proposed tailings storage facility, Tailings Corridor, and Borrow Areas, collectively referred to as "Tailings Area" (**Figure 3**).

The Study Area also encompasses areas downstream of proposed GPO activities, and other offsite areas within the vicinity of the GPO footprint. Downstream areas within the Study Area include a

reach of Queen Creek between the US 60 bridge downstream to Whitlow Ranch Dam, approximately 16 miles (Figure 2).

To collect additional baseline data of special-status plant species that occur near the project, WestLand also surveyed locations that are not within the GPO footprint and/or its vicinity, or downstream areas as specified in the screening analysis (WestLand 2017). These locations, defined as "other offsite areas", were selected based on water availability; that is, they contain perennial or intermittent water. Other offsite areas include:

- Queen Creek and its vicinity outside of the downstream reach (Figure 2),
- Portions of Arnett Creek and Telegraph Canyon and vicinity (Figure 4), and
- Mineral Creek (**Figure 5**).

The West Plant Site (WPS) and MARRCO Corridor (includes the Upper MARRCO, Lower MARRCO, Filter Plant, and Loadout Facility) were excluded from the Study Area due to the determination that special-status plant species associated with water features did not have potential to occur within these areas or vicinity.

2.1. GPO FOOTPRINT AND VICINITY

2.1.1. East Plant Site and Vicinity

The East Plant Site is located two to three miles east of Superior, Arizona (**Figure 2**) in a transitional zone on the northeastern edge of the Basin and Range physiographic province. Elevations range from 3,100 ft amsl near Queen Creek to 4,648 ft amsl at a high point on the Apache Leap escarpment that overlooks Superior. The western edge of this area is generally very steep, with the cliffs of the Apache Leap escarpment rising abruptly above Superior. East of Apache Leap, an area of parallel ridges and valleys trends to the northeast. The northeastern portion of the area is relatively flat, and most of the drainages flow northwest towards Queen Creek; however, in the southern portion of the parcel, Rio Rancho Creek and Hackberry Creek drain east towards Devils Canyon.

The water features within the vicinity of East Plant Site (i.e., drainages, stock ponds) range from ephemeral to intermittent. Surface water runoff in the vicinity is captured in man-made earthen impoundments and Civilian Conservation Corps check dams, some of which support riparian vegetation and could be considered intermittent (WestLand 2004a, 2004b, 2011). There are also some springs and pools in Queen Creek directly north of the East Plant Site, some of which support wetland and riparian vegetation (WestLand 2010, 2012c).

Four upland biotic communities, Interior Chaparral, Madrean Evergreen Woodland, Arizona Upland Subdivision of Sonoran Desertscrub, and Interior Riparian Deciduous Forest (Brown 1994), are found

within the East Plant Site. Interior Chaparral covers most of the parcel and is represented by manzanita (*Arctostaphylos pungens*) and shrub live oak (*Quercus turbinella*). Madrean Evergreen Woodland represented by Emory oak (*Quercus emoryi*), pinyon pine (*Pinus edulis*), one seed juniper (*Juniperus monosperma*), and mountain mahogany (*Cercocarpus montanus*) occur as bands along the deeper alluvium and on the steeper north facing slopes above Queen Creek. Arizona Upland Subdivision of Sonoran Desertscrub, represented by saguaro (*Carnegiea gigantea*) and hedgehog cactus (*Echinocereus fasciculatum*), occurs on a south facing hillslope above Rancho Rio Creek in the southern portion of the parcel. Interior Riparian Deciduous Forest, represented by Fremont cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*), occurs in patches around stock ponds and along Queen Creek Canyon directly north of East Plant Site (WestLand 2012c).

2.1.2. Tailings Area and Vicinity

The Tailings Area is located entirely on NFS lands and is approximately 4,381 acres in size (**Figure 3**). The Tailings Area is situated at the eastern edge of the Basin and Range physiographic province. The topography of the area is characterized by south or southwest-trending ridges with intervening drainages that discharge to Queen Creek. In the northern portions of the Tailings Area, the landscape transitions into steeper-sloped peaks and ridges with areas of bare rock and small cliffs. Exposed bedrock and outcrops occur along some of the canyons. Elevations within the area range from approximately 2,150 ft (655 m) above mean sea level (amsl) in the southwest to approximately to 3,050 ft (930 m) amsl where the Tailings Corridor enters the WPS.

The principal drainages within the vicinity of the Tailings Area are Hewitt Canyon, Roblas Canyon, Bear Tank Canyon, Potts Canyon, Rice Water Canyon, Happy Camp Canyon, and Silver King Wash. All these drainages discharge to Queen Creek and are ephemeral for the majority of their length, with a few short portions of intermittent reaches. There are also several springs in the area, (**Figure 3**) some of which support wetland and riparian vegetation.

The Tailings Area occurs within the Arizona Upland subdivision of the Sonoran Desertscrub biotic community (Brown and Lowe 1980). Brown and Lowe's (1980) mapping classifications were made on a large scale and do not show finer scale variations of vegetation associations within a relatively small area such as the Tailings Area. WestLand (WestLand 2014) provided a fine-scale vegetation map identifying seven major upland plant associations that occur within the Tailings Area. These associations included: 1) Jojoba-Paloverde Shrubland, 2) Ocotillo-Paloverde/Mixed Cacti Shrubland, 3) Jojoba-Paloverde/Triangleleaf Bursage Shrubland, 4) Single Whorl Burrobrush Shrubland, 5) Mesquite-Catclaw Acacia Wash Shrubland, 6) Rock Outcrop, and 7) Crucifixion Thorn Shrubland.

2.2. QUEEN CREEK

Queen Creek is located within the transitional zone on the northeastern edge of the Basin and Range physiographic province (**Figure 2**), and is an east to west trending drainage originating in the Superstition Mountains northeast of Superior at approximately 4,800 ft (1463 m) amsl. Water features surveyed in Queen Creek in 2017 included features considered as downstream and features considered as other offsite areas (**Figure 2**), as well as features in the East Plant Site and Vicinity (**Figure 2**). All water features surveyed in Queen Creek were located on a combination of NFS lands, and private inholdings. Elevations within the portions surveyed ranged from approximately 4,400 ft (1,333 m) amsl to around 2,600 ft (788 m) amsl.

2.2.1. Downstream Reach of Queen Creek

Through Superior, Queen Creek meanders approximately 2 miles (3.2 km) before reaching the Superior Waste Water Treatment Plant at approximately 2,550 ft (777 m) amsl. A two- to three-mile stretch of Queen Creek, downstream of the Superior Waste Water Treatment Plant, runs along the northern edge of an extensive outcrop belt formed from the Picket Post Mountain volcanics (Montgomery & Associates 2013). Along this stretch of Queen Creek, the Boyce-Thompson Arboretum (BTA), an Arizona State Park, occurs immediately adjacent to and includes a short reach of Queen Creek (**Figure 2**).

Downstream of the Superior Waste Water Treatment Plant and the Haborlite perlite mine, discharges from these facilities maintain perennial flow in Queen Creek for approximately one mile (1.6 km) (Montgomery & Associates 2017a), however the extent of the perennial reach can vary based on effluent discharge rates and seasonal precipitation events. Water features surveyed within this downstream reach included the perennial reach.

Along this reach the adjacent uplands are Arizona Upland Subdivision Sonoran Desertscrub (Brown 1994). The vegetation along the portion of Queen Creek below the Superior Waste Water Treatment Plant is supported by effluent water and characteristic of Sonoran Riparian Deciduous Forest (Brown 1994), represented by Fremont cottonwood and Goodding's willow (Golder Associates 2006; WestLand 2012c).

2.2.2. Queen Creek - Offsite Area

From its origin, Queen Creek travels south and west for approximately 4 miles (6.5 km) before reaching US 60 at approximately 3,500 ft (1067 m) amsl (**Figure 2**). Along this upper reach, the drainage is channelized in the steep-walled Queen Creek Canyon. and is spatially intermittent with periods of sustained winter streamflow generally beginning in November and lasting through April (Montgomery & Associates 2017a). Water features surveyed within this reach included one spring – Pump Station Spring.

From the headwaters of Queen Creek to US 60, the adjacent uplands are represented by a transitional ecotone, mixing Interior Chaparral (Brown 1994) and Madrean Evergreen Woodland (Brown 1994) characteristics. The vegetation structure and composition along the upper portion of Queen Creek is characteristic of Interior Riparian Deciduous Forest (Brown 1994), where it is represented by Arizona sycamore (*Platanus wrightii*), Arizona walnut (*Juglans major*), Fremont cottonwood, velvet ash (*Fraxinus velutina*), and bigtooth maple (*Acer grandidentatum*).

2.3. OTHER OFFSITE AREAS

2.3.1. Arnett Creek and Vicinity

Arnett Creek and Telegraph Canyon are located within the transitional zone on the northeastern edge of the Basin and Range physiographic province (**Figure 4**). Arnett Creek is a southeast to northwest trending drainage originating at approximately 3,700 ft (1128 m) amsl on the western slopes of Sleeping Beauty Mountain, and travelling approximately 9 miles (14.5 km) before terminating at the confluence of Queen Creek near the BTA, just south of U.S. 60 at approximately 2,360 ft (719 m) amsl. Telegraph Canyon is a south to north trending drainage originating at approximately 3,400 ft (1030 m) amsl south of Picketpost Mountain, and travelling approximately 5 miles (8 km) before terminating at the confluence with Arnett Creek south of Superior, Arizona at approximately 2,600 ft (788 m) amsl. The upstream portions of both drainages are channelized, meandering through the intervening areas between rolling hills in the landscape, until reaching the volcanic formations surrounding Picket Post Mountain. Here, the drainages are moderately confined by steep canyon walls.

Arnett Creek and Telegraph Canyon are spatially intermittent to ephemeral, primarily fed from winter and summer runoff. Portions of Arnett Creek considered for survey included an intermittent extent approximately 1,300 m in length present during the summer months, located southwest of Haborlite perlite mine (**Figure 4**). Water features surveyed included a reach, several springs, and earthen impoundments. All sites surveyed in Arnett Creek and Telegraph Canyon were located on NFS lands (**Figure 4**). Elevations within the portions surveyed ranged from approximately 3,400 ft (1,036 m) amsl to 2,450 ft (747 m) amsl.

The adjacent upland vegetation to the drainages is characteristic of the Arizona Upland Subdivision of Sonoran Desertscrub biotic community (Brown 1994). The vegetation around the reach and springs surveyed along Arnett Creek is characteristic of Sonoran Riparian Deciduous Forest and Woodland biotic community (Brown 1994), represented by velvet ash, Fremont's cottonwood, and Goodding's willow. The vegetation adjacent to the springs and impoundments surveyed in Telegraph Canyon is characteristic of Sonoran Riparian Scrubland (Brown 1994), represented by velvet mesquite (*Prosopis velutina*), burrobush (*Hymenoclea monogyra*), desert broom (*Baccharis sarothroides*), seepwillow (*B. salicifolia*), desert willow (*Chilopsis linearis*), and saltcedar (*Tamarix* sp.).

2.3.2. Mineral Creek

Mineral Creek is located within the transitional zone on the northeastern edge of the Basin and Range physiographic province (**Figure 5**). Mineral Creek begins at the convergence of a number of drainages in the foothills of the Pinal and Dripping Springs mountains at approximately 3,050 ft (930 m) amsl and travels south approximately 5.6 miles (9.0 km) before reaching the confluence with Devils Canyon at the Big Box Dam at an elevation of approximately 2,300 ft (701 m) amsl. Along this portion of Mineral Creek, the channel is confined by moderately steep canyon walls and is spatially intermittent to perennial with periods of sustained winter and summer streamflow (Montgomery & Associates 2017a). South of the Big Box Dam, Mineral Creek is diverted underground via a diversion tunnel until reaching the surface again at the confluence with the Gila River.

The reach of Mineral Creek surveyed in 2017 extends from the confluence with Lyons Fork tributary downstream to approximately 1.25 km upstream of the Big Box Dam reservoir (**Figure 5**). The total length of Mineral Creek and Lyons Fork surveyed is about 3.2 miles (5.1 km) in length and is located entirely on Arizona State Trust lands. Elevations in the reach surveyed range from approximately 2,800 ft (855 m) at the upstream terminus to approximately 2,400 ft (731 m) at the downstream terminus. Features surveyed included a reach and several springs.

Adjacent upland vegetation to Mineral Creek is characteristic of the Arizona Upland Subdivision of Sonoran Desertscrub biotic community (Brown 1994). The majority of the vegetation structure and composition along the surveyed portion of Mineral Creek is characteristic of Interior Riparian Deciduous Forest and Woodland biotic community (Brown 1994), represented by velvet ash, Fremont cottonwood, Goodding's willow, and Arizona sycamore (WestLand 2012c).

3. METHODS

Based on the results of the previous studies and surveys by WestLand and Montgomery and Associates (Montgomery & Associates 2013, 2017c, 2017b), 40 water features in five general locations were selected to be surveyed in 2017 (**Table 1**). Within the five general locations, which are described above, sites including springs, seeps, pools, and stock tanks, and reaches including perennial and intermittent drainages, were surveyed. For this study, a spring was defined as either surface water or vegetation indicative of a reliable water source. Seeps were defined as minor water sources emitting from canyon walls, where mineral staining and/or riparian vegetation indicated consistent water seepage. Stream reaches were defined as hydrologically and/or vegetationally distinct lengths of a drainage.

The naming of the water features follows that used in reports by Montgomery & Associates (Montgomery & Associates 2013, 2017c, 2017b). Some of the water features are named with alphanumerical station identifiers. Station identifiers consist of one or two letters identifying the watershed or sub-watershed (e.g. MC for Mineral Creek), a numerical value that identifies the number

of kilometers along the stream channel upstream from a defined confluence or major hydrographic feature (e.g. MC 3.4), and a single letter related to the position of the station relative to the streambed (e.g. MC 3.4W). Location relative to the streambed is indicated by "C" for the channel, "W" for a water feature west of the stream channel, and "E" for a water feature east of the spring channel (Montgomery & Associates 2017c). Other water features have a common name, either from a U.S. Geological Survey topographic map (e.g. Pump Station Spring), or if the water feature is not shown on a topographic map, then a name describing the channel morphology (e.g. Boulder Hole), was used.

At each water feature surveyed, the following data were collected. Location information was recorded with a handheld Garmin[®] Global Positioning System (GPS), and representative photographs of the water feature were taken. Water samples were collected in a graduated cylinder, and water parameter measures, including Temperature, pH, and Electrical Conductivity (EC), were recorded using an Oakton[®] Waterproof PCD 650 Multiparameter Meter. Observations, including substrate, and presence of standing and flowing water were recorded. Plant species were identified and assigned wetland ratings taken from the Wetland Plant List for the Arid West Region (Lichvar et al. 2016). For the purposes of this report, wetland species are defined as those with a rating of a) Facultative Wetland (FACW), or b) Obligate Wetland (O), that is they a) usually occur in wetlands but occasionally are found in non-wetlands, or b) they almost always occur in wetlands under natural conditions.

At each water feature, plant species records were limited to the narrow band of wetland vegetation surrounding the feature or where wetland species gave way to distinct upland vegetation species. Trees were identified if they were within varying distances from a spring or pool, which depended on the specific topography of the site. Emphasis was placed on recording those herbaceous plant species associated with increased moisture regimes, rather than plant species that are more ubiquitous such as the woody vegetation that makes up the riparian under- and over-stories of the streams in the Study Area. Observations of non-native species were also recorded.

Some of the water features visited were not suitable for complete data collection and certain measurements were not taken if no pool, water flow, or moisture was observed, and the water feature appeared to be inactive.

4. **RESULTS**

Surveys were conducted over a period of approximately three weeks in May and June of 2017. Thirty-seven water features were surveyed within the Study Area. No special-status plant species were observed during survey of the water features.

The location of the water features, a summary of the physical characteristics of the water features, the occurrence of wetland plant species, non-native plant species and other plant species observed at each location for each water feature are provided in the following sections and in **Table 1**. Water parameter

measurements are also provided in **Table 1**. Representative photographs of the water features and associated vegetation are provided in **Appendix A**.

4.1. GPO FOOTPRINT

4.1.1. East Plant Site and Vicinity

Six water features were visited at the East Plant Site and its vicinity in May and June of 2017: Boulder Hole, Eddie's Spring, Gibson Well Spring, Number 9 Wash Tinajas, QC 22.6 E (Karst Spring) and Queen Seeps (**Table 1; Figure 2**). No special-status plant species were observed at these water features. Other water features at the East Plant Site are described in the 2017 Oak Flat Surface Water Monitoring Program report (Montgomery & Associates 2017a).

Boulder Hole is a depression in the channel of Queen Creek approximately 0.5 mile (0.7 km) upstream from the US 60 bridge (**Figure 2**). The 5- by 5-meter depression is formed in the center of the channel as a result of the presence of large boulders upstream and downstream of the site. Although reported as having water consistently present (Montgomery & Associates 2013), at the time of the field visit, there was no water in the depression, and a beehive was active under the boulder that frames the upstream portion of the pool. There is no vegetation associated with the site, most likely due to scouring of the channel during high flow events (**Appendix A; Photo 1**). No special-status, wetland or non-native plant species were observed. Water parameter measurements were not collected at this location as there was no surface water present (**Table 1**).

Eddie's Spring is a 5- by 5-meter pool in the south canyon wall of Queen Creek approximately 0.7 mile (1.1 km) upstream from the US 60 bridge (**Figure 2**). The pool is perched approximately two meters above the canyon floor and is ringed by bedrock and large boulders. At the time of the field visit, water was present in the pool and observed seeping into the pool from the surrounding bedrock. The bedrock substrate prevents much herbaceous vegetative growth but a Goodding's willow and velvet ash were present (**Appendix A, Photo 2**). Algae was present on the surface of the pool. No special-status, wetland or non-native plant species were observed. Water parameter measurements were not collected at this location as the instruments were not functioning correctly (**Table 1**).

Gibson Well and Spring is located in Oak Flat Wash immediately upstream of the confluence with Queen Creek (**Figure 2**). The well is a hand-dug well in alluvial substrate, approximately 7 ft (2 m) in depth, and dry at the time of the field visit. The spring seeps from the banks on either side of the streambed just south of the well, but at the time of the field visit no surface water was present, only dampness. A high density of herbaceous wetland vegetation was observed (**Appendix A, Photo 3**) including Elliott's rush (*Juncus elliottii*), yellow monkeyflower (*Mimulus guttatus*), and pale spikerush (*Eleocharis macrostachya*). Other wetland species observed included coyote willow (*Salix exigua*), false indigobush (*Amorpha fruticosa*), and Arizona sycamore. No special-status plant species were observed.

Non-native species observed included oats (*Avena sativa*) and horehound (*Marrubium vulgare*). Water parameter measurements were not collected at this location as there was no surface water present (**Table 1**).

Number 9 Wash Tinajas are located in the channel of Number 9 Wash approximately 100 ft (30 m) from the confluence with Queen Creek (**Figure 2**). A series of three basins are present carved into bedrock ledges in the streambed. At the time of the field visit 0.25 cm of water remained in the three basins (**Appendix A, Photo 4**). Wetland species observed included grassleaf rush (*Juncus marginatus*) and Goodding's willow. No special-status or non-native plant species were observed. Water parameter measurements are provided in **Table 1**.

QC 22.6 E (Karst Spring) is located 200 ft (65 m) downstream of the US 60 bridge (Figure 2). A solution void in limestone is present on the east bank of Queen Creek about three meters east of the channel. At the time of the field visit there was no surface water observed, but water staining was present on the limestone above the stream channel, and surface water has been observed at this feature previously (Montgomery & Associates 2013). Wetland species observed included a small patch of yellow monkeyflower (Appendix A; Photo 5). No special-status or non-native plant species were observed. Water parameter measurements were not collected at this location as there was no surface water present (Table 1).

Queen Seeps is located on the south slope of Queen Creek Canyon, directly below Shaft No. 9 (**Figure 2**). No surface water is evident but an approximately 300-meter reach of soil on the slope is saturated, and supports a dense thicket of vegetation (**Appendix A, Photos 6-7**). Wetland plant species observed include coastal woodfern (*Dryopteris arguta*), Arizona sycamore, yellow monkey flower and wild heliotrope (*Phacelia distans*). No special-status plant species were observed. Non-native species observed included Himalayan blackberry (*Rubus* sp.). Water parameter measurements were not collected at this location as there was no surface water present (**Table 1**).

4.1.2. Tailings Area and Vicinity

Thirteen water features were visited in Near West and its vicinity in May and June of 2017: Bear Tank Spring, Benson Spring, I Berry Spring, Bitter Spring, Conley Spring, Happy Camp Spring, Government Tank, No Name Spring, Perlite Spring, Potts Spring, "Possible" Spring, Lower Railroad Spring, and Walker Spring (**Table 1; Figure 3**). No special-status plant species were observed at these water features.

Bear Tank Spring is located in the channel of Bear Tank Canyon approximately 1.8 miles (3 km) upstream of the confluence with Queen Creek (**Figure 3**). The uppermost water feature is a 10- by 10-meter pool at the base of a conglomerate ledge. About 30 meters downstream, small seeps at the base of a Goodding's willow flow another 10 meters and converge with another seep under a bedrock

ledge. A further five meters downstream, a muddy pool is formed under a rock from which a pipe extrudes and drips. The lowermost water feature is a tinaja located 0.35 mile (0.5 km) downstream of the spring where a depression in the bedrock captures water below a dirt road, and a small seep in the bedrock above the tinaja contributes to the pool. Wetland plants observed include yellow monkeyflower, false pennyroyal (*Hedeoma* sp.), watercress (*Nasturtium officinalis*), rabbitsfoot grass (*Polypogon monspeliensis*) and Goodding's willow (**Appendix A, Photos 8-10**). No special-status plant species were observed. Non-native species observed included rabbitsfoot grass and red brome (*Bromus rubens*). Water parameter measurements were taken at the uppermost and lowermost features, and are provided in **Table 1**.

Benson Spring is located in the channel of Benson Spring Canyon 0.5 mile (0.8 km) upstream from the confluence with Queen Creek (**Figure 3**). The upper portion of the spring is a 20- by 20-meter tinaja in conglomerate bedrock that collects water from seeps that occur in the bedrock and from runoff events. Downstream of the tinaja, seeps occur in the loamy substrate and continue for approximately 50 meters, with several small pools along the flow (**Appendix A, Photos 11-12**). Wetland plants observed include yellow monkeyflower, speedwell (*Veronica anagallis-aquatica*), rabbitsfoot grass, pale spikerush, toad rush (*Juncus bufonius*) and Goodding's willow. No special-status plant species were observed. Non-native species observed included rabbitsfoot grass, Bermuda grass (*Cynodon dactylon*) and sowthistle (*Sonchus* sp.). Water parameter measurements are provided in **Table 1**.

Benson Tank is located in the channel of Benson Spring Canyon 0.3 mile (0.5 km) upstream from Benson Spring (**Figure 3**). An earthen impoundment across the drainage captures runoff in a 50- by 100-meter depression in which surface water was present at the time of the field visit. Algae was present on the surface of the tank. Wetland plants observed include seepwillow (**Appendix A**, **Photo 13**). No special-status plant species were observed. Non-native species observed included rabbitsfoot grass and Bermuda grass. Water parameter measurements are provided in **Table 1**.

Bitter Spring is located in the channel of Peachville Wash approximately 1 mile (1.5 km) above the confluence with Silver King Wash (**Figure 3**). Within the incised channel, bedrock intrudes across the streambed and several seeps are present, which flow across bedrock and pool in several places. Dense patches of herbaceous vegetation line the stream, but there is no riparian vegetation overstory (**Appendix A, Photo 14**). Wetland plants observed include yellow monkeyflower and toad rush. No special-status plant species were observed. Non-native species observed included oats. Water parameter measurements are provided in **Table 1**.

Conley Spring is located in the channel of Peachville Wash approximately 1 mile (1.5 km) above the confluence with Silver King Wash (**Figure 3**). Surface flow starts in a small pool underneath a dead Fremont cottonwood (**Appendix A, Photo 15**). The surface flow extends over bedrock substrate for over 100 meters, occasionally forming small pools. Algae is present along the flow. Flow ends where the bedrock channel turns into a sandy bottom. Wetland plants observed include watercress, yellow monkey flower,

and wild fuchsia (*Epilobium canum*). No special-status plant species were observed. Non-native species observed included oats and fountain grass (*Pennisetum setaceum*). Water parameter measurements are provided in **Table 1**.

Government Tank is located on the east bank of Hewitt Wash, approximately 4.5 miles (7.25 km) above the confluence with Queen Creek (**Figure 3**). A two-meter deep depression is present at the base of a rock outcrop with signs of seepage. No stream channel enters the depression. At the time of the field visit, a one- by one-meter pool of muddy water was present at the bottom of the depression (**Appendix A, Photo 16**). Wetland plants observed include speedwell, rabbitsfoot grass, and Goodding's willow. No special-status plant species were observed. Non-native species observed included Bermuda grass, clover (*Melilotus* sp.), and rabbitsfoot grass. Water parameter measurements were not collected at this location due to safety concerns about being stung as the surface of the water was covered with wasps and bees (**Table 1**).

Happy Camp Spring is located in the channel of Happy Camp Canyon approximately 2.8 miles (4.5 km) above the confluence with Queen Creek (Figure 3). Flow starts in a dense patch of vegetation just downstream from a concrete dam (Appendix A, Photo 17), but areas of damp sand are present upstream from this. Flows from the stream banks converge into the stream bed and flow downstream for approximately 50 meters. Wetland plants observed include purple mat (*Nama demissa*), yellow monkeyflower, rabbitsfoot grass, toad rush, grassleaf rush, and Goodding's willow. No special-status plant species were observed. Non-native species observed included rabbitsfoot grass, Bermuda grass, and Malta star thistle (*Centaurea melitensis*). Water parameter measurements are provided in **Table 1**.

I Berry Spring is located in the channel of Fortuna Wash 0.3 mile (0.5 km) above the confluence with Silver King Wash (**Figure 3**). A developed well and water tank are on the road above the spring. Within the incised channel, bedrock intrudes across the streambed and water seeps in several places, collects, and flows. The flows disappear downstream in sandy substrate. At the upper end of the seeps, an open ended horizontal pipe is embedded in the bedrock and a small concrete dam is constructed, evidence of former spring development. A disjunct lower reach is surrounded by herbaceous vegetation and flows, and pools occur over 15 meters. There is no overstory of riparian vegetation. Wetland plants observed include yellow monkeyflower and seepwillow (**Appendix A, Photo 18**). No special-status plant species were observed. Non-native species observed included oats. Water parameter measurements are provided in **Table 1**.

Lower Railroad Spring is located on the Picketpost Mountain USGS 7.5-minute quadrangle topographic map just north of where the MARRCO railroad crosses Happy Camp Canyon (Figure 3). However, at the time of this field visit, as in prior surveys (WestLand 2012a), there was no surface water or moisture evident, and no sign of this water feature. (Appendix A, Photo 19). No special-status or wetland plant species were observed. Non-native species observed included Bermuda grass.

Water parameter measurements were not collected at this location as there was no surface water present (Table 1).

No Name Spring is located in the channel of Whitford Canyon, just above the confluence with Potts Canyon and 3.7 miles (6 km) above the confluence with Queen Creek (**Figure 3**). Several seeps occur at bedrock contacts along the stream channel between sandstone and mudstone, and at the time of the field visit flows and pools were present in the stream channel for approximately 500 meters. There is also evidence of seepage in the form of salt deposits, in areas along the banks. The flow disappears into the stream channel in sandier areas and then reappears in gravelly, bedrock reaches. Filamentous and crustose algae is present along the flow (**Appendix A, Photo 20**). Wetland plants observed include cattail (*Typha* sp.), yellow monkeyflower, rabbitsfoot grass, toad rush, barnyard grass (*Echinochloa crus-galli*), arrow weed (*Pluchea sericea*), Arizona centaury (*Zeltnera calycosa*) and Goodding's willow. No special-status plant species were observed. Non-native species observed included barnyard grass, Bermuda grass, oats, rabbitsfoot grass, clover and saltcedar. Water parameter measurements are provided in **Table 1**.

Perlite Spring is located in an unnamed canyon east of Bear Tank Canyon 1.8 miles (3 km) above the confluence with Bear Tank Canyon (**Figure 3**). At the time of the field visit, there was a pool of water approximately 15 by 20 meters and one meter deep at the base of a rock outcrop. An earthen impoundment is present upslope and northwest of Perlite Spring which was dry except for a small muddy pool (**Appendix A, Photos 21-22**). Wetland species present included yellow monkeyflower, rabbitsfoot grass and Goodding's willow. No special-status plant species were observed. Non-native species observed included Bermuda grass, canary grass (*Phalaris canariensis*), rabbitsfoot grass, red brome, stinkgrass (*Eragrostis cilianensis*), and Malta star thistle. Water parameter measurements were collected at the spring and are provided in **Table 1**.

"Possible" Spring is located in Potts Canyon 2.5 miles (4.1 km) above the confluence with Queen Creek (**Figure 3**). Water is present in the stream channel upstream of bedrock contacts between perlite and conglomerate. Several small pools and seeps and flows are present for approximately 100 meters, with algae and wetland plants present along the flows (**Appendix A, Photo 23**). Wetland species present include toad rush, yellow monkeyflower, rabbitsfoot grass and Goodding's willow. No special-status plant species were observed. Non-native species observed included Bermuda grass and rabbitsfoot grass. Water parameter measurements are provided in **Table 1**.

Walker Spring is located at the confluence of Happy Camp canyon and Silver King Wash (**Figure 3**). Surface water flow starts just below a conglomerate bedrock ledge in the streambed. Both sides of the stream banks are saturated and seeping. Seeps, flows, and pools are present for approximately 30 meters (**Appendix A, Photo 24**). Wetland species observed include purple mat, seepwillow, and speedwell. No special-status plant species were observed. Non-native species observed included red brome and clover. Water parameter measurements are provided in **Table 1**.

4.2. QUEEN CREEK

4.2.1. Queen Creek - Downstream

One water feature was visited in the downstream reach of Queen Creek during June 2017, the Queen Creek Surface Water Reach (**Table 1, Figure 2**). No special-status plant species were observed at this water feature.

Queen Creek Surface Water Reach is a ~700-meter-long reach of the drainage supported by treated wastewater from the Town of Superior's Wastewater Treatment Plant (Figure 4). The riparian overstory creates a closed canopy with a mix of native and non-native species (Appendix A; Photos 25-27). Native trees are dominant and include Fremont cottonwood, Goodding's willow, velvet ash, velvet mesquite, netleaf hackberry, catclaw acacia, and mulberry (*Morus* sp.). Non-native trees are common and include date palm (*Phoenix dactylifera*), tree tobacco (*Nicotiana glauca*), Mexican paloverde (*Parkinsonia aculeaticarpa*), tree of heaven (*Ailanthus altissima*), and Mexican fan palm (*Washingtonia robusta*). Other non-native species observed include Bermuda grass, rabbitsfoot grass, horehound, clover, oleander (*Nerium oleander*), and Johnson grass (*Hordeum jubatum*). Wetland species observed include Arizona centaury, nutsedge (*Cyperus esculentus*), cattail, Goodding's willow, seepwillow, pale spike rush, yellow monkey flower, rabbitsfoot grass, speedwell, and watercress.

Water parameter measurements were collected at two locations and are provided in Table 1.

4.2.2. Queen Creek –Offsite Area

One water feature associated with Queen Creek offsite area was surveyed by WestLand in May of 2017, Pump Station Spring (**Table 1; Figure 2**). No special-status plant species were observed at this water feature.

Pump Station Spring is located in the channel of upper Queen Creek, north of Oak Flat (**Figure 2**). At the time of the field visit, at the upstream end of the reach moisture seeps out of the clay stream banks and supports three 1.5 feet (0.5 m) long pools in a 65-meter reach of the damp streambed. Further downstream several tinajas are present. Well-developed riparian overstory provided 100-percent cover at the upper end of the reach with trees including Arizona sycamore, Bonpland's willow (*Salix bonplandiana*), Goodding's willow, netleaf hackberry, elderberry (*Sambucus* sp.), and hoptree (*Ptelea trifoliata*). Along the stream channel golden columbine (*Aquilegia chrysantha*), geranium (*Geranium caespitosum*), deergrass (*Muhlenbergia rigens*), honeysuckle (*Lonicera alba*) and scarlet hedgenettle (*Stachys coccinea*) are scattered.

No special-status or non-native plant species were observed. Wetland plants observed include pale spikerush, wild fuchsia, mint (*Mentha* sp.) toad rush, Elliot's rush (*Juncus elliottii*), swordleaf rush (*Juncus ensifolius*), and speedwell. Water parameter measurements were taken at two locations, the most

upstream observed water and the furthest downstream observed water (**Appendix A, Photos 28-29**), and are provided in **Table 1**. The most upstream water is the first of a string of five small pools along the stream channel. The most downstream surface water is a one by 10-meter rock tinaja.

4.3. OTHER OFFSITE AREAS

4.3.1. Arnett Creek & Telegraph Canyon

Thirteen water features associated with Arnett Creek and/or Telegraph Canyon were surveyed by WestLand in May of 2017, one reach and 12 sites: AC 1.8E, Arnett Creek Surface Water Reach, Blue Spring, Bored Spring, Filaria Spring, Hidden Spring, Kanes Spring, Lime Tank, Rock Tank, S. Filaria Spring, Thompson Spring, Trough Spring, and Wild Horse Spring (**Table 1; Figure 4**). No special-status plant species were observed at these water features.

AC 1.8E is located in Arnett Creek 4.5 miles (7.5 km) upstream of the confluence with Queen Creek (**Figure 4**). A springbox with a locked steel lid and approximately six-inch-diameter corroded steel pipe are present within the stream channel (**Appendix A, Photo 30**). No water was observed in the springbox. Wetland species observed included seepwillow. No special-status or non-native plant species were observed. Water measurements were not collected at this location as there was no surface water present (**Table 1**).

Arnett Creek Surface Water Reach begins just below the confluence with Telegraph Canyon (**Figure 4**) and is composed of a series of pools and flows over alluvial boulders, cobbles, and sand (**Appendix A, Photos 31-32**). The overstory is composed of velvet ash, Fremont cottonwood, velvet mesquite, and saltcedar. No special-status plant species were observed. Wetland species observed include algae, nutsedge (*Cyperus esculentus*), yellow monkeyflower, rabbitsfoot grass, pale spikerush, Elliott's rush, grassleaf rush, watercress, and Goodding's willow. Non-native species observed include Bermuda grass, oleander, stinkgrass, and saltcedar. Water parameter measurements were taken at three locations and are provided in **Table 1**.

Blue Spring is located a short distance downstream from the Arnett Creek crossing of Arizona Highway 177 (Figure 4). Seeps over bedrock in the streambed support wetland plants including nutsedge, yellow monkeyflower, rabbitsfoot grass, seepwillow, and Goodding's willow (Appendix A, Photo 33). No special-status plant species were observed. Non-native species observed include Bermuda grass, oats, horehound, clover, rabbitsfoot grass and saltcedar. Water measurements were not collected at this location as there was no evident surface water present (Table 1).

Bored Spring is located in a small drainage immediately east of Arizona Highway 177 (**Figure 4**) and is a ~20- by 8-meter man-made spring piped to a trough downstream (**Appendix A, Photos 34-35**). The spring area is overstoried by a large Fremont cottonwood with velvet mesquite also present. Around the

perimeter of the spring the herbaceous vegetation is composed of mostly non-native species including African sumac (*Rhus lanca*), saltcedar, Bermuda grass, fountain grass, red brome, and clover. Overflow from the trough supports wetland species yellow monkeyflower, and Goodding's willow. No special-status plant species were observed. Water parameter measurements were collected at the trough, and are provided in **Table 1**.

Filaria Spring is located within an east side canyon of Telegraph Canyon (**Figure 4**). No surface water, special-status species, wetland species or invasive species were observed (**Table 1**).

Hidden Spring is located in a narrow, limestone canyon east of Arizona Highway 177 (**Figure 4**) on bedrock substrate. A caisson made from a galvanized culvert encloses the spring which is piped to a trough (**Appendix A, Photos 36-37**). The trough has algae on the surface, overflows, and the flow supports a scattering of the wetland plants, yellow monkeyflower and rabbitsfoot grass. Non-native species observed include Malta star thistle, red brome, Johnson grass, and a patch of common garden iris (*Iris* sp.), probably a relict from when the area was homesteaded. A travertine cave on the slope across from the spring may have been the original spring but shows no evident moisture or seepage. No special-status plant species were observed. Water parameter measurements were collected at the trough, and are provided in **Table 1**.

Kanes Spring is located in a narrow, limestone canyon east of Arizona Highway 177 that is tributary to Arnett Creek (**Figure 4**). Seeps occur between the limestone strata and the flows collect in small bedrock pools (**Appendix A, Photo 38**). A spring box with several generations of outlet piping is evident. Canyon grape (*Vitis arizonica*) and desert hackberry (*Celtis pallida*) form a thicket on the slope above and around the spring (**Appendix A, Photo 39**). Wetland plants observed include yellow monkeyflower, seepwillow, and grassleaf rush. No special-status plant species were observed. Water parameter measurements are provided in **Table 1**.

Lime Tank is located east of Arizona Highway 177 and is an earthen impoundment (Appendix A, Photo 40) along an ephemeral drainage in the next main drainage south of Kanes Spring (Figure 4). Around the perimeter of the approximately 32- by 32-meter earthen impoundment the vegetation is composed of mostly non-native species including oats, red brome, canary grass, rabbitsfoot grass, and saltcedar. Wetland species observed include rabbitsfoot grass. No special-status plant species were observed. Water parameter measurements are provided in Table 1.

Rock Tank is located within an east side canyon of Telegraph Canyon (**Figure 4**). An earthen impoundment holds water approximately 50 meters long and up to 2 meters deep, with algae present on the surface of the water (**Appendix A, Photos 41-42**). Wetland plant species observed include seepwillow, pale spikerush, and rabbitsfoot grass. No special-status or invasive plant species were observed. Water parameter measurements are provided in **Table 1**.

S. Filaria Spring is located within an east side canyon of Telegraph Canyon (**Figure 4**). No surface water, or special-status, wetland or invasive plant species were observed (**Table 1**).

Thompson Spring is located in Arnett Creek at the confluence with Telegraph Canyon (**Figure 4**). The spring is located above the streambed on a steep rock face within an alcove under a rock overhang. The rock face seeps and flows to the stream channel and flows and pools downstream (**Appendix A**, **Photo 43**). No special-status plant species were observed. Wetland plant species observed include nutsedge, yellow monkeyflower, pale spikerush, and Goodding's willow. Non-native plant species observed include oleander and saltcedar. Water parameter measurements were collected at the pool, and are provided in **Table 1**.

Trough Spring is located in a western tributary of Telegraph Canyon (**Figure 4**). Bedrock intrudes across the streambed and a small seep occurs under a Goodding's willow (**Appendix A, Photo 44**). A steel culvert holds approximately 16inches of water and is piped downstream to a trough, which was empty. Wetland species observed included Goodding's willow and seepwillow, while the non-native grasses oats and Bermuda grass were the herbaceous understory. No special-status plant species were observed. Water parameter measurements are provided in **Table 1**.

Wild Horse Spring is located east of Arizona Highway 177 along Oak Creek. (**Figure 4**). A bedrock ledge has several small rock basins which hold water (**Appendix A, Photo 45**). A pipe extended out of the bedrock at the upper end of a reach of fairly dense vegetation including velvet mesquite, catclaw acacia, sugar sumac (*Rhus ovata*), and Arizona rosewood (*Vauquelinia californica*) No special-status, wetland or invasive plant species were observed. Water parameter measurements are provided in **Table 1**.

4.3.2. Mineral Creek

Three water features associated with Mineral Creek were surveyed by WestLand in June of 2017, two sites, LF 0.2C and MC 3.4W, and one reach, Mineral Creek Surface Water Reach (**Table 1; Figure 5**). No special-status plant species were observed at these water features.

LF 0.2 C is where the first surface water was observed in Lyon's Fork above the confluence with Mineral Creek during the field visit (Figure 5). Seeps along the banks flow into a 10- by 1-meter pool with algae present. Surface flow commences in the stream channel about 10 meters downstream from the pool (Appendix A, Photo 46). No special-status plant species were observed. Wetland plants observed include pale spikerush, yellow monkeyflower, rabbitsfoot grass, Bonpland's willow, seepwillow, and speedwell. Non-native plants observed include rabbitsfoot grass. Water parameter measurements are provided in Table 1.

Mineral Creek Surface Water Reach begins at the confluence of Lyon's Fork and Mineral Creek (**Figure 5**) and continues downstream as a series of flows, seeps, and pools (**Appendix A, Photo 47**). Interior Riparian Deciduous Forest forms a canopy of Bonpland willow, Goodding's willow, velvet ash,

Fremont cottonwood, Arizona sycamore, and Arizona walnut. No special-status plant species were observed. Wetland plants observed include pale spikerush, swordleaf rush, yellow monkeyflower, watercress, Arizona sycamore, Bonpland's willow, Goodding's willow, rabbitsfoot grass, western poison ivy (*Toxicodendron rydbergii*), seepwillow, and speedwell. Non-native plant species observed include Bermuda grass, clover, tree tobacco, and rabbitsfoot grass. Water parameter measurements are provided in **Table 1**.

MC 3.4 W is a spring on the hillslope west of and above Mineral Creek's stream channel (**Figure 5**). The spring creates saturated soil for approximately 50 meters down slope. A patch of golden columbine (**Appendix A, Photo 48**) and the wetland plants horsetail (*Equisetum hyemale*) and yellow monkeyflower are present where the spring reaches the stream channel of Mineral Creek. A robust patch of Fremont cottonwood, Arizona sycamore, velvet ash, Arizona walnut, and netleaf hackberry, some of which have trunks greater than one meter in width, occurs down the hillslope. Water parameter measurements were collected from the stream channel of Mineral Creek and are provided in **Table 1**.

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TABLE I

	Feature Description		Water Chemistry ¹ Wetl		Wetland	Non-Native Plant	Special Status					
Feature		Northing	g Easting	Water Presence	Substrate	рН	т⁰С	EC µS	Plant Species Observed ²	Species Observed	Plant Species Observed	
East Plant Site and Vicinity												
Boulder Hole	Large hole in channel approximately two meters deep. No vegetation in proximity to feature -	492234	3684747	No surface water present	Alluvium	-	-	-	None	None	None	
Eddie's Spring	A 5 by 5-meter pool in the channel is approximately 0.25 meters deep	492595	3684867	Surface water present	Bedrock	-	-	-	Platanus wrightii Salix gooddingii	None	None	
Gibson Well/Spring	A stream channel upstream of well is lined with wetland plants, indicating shallow groundwater. Water was observed within the well approximately 1.5 meters below the ground surface.	494519	3685745	No surface water present	Alluvium	-	-	-	Amorpha fruticosa Eleocharis macrostachya Juncus elliotti Mimulus guttatus Platanus wrightii Salix exigua	Avena sativa Marrubium vulgare	None	
Number 9 Wash Tinajas	Series of bedrock pools	494205	3685518	Surface water present ~ 25 cm depth	Bedrock	9.41	25.5	242	Juncus marginatus Salix gooddingii	None	None	
QC 22.6E (Karst Spring)	Solution void in limestone	491659	3684231	No surface water present	Bedrock	-	-	-	Mimulus guttatus	None	None	
Queen Seeps	North-facing slope is saturated and supports dense thicket	493857	3685619	No surface water present	Bedrock Alluvium	-	-	-	Dryopteris arguta Mimulus guttatus Phacelia distans Platanus wrightii	<i>Rubus</i> sp.	None	
				Tailings Area and Vicinity								
Bear Tank Spring	The spring feature is a 10 by 10-meter pool at the base of a conglomerate ledge. About 30-meter downstream small seeps flow another 15-meter downstream a muddy pool is formed under rock from which a pipe extrudes and drips. The tinaja captures stream runoff below the road and a small seep in the bedrock	Spring 482353 Tinaja 481997	Spring 3685657 Tinaja 3685256	Spring Water is pooled at upper end and seeps over approximately 50-meters Tinaja Standing water present in tinaja and seeps from east side of pool	Alluvium over bedrock	Spring 8.75 Tinaja 8.0	Spring 31.3 Tinaja 27.3	Spring 740 Tinaja 1038	Baccharis salicifolia Hedeoma sp. Mimulus guttatus Nasturtium officinale Polypogon monspeliensis Salix gooddingii	Bromus rubens Cynodon dactylon Polypogon monspeliensis	None	
Benson Spring	Upper portion of spring is a 20 by 20-meter tinaja in conglomerate. Seeps occur downstream from the loamy substrate and continue for approximately 50 meters, with several small pools along the flow	481575	3684527	Standing water present in pool Water present in three pools and a small channel of water	Bedrock	8.29	27.7	915	Eleocharis macrostachya Juncus bufonius Mimulus guttatus Polypogon monspeliensis Salix gooddingii Veronica anagallis-aquatica	Cynodon dactylon Polypogon monspeliensis Portulaca suffrutescens Sonchus sp.	None	
Benson Tank	Water is impounded along a drainage and forms a pool	481962	3684659	Surface water in pool is approximately 20 by 40-meters	Alluvium	9.95	30.3	152	Algae Baccharis salicifolia	Cynodon daactylon Tamarix sp.	None	
Bitter Spring	Bedrock intrudes across streambed and forms several seeps, flows and pools	491736	3689303	Water flows across bedrock for approximately 50 meters	Bedrock	7.6	21.0	1128	Juncus bufonius Mimulus guttatus	Avena sativa	None	
Conley Spring	Bedrock intrudes across streambed and forms several seeps, flows, and pools. Flow ends where bedrock turns into sandy bottom	491530	3687202	Incised channel has flow for about 100 meters	Bedrock	8.1	20	902	Algae Epilobium canum Mimulus guttatus Nasturtium officinale	Avena sativa Pennisetum setaceum	None	
Government Tank	One- by one-meter pool at base of rock outcrop with signs of seepage.	479917	3689540	Small pool	Alluvium	-	-	-	Baccharis salicifolia Polypogon monspeliensis Salix gooddingii Veronica anagallis-aquatica	Cynodon dactylon Melilotus officinale Polypogon monspeliensis	None	

Table I. Physical and Vegetation Characteristics at the Water Features Visited in May and June of 2017
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_			_			Wate	er Chem	istry ¹	Wetland	Non-Native Plant	Special Status Plant Species Observed
Feature	Feature Description	Northing	Easting	Water Presence	Substrate	рН	т⁰С	EC μS	Plant Species Observed ²	Species Observed	
Happy Camp Spring	Flow starts just downstream from concrete dam but damp sand upstream	486835	3685585	Flow for approximately 50 meters from seeps in banks and under dam	Alluvium	9.1	21	730	Hedeoma sp. Juncus bufonius Juncus marginatus Mimulus guttatus Nama demissa Polypogon monspeliensis Salix gooddingii	Centaurea melitensis Cynodon dactylon Polypogon monspeliensis	None
I Berry Spring	Bedrock intrudes across streambed and forms several seeps, flows and pools	490677	3688819	Water seeps from bedrock and is present in several small pools	Bedrock	7.4	26	16.75	Baccharis salicifolia Mimulus guttatus	Avena sativa	None
Lower Railroad Spring	No evidence of spring or developed infrastructure	485172	3683210	No water present	Alluvium	-	-	-	None	Cynodon dactylon	None
No Name Spring in Whitford Canyon	Several seeps occur at contacts along the stream channel between sandstone and mudstone. Evidence of seepage from banks where salt deposits are present. Flow disappears into stream channel in sandier areas and then reappears in gravelly, bedrock reaches. Some pooling occurs	485985	3687122	Surface water flow for approximately 500 meters	Alluvium Bedrock	8.0	23.9	-	Algae – filamentous and crustose Baccharis salicifolia Echinochloa crus-galli Juncus bufonius Mimulus guttatus Pluchea sericea Polypogon monspeliensis Salix gooddingii Typha latifolia Zeltnera calycosa	Avena sativa Cynodon dactylon Melilotus sp. Polypogon monspeliensis Tamarix sp.	None
Perlite Spring (Perlite Quarry Tank 2)	Pool at base of rock outcrop holds water. No evidence of source apparent. Impoundment further upslope is mostly dry	484444	3686797	Pool at base of rock overhang, approximately 15 by 20 meters and one meter deep. Water catchment is dry except for small muddy pool	Alluvium	9.0	24.1	355	Mimulus guttatus Polypogon monspeliensis Salix gooddingii	Bromus rubens Centaurea melitensis Cynodon dactylon Eragrostis cilianensis Phalaris canariensis Polypogon monspeliensis	None
"Possible" Spring in Potts Canyon	Water is present in the stream channel upstream of the contact between perlite and conglomerate. Several small pools are present	485137	3686453	Seeps and flow present for approximately 100 meters.	Alluvium	7.5	34.4	1218	Algae Juncus hufonius Mimulus guttatus Polypogon monspeliensis Salix gooddingii	Cynodon dactylon Polypogon monspeliensis	None
Walker Spring	Flow starts just below conglomerate ledge in streambed. Banks are saturated and seeping on both sides of the stream	486373	3684211	Seeps, flows and pools present for approximately 30 meters	Bedrock	8.7	26	1360	Baccharis salicifolia Nama demissa Veronica anagallis-aquatica	Bromus rubens Melilotus officinale	None
				Queen Creek – Downstream and Offsite Area							
Queen Creek Perennial Reach	The Town of Superior Wastewater Treatment Plant and the Harborlite perlite mine discharges into Queen Creek support flow	487112	3681957	Surface water present and flowing	Alluvium Bedrock	7.74	21.7 27.2	811 838	Baccharis salicifolia Cyperus esculentus Eleocharis macrostachya Mimulus guttatus Nasturtium officinale Polypogon monspeliensis Salix gooddingii Typha sp. Veronica anagallis-aquatica Zeltnera calycosa	Cynodon dactylon Marrubium vulgare Melilotus officinale Nerium oleander Nicotiana glauca Phoenix dactylifera Polypogon monspeliensis Sorghum halepense	None

Table I. Physical and Vegetation Characteristics at the Water Features Visited in May and June	of 2017
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_						Wate	er Chem	istry ¹	Wetland	Non-Native Plant	Special Status
Feature	Feature Description	Northing	Easting	Water Presence	Substrate	pН	т⁰С	EC μS	Plant Species Observed ²	Species Observed	Plant Species Observed
Pump Station Spring	Spring and reach in channel of upper Queen Creek	Start Reach 494001 End Reach 494235	Start Reach 3689076 End Reach 3688969	Water present in pools and damp streambed	Alluvium Bedrock	7.61 8.02	19.2 23.6	838 861	Amorpha fruticosa Baccharis salicifolia Eleocharis macrostachya Epilobium incanum Mentha sp. Mimulus guttatus Juncus bufonius Juncus elliottii Juncus ensifolius Platanus wrightii Salix bonplandiana Salix gooddingii Veronica anagallis-aquatica	None	None
			(Offsite Area – Arnett Creek and Telegraph Canyon							
AC1.8E	Spring box in stream channel with bolted metal lid.	485204	3681687	No water present	Alluvium	-	-	-	Baccharis salicifolia	None	None
Arnett Creek Surface Water Reach	Water present in reach with interruptions for approximately one km	Start Reach 487292 End Reach 486425	Start Reach 3680525 End Reach 3681080	Surface water present in pools and as flow	Alluvium	7.69 7.93 7.60	25.7 26.4 28.4	823 908 982	Algae Cyperus esculentus Eleocharis macrostachya Juncus elliottii Juncus marginatus Mimulus guttatus Nasturtium officinale Polypogon monspeliensis Salix gooddingii	Cynodon dactylon Eragrostis cilianensis Nerium oleander Polypogon monspeliensis Tamarix sp.	None
Blue Spring	Damp spot in streambed where bedrock substrate meets sand bottom	491960	3676483	Water present in barely wet seep	Bedrock	-	-	-	Baccharis salicifolia Cyperus esculentus Mimulus guttatus Polypogon monspeliensis Salix gooddingii	Avena sativa Cynodon dactylon Marrubium vulgare Melilotus officinalis Polypogon monspeliensis	None
Bored Spring	Water seeps out of the ground and forms a stagnant pool. A muddy stretch extends about 20-meter downstream from the pool	491133	3681161	Water present in 5-meter x 5-meter man-made spring with a cattle trough downstream	Alluvium	7.7	2.0	752	Baccharis salicifolia Mimulus guttatus Salix gooddingii	Bromus sp. Cynodon dactylon Melilotus officinale Pennisetum setaceum Rhus lancea Tamarix sp.	None
Hidden Spring	Water collects in an underground galvanized steel culvert and is piped to a metal trough, which overflows and forms a shallow stream for approximately 5-meters. Travertine cave on slope to south may have been original spring	491236	3679618	Water present in steel culvert and trough	Alluvium	7.69	20.8	733	Algae Mimulus guttatus Polypogon monspeliensis	Bromus sp. Centaurea melitensis Hordeum jubatum	None
Filaria Spring	No evidence of spring	487578	3677827	No water present	Alluvium	-	-	-	None	None	None
Kanes Spring	Seeps occur at contact between limestone strata. Some flow is captured in small tinajas below the seeps	493025	3678395	Water present in pools and as flow	Bedrock	7.73	20.3	7.45	Baccharis salicifolia Juncus marginatus Mimulus guttatus	None	None

Table I. Physical and Vegetation Characteristics at the Water Features Visited in May and June of 2017

						Wate	er Chem	istry 1	Wetland	Non-Native Plant Species Observed	Special Status Plant Species Observed
Feature	Feature Description	Northing	Easting	Water Presence	Substrate	pН	т⁰С	EC μS	Plant Species Observed ²		
Lime Tank	A catchment is fed by a pipe at the upstream end which collects from an upper basin	492248	3678032	Water present in 32-meter by 32-meter cattle tank	Alluvium	8.75	20	191	Polypogon monspeliensis	Avena sativa Bromus sp. Phalaris canariensis Prosopis velutina Quercus arizonica Senegalia greggii Tamarix sp.	None
Rock Tank	Earthen impoundment	486840	3677788	Water present up to 2-meter depth	Bedrock	9.9	24.0	139	Algae Baccharis salicifolia Eleocharis macrostachya Polypogon monspeliensis	Polypogon monspeliensis	None
S. Filaria Spring	No evidence of spring	487296	3677272	No water present	Alluvium	-	-	-	None	None	None
Thompson Spring	Seeps from south bank contribute to flow and pool.	487325	3680525	Water present in three by 7-meter pool and seep	Alluvium	7.42	22.6	785	Cyperus esculentus Eleocharis macrostachya Mimulus guttatus Salix gooddingii	Nerium oleander Tamarix sp.	None
Trough Spring	Bedrock intrudes across streambed and small seep occur. A steel culvert holds approximately 16-inches water and is piped downstream to trough	486108	3675684	Water present in barely wet seep in streambed, trough is dry	Bedrock	7.7	20	2.03	Baccharis salicifolia Salix gooddingii	Avena sativa Cynodon dactylon	None
Wild Horse Spring	A bedrock ledge with several small tinajas intrudes across the stream. A pipe is inset in the downstream end of the ledge and emerges from the ground approximately 50 meters downstream	494950	3677443	Water present in tinajas	Bedrock	6.7	24.1	277	None	None	None
				Offsite Area – Mineral Creek							
LF 0.2C	First evidence of moisture in Lyon's Fork above confluence with Mineral Creek	502750	3680268	Seeps along river right contribute to 10- by one-meter pool. Flow commences in stream channel 10 meters downstream from pool	Alluvium	6.3	22.4	656	Algae Baccharis salicifolia Eleocharis macrostachya Mimulus guttatus Polypogon monspeliensis Salix bonplandiana Veronica anagallis-aquatica	Polypogon monspeliensis	None
Mineral Creek Perennial Reach	Surface flow in Lyon's Fork continues into Mineral Creek. Seeps along the banks at confluence with Mineral Creek contribute to flow in Mineral Creek	Start Reach 502296 End Reach 500705	Start Reach 3680169 End Reach 3676454	Water present as flow in channel	Alluvium Bedrock	7.2	20.0	633	Algae Baccharis salicifolia Eleocharis macrostachya Juncus ensifolius Mimulus guttatus Nasturtium officinalis Platanus wrightii Polypogon monspeliensis Salix bonplandiana Salix gooddingii Toxicodendron rydbergii Veronica anagallis-aquatica	Cynodon dactylon Melilotus officinale Nicotiana glauca Polypogon monspeliensis	None
MC 3.4W	Spring emanates from slope on west side of stream channel and continues for approximately 65 meters to the stream channel	501210	3678030	Saturated	Loam	8.4	25.9	626	Equisetum hyemale Mimulus guttatus Platanus wrightii	None	None

Table I. Physical and Vegetation Characteristics at the Water Features Visited in May and June of 2017

¹ Dashes indicate water parameters were not measured, either because no water was present, could not be accessed, or instruments were not functioning. See report text for clarification.

² For the purposes of this report, wetland species are defined are those with a rating of a) Facultative Wetland or b) Obligate Wetland, that is they a) usually occur in wetlands but occasionally are found in non-wetlands, or b) they almost always occur in wetlands under natural conditions.

FIGURES

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T1S, R11-13E, and T2S, R11-13E, Pinal County, Arizona, Mesa and Globe USGS 1:100,000 Quadrangle.

Legend

• Survey Site

---- Survey Reach

GPO Project Area

Surface Management (BLM 2017, WRI Modified 2017)

Bureau of Land Management (BLM)

Private Land (No Color)

State Trust Land

US Forest Service (USFS)





RESOLUTION COPPER Survey of Surface Water Features In The Resolution Project Area

> Vicinity Map Figure 1







Legend

Surface Management (BLM 2017, WRI Modified 2017)

Private Land (No Color)

US Forest Service (USFS)

Survey Site

T1S, R11E, Portions of Sections 15, 25, 35 and 36, T1S, R12E, Portions of Sections 13, 14, 20, 24, 28, 30 and 32. T2S, R11E, Portion of Section 2, T2S, R12E, Portion of Section 6, Pinal County, Arizona, Picketpost Mountain, and Superior USGS 7.5' Quadrangles (2014)





Date: 12/21/2017

User: rwitzke

RESOLUTION COPPER Survey of Surface Water Features In The Resolution Project Area

> TAILINGS AREA AND VICINITY Figure 3





Sp

ARNETT CREEK AND VICINITY

Figure 4







OTHER OFFSITE AREAS -MINERAL CREEK Figure 5

APPENDIX A

Photographs of Surface Water Features in Study Area **Photo 1.** East Plant Site and Vicinity: Boulder Hole, view of empty pool along channel



Photo 2. East Plant Site and Vicinity: Eddie's Spring, view of pool in channel



Photo 3. East Plant Site and Vicinity: Gibson Well Spring, view of seepy area along streambed



Photo 4. East Plant Site and Vicinity: Number 9 Wash Tinajas, view of surface water feature



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 5. East Plant Site and Vicinity: QC 22.6E (Karst Spring), view of limestone void



Photo 6. East Plant Site and Vicinity: Queen Seeps, view of thicket on south slope







Photo 8. Tailings Area and Vicinity: Bear Tank: view of 10- by 10meter pool



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 9. Tailings Area and Vicinity: Bear Tank: view of seep around open-ended horizontal spring pipe



Photo 10. Tailings Area and Vicinity: Bear Tank Tinaja: view of basin in bedrock





Photo 11. Tailings Area and Vicinity: Benson Spring: view of tinaja



Photo 12. Tailings Area and Vicinity: Benson Spring: view upstream showing Goodding's willow and velvet mesquite



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity

Appendix A Photopage 3

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Photo 13. Tailings Area and Vicinity: Benson Tank, view of impoundment



Photo 14. Tailings Area and Vicinity: Bitter Spring, view of seeps and flows along bedrock in streambed



Photo 15. Tailings Area and Vicinity: Conley Spring, view of pool under dead cottonwood at start of surface water flow



Photo 16. Tailings Area and Vicinity: Government Tank, view of depression



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 17. Tailings Area and Vicinity: Happy Camp Spring, view upstream of surface water flow and concrete dam



Photo 18. Tailings Area and Vicinity: I Berry Spring, view of bedrock intrusion across streambed and small concrete dam



Photo 19. Tailings Area and Vicinity: Lower Railroad Spring, view showing xero-riparian vegetation



Photo 20. Tailings Area and Vicinity: No Name Spring in Whitford Canyon, view of seeps at bedrock contacts along the stream channel



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 21. Tailings Area and Vicinity: Perlite Spring, view of impoundment



Photo 22. Tailings Area and Vicinity: Perlite Spring, view of pool and Goodding's willow below rock outcrop







Photo 24. Tailings Area and Vicinity: Walker Spring, view of saturated streambed below the conglomerate bedrock ledge



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 25. Queen Creek: Surface Water Reach, view of pool along reach



Photo 26. Queen Creek: Surface Water Reach, view of surface water and riparian vegetation





Photo 27. Queen Creek: Surface Water Reach, view of algae in surface water



Photo 28. Queen Creek: Pump Station Spring, view of pool along reach



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity

Photo 29. Queen Creek: Pump Station Spring, view of pool at end of reach



Photo 30. Arnett Creek & Telegraph Canyon: AC 1.8E, view of spring box





Photo 31. Arnett Creek & Telegraph Canyon: Arnett Creek Surface Water Reach, view of riparian vegetation and flow



Photo 32. Arnett Creek & Telegraph Canyon: Arnett Creek Surface Water Reach, view of pool



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity

Appendix A Photopage 8

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Photo 33. Arnett Creek & Telegraph Canyon: Blue Spring, view of bedrock ledge in streambed



Photo 34. Arnett Creek & Telegraph Canyon: Bored Spring, view of muddy pool under Fremont cottonwood





Photo 35. Arnett Creek & Telegraph Canyon: Bored Spring, view of trough downstream of spring



Photo 36. Arnett Creek & Telegraph Canyon: Hidden Spring, view of spring



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity

Appendix A Photopage 9

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Photo 37. Arnett Creek & Telegraph Canyon: Hidden Spring, view of trough downstream of spring



Photo 38. Arnett Creek & Telegraph Canyon: Kanes Spring, view of pools on bedrock







Photo 40. Arnett Creek & Telegraph Canyon: Lime Tank, view of impoundment



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 41. Arnett Creek & Telegraph Canyon: Rock Tank, view of pool



Photo 42. Arnett Creek & Telegraph Canyon: Rock Tank, view of pool



Photo 43. Arnett Creek & Telegraph Canyon: Thompson Spring, view of start of surface water flow



Photo 44. Arnett Creek & Telegraph Canyon: Trough Spring, view of culvert and seep under Goodding's willow



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity



Photo 45. Arnett Creek & Telegraph Canyon: Wild Horse Spring, view of pools on bedrock



Photo 46. Mineral Creek: LF 0.2C, view of start of surface water flow in Lyon's Fork





Photo 47. Mineral Creek Surface Water Reach, view of surface water flow



Photo 48. Mineral Creek Surface Water Reach, view of patch of golden columbine in saturated soil



Representative Photographs of the Surface Water Features in the Resolution Project Area and Vicinity

Appendix A Photopage 12

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