APPENDIX H

Water Supply Analysis

Prepared for:
San Diego Regional Storm Water Copermittee
County of San Diego Department of Public

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memorandum

date	February 28, 2017
to	Ruth Dela Rosa, County of San Diego
cc	
from	Lindsey Sheehan PE, Jaclyn Anderson, Ellen Buckley
subject	San Diego County Water Supply Quantification Analysis for the San Diego Region Storm Water Resources Plan

An analysis of potential water supply projects was undertaken to quantify the volume of storm water that could potentially be reused in San Diego County. This analysis was conducted to provide a baseline against which to compare projects submitted to the San Diego Region Storm Water Resources Plan (SWRP). This memo describes the steps of the analysis and the results.

1. Introduction

This memo presents an assessment of potential storm water and dry weather flow capture and direct use opportunities in San Diego County. Direct use, in this context, is an end use that can augment and/or conserve local water supplies. Opportunities for direct use of captured storm water and dry weather flows have greater constraints in San Diego County compared to other regions due to a more limited number of groundwater aquifers that are used for potable water supply and a more limited current capacity for treatment and redistribution of captured storm water. The purpose of this assessment is to supplement watershed and regional plans to identify water supply opportunities for further development and prioritization. The opportunities presented in this memo provide a tool for project sponsors to potentially develop or expand projects in order to provide greater water supply benefits to the San Diego region.

Three types of storm water capture and beneficial use opportunities are presented and assessed in this memo, and include:

- **Irrigation** - Store and divert storm water and/or dry weather flows to be used as irrigation onsite, at a park, for habitat restoration, and/or to sustain a natural treatment system.
- **Groundwater Aquifer Recharge** - Store and infiltrate storm water and/or dry weather flows to recharge a groundwater aquifer that is used as a potable water supply.

- **Treatment Facility for Recycled and Potable Water** – Store and divert storm water and/or dry weather flows to a wastewater or water treatment facility for recycled or potable water use

2. Parcel and Opportunity Analysis

The first step in the water supply analysis was a public parcel assessment used to identify potential opportunities for use of storm water and/or dry weather flows. Three types of parcels/opportunities were identified:

- **Irrigation** – parcels with a major Municipal Separate Storm Sewer System (MS4) outfall (greater than 36 inches) that are within a quarter mile of a park or a golf course.
- **Groundwater Aquifer Recharge** – parcels within a mile of a groundwater basin that is used for potable water supply.
- **Treatment Facility for Recycled and Potable Water** – existing ocean outfalls and creeks that enter lagoons.

Figure 1 presents a map of the 118 public parcel that could be used to collect storm water and dry weather runoff for irrigation. Figure 2 presents the 5,919 public parcels within a mile of a groundwater basin used for potable water supply. Figures 3 and 4 present the existing ocean outfalls and creeks that enter lagoons, which offer opportunities to divert dry weather flow to a treatment plant. These parcels represent an initial identification of opportunities, but further analysis of project feasibility is needed.

3. Water Supply Quantification

Once parcels were identified, they were categorized by land use type and size, as presented in Table 1. Open space/parks, schools, and transportation were identified as the best opportunities for storm water management and five categories were developed to best represent the identified parcels (Table 2). Five sites were chosen to represent the different parcel categories and storm water modeling and a conceptual design was developed for each.

TABLE 1. PARCEL OPPORTUNITIES BY LAND USE AND SIZE

Land Use	1-5 acres	5-25 acres	25-50 acres	50-100 acres	>100 acres	Total
Agriculture	19	12	4	4	1	40
Commercial	32	13	2	1	1	49
Industrial	23	7	2	-	-	32
Open Space/Parks	186	266	91	74	71	688
Public Service	57	24	3	3	4	91
Residential	17	14	3	-	3	37
Schools	17	119	24	9	1	170
Transportation	60	26	8	2	4	100
Total	411	481	137	93	85	1,207

TABLE 2. PARCELS FOR WATER SUPPLY PROJECTS

Land Use	Size	# of Parcels
Transportation	1 – 5 acres	60
Schools	-	170
	1 – 5 acres	186
Open Space/Parks	5 – 25 acres	266
	> 25 acres	236
Total		**918**

3.1 Representative Sites

3.1.1 Transportation

The representative site for the transportation land use category was a parcel along the train tracks in Del Mar, south of the San Dieguito lagoon (Figure 5). It was assumed that, due to narrow parcel dimensions and the train right of way, 20% of the site could be used for aboveground storage and that the storage would not exceed 3 feet in depth. For transportation parcels, it was assumed that the storage could be infiltrated into groundwater basins and used for irrigation on the landscaped slopes of the right of way (irrigating 50% of the site area).

3.1.2 Schools

The representative site for the school land use category was Point Loma High School in Point Loma (Figure 6). It was assumed that underground storage could be utilized under parking lots or open lots, or roughly 25% of the site area, at a depth up to 4 feet. For school parcels, it was assumed that the storage could be infiltrated into groundwater basins and used for irrigation of 50% of the site (e.g. sports fields, landscaping).

3.1.3 Open Space/Parks

Three representative sites were chosen for the open space/park land use category to capture the range in sizes. The smallest site was a 2-acre, open space parcel south of the Batiquitos Lagoon (Figure 7). The middle site was a 7-acre, open space parcel northeast of San Elijo Lagoon (Figure 8). The largest representative site was a 23-acre, open space parcel in Oceanside (Figure 9).

For the smaller sites, it was assumed that it would be harder to fit an aboveground basin within the shape of the site than in the larger sites, so it was assumed that 50% of the site could be used for storage. For the medium and large sites, 60% and 70% of site was assumed for storage, respectively. A 4-foot storage depth was assumed for all sites. For open space/park parcels, it was assumed that the storage could be infiltrated into groundwater basins and then any excess storage would either be used for irrigation if the site was a park or was near a park, or transferred to a treatment facility otherwise.

3.2 Hydrology Modeling

For each representative parcel, topographic data were acquired for the site and surrounding areas to determine the potential drainage area. The 7.5’ USGS DEMs were downloaded from The National Map (USGS) and brought

into ArcMap. The Hydrology Toolbox in ArcMap was used to determine the drainage area of each parcel based on the topography.

The San Diego Hydrology Model v3.0 (SDHM3.0) was used to model runoff from these drainage areas. The model uses rainfall data and watershed land cover to determine runoff that would reach the site. The time step can be specified to produce varying time series of runoff flow data that would reach the site. Permeability, slope, hydrologic soil type, and ground cover (e.g. dirt, grass, gravel, etc) for the watershed were input into the model to determine the runoff coefficient. These factors were determined based on soil data from the Web Soil Survey, aerial imagery, and site knowledge. Forty to 45 years of rainfall data from the nearest San Diego ALERT station were used to drive the model.

TABLE 3. SDHM3.0 MODEL INPUTS

Land Use	Site	Rainfall Station	Drainage Area Land Categorization	Drainage Area (ac)
Transportation	Del Mar Train Right of Way	Encinitas	Entirely developed, some urban green	88
Schools	Point Loma High School	Lindberg Field	Very developed, 30% urban grass	15
Open Space/Parks	South of Batiquitos Lagoon	Encinitas	80% grass, 20% neighborhood	20
	Northeast of San Elijo Lagoon	Encinitas	80% green space, 20% low density housing	29
	Oceanside	Oceanside	Very developed, 20% grass, 10% dirt	721

The model output flow time series for the 40-45 year period for each site. The flow output is likely an overestimate of the total flow to the parcel due to infiltration into soils on the way to the parcel and storm water infrastructure interference that could be draining runoff before the flow reaches the parcel.

3.3 Water Reuse Calculations

3.3.1 Infiltration

Infiltration was calculated using the flow time series produced by the SDHM3.0 model. An infiltration rate of 0.07 in/hr was chosen based on the San Diego County C/D hydrologic soil type and a maximum drainage time of 72 hours was assumed for aboveground storage, based on vector control guidelines. Any remaining water volume that could not be infiltrated in this time period was assumed to be either used for irrigation or sent to a treatment facility. Table 4 provides the results of the infiltration calculation for each site.

3.3.2 Irrigation

Of the representative sites using irrigation onsite (transportation and school sites), only Point Loma High School did not have excess water after infiltration. This is likely due to the small drainage area (Figure 6) resulting in lower flow rates relative to the amount of storage. Therefore, the school site does not include an estimate for volume of irrigation in Table 4.

For the representative sites using irrigation offsite (open space/parks sites) at a park or golf course, it was assumed that 10 acres of the park or golf course could require irrigation, based on an analysis of the median park size in San Diego County.

For all sites, an irrigation rate of 3 ac-ft/yr per acre of land was chosen based on medium/high water use plants in either Coastal or Inland evapotranspiration zones. This rate was multiplied by the area to be irrigated to determine a maximum volume of water that could be used for irrigation. The maximum volume was then compared to the excess flow volume and the smaller of the two values was chosen for the volume of water that could be used for irrigation (Table 4).

3.3.3 Treatment Facility

For the three open space/parks sites, it was assumed that any excess water not infiltrated to a potable groundwater basin would be directed to a treatment facility. This assumption was made to produce a rough quantification of the volume of storm water that could be redirected to a treatment facility, but the feasibility of each project should be further considered based on existing infrastructure. Table 4 presents an estimate of volumes that could be sent to a treatment facility.

TABLE 4. WATER REUSE FOR REPRESENTATIVE SITES

Land Use	Site	Infiltration (ac-ft/yr)	Irrigation (ac-ft/yr)	Water Treatment (ac-ft/yr)
Transportation	Del Mar Train Right of Way	5.0	5.6	0
Schools	Point Loma High School	6.4	0	0
Open Space/Parks	South of Batiquitos Lagoon	2.9	0.7	0.7
	Northeast of San Elijo Lagoon	4.5	0.3	0.3
	Oceanside	98.1	30.0	301.7

3.4 Extrapolation to San Diego County

Based on values calculated for each representative site, total volumes of storm water that could be infiltrated, used for irrigation, and sent to a treatment facility were estimated for all of the parcels identified in Section 2. Table 5 presents the resulting volumes.

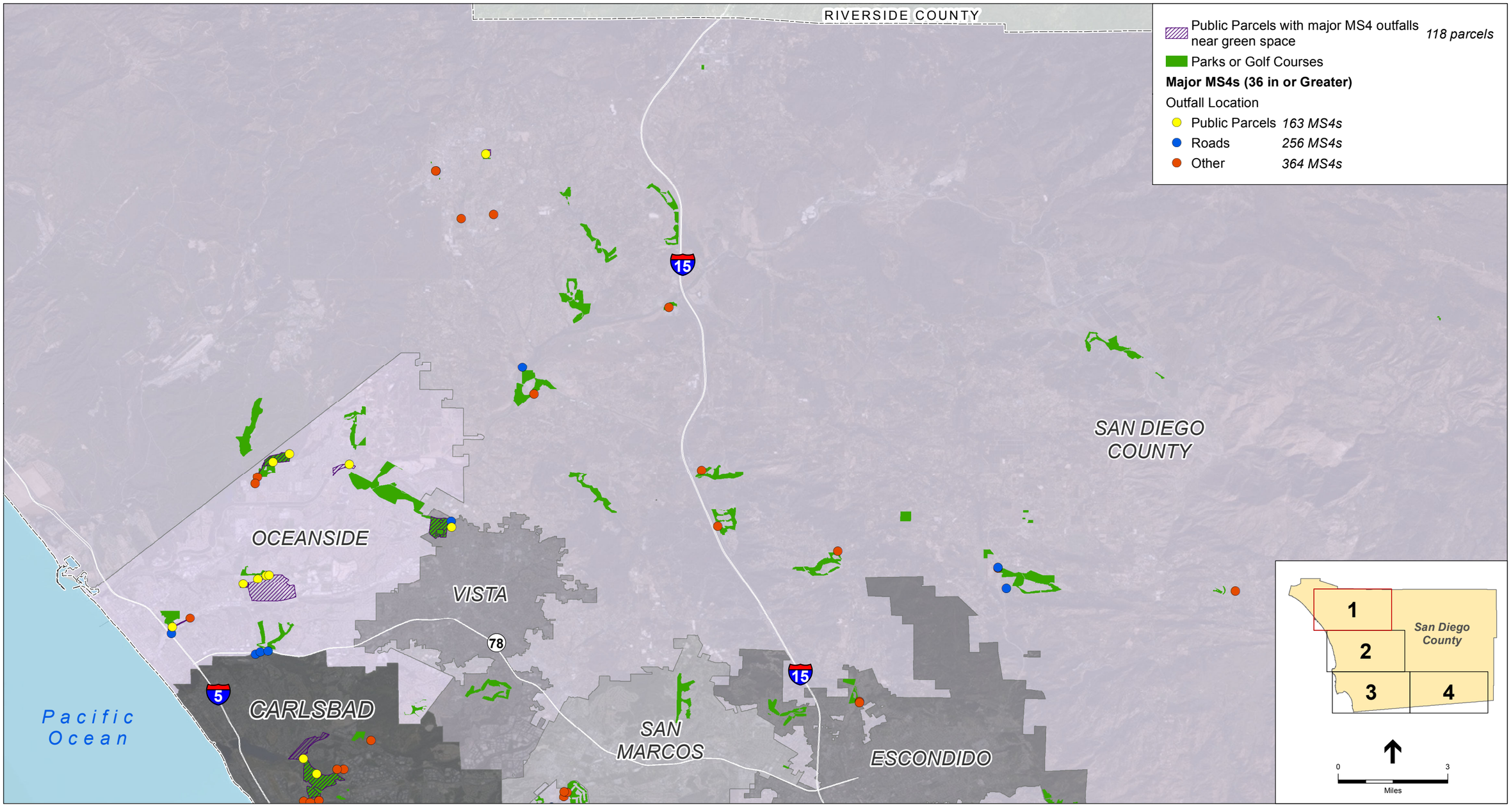
TABLE 5. WATER SUPPLY ANALYSIS

Land Use	Size	Near Potable GW Basin?	Near (or is) Park/Golf Course?	# of Parcels	Infiltration to Potable GW Basin (ac-ft/yr)	Infiltration to Non-Potable GW Basin (ac-ft/yr)	Irrigation (ac-ft/yr)	Water Treatment (ac-ft/yr)
Transportation	1-5 ac	Yes	-	57	283	-	318	-
	1-5 ac	No	-	3	-	15	17	-
Schools	-	Yes	-	161	1,023	-	-	-
	-	No	-	9	-	57	-	-
Open Space/Parks	1-5 ac	Yes	-	170	486	-	-	112
		No	Yes	8	-	23	5	-
		No	No	8	-	23	-	5
	5-25 ac	Yes	-	229	1,020	-	-	57
		No	Yes	26	-	116	7	-
		No	No	11	-	49	-	3
	> 25 ac	Yes	-	206	20,201	-	-	62,145
		No	Yes	20	-	1,961	600	-
		No	No	10	-	981	-	3,017
Total					23,014	3,225	947	65,339

4. Discussion

The water supply opportunities analysis documented in this memo resulted in an estimate of 92,500 ac-ft of storm water that could be captured, stored, and reused through infiltration, irrigation, and/or water treatment in San Diego County annually. Approximately 26,200 ac-ft of water could be infiltrated to either a potable (23,000 ac-ft) or non-potable groundwater basin (3,200 ac-ft), while approximately 950 ac-ft could be used for irrigation either onsite or at a local park or golf course, and 65,300 ac-ft could be sent to a water treatment facility. These estimates offer a quantitative comparison to the projects submitted to the SWRP with a water supply benefit and provide a rough estimate of the total possible volume of storm water that could be reused.

This analysis is based on many assumptions and should only be used as a planning-level estimate of water supply opportunities. It is expected that other plans will be developed to better estimate these opportunities, including the IRWMP update, which is expected to include a Storm Water Capture Feasibility Study.



SOURCE: ESRI, 2016; SanGIS, 2016

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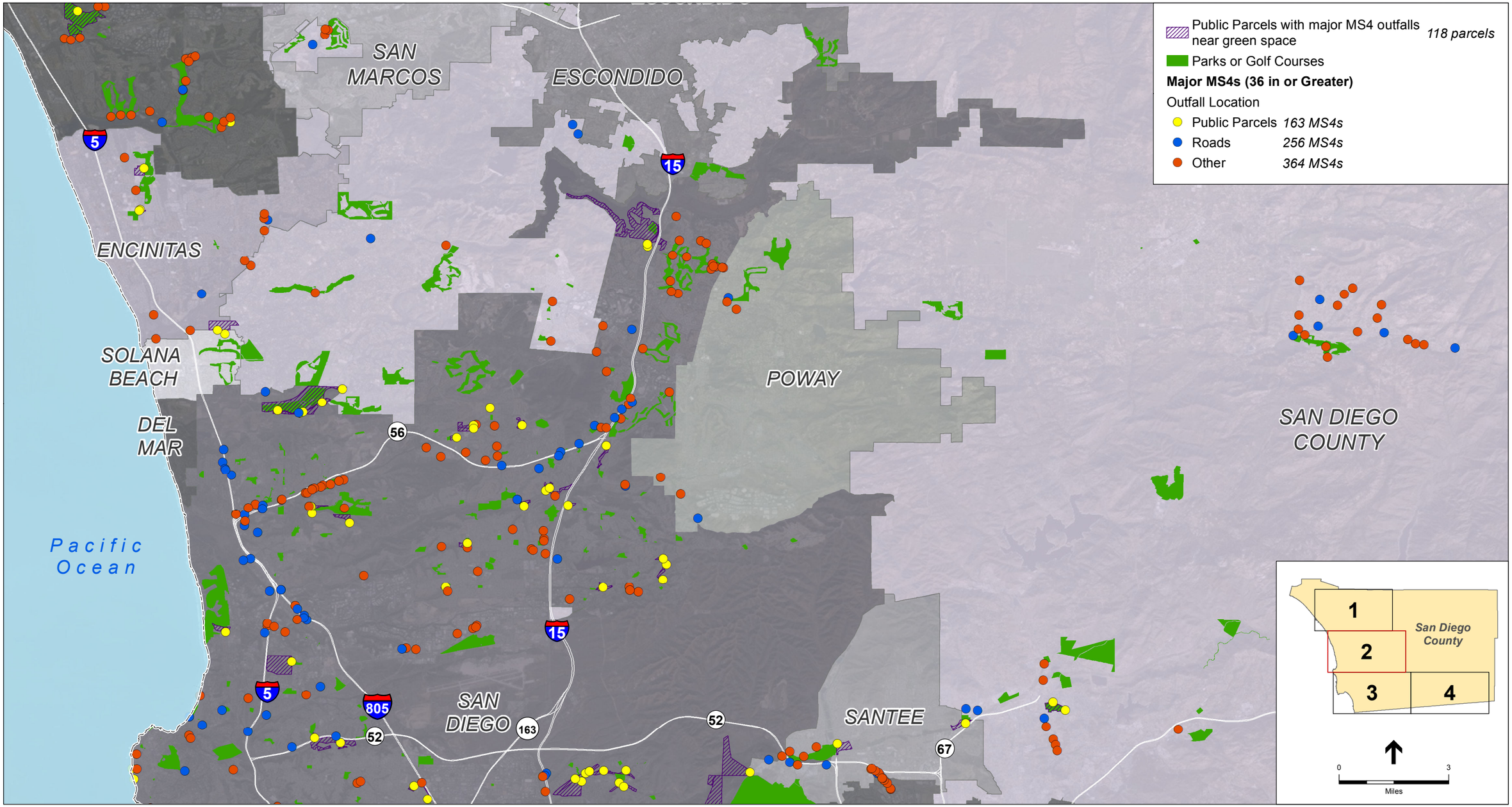
Figure 1-a

Public Parcels with Major MS4 Oufalls
Located within 1/4 Mile of Green Space



SOURCE: ESRI, 2016; SanGIS, 2016

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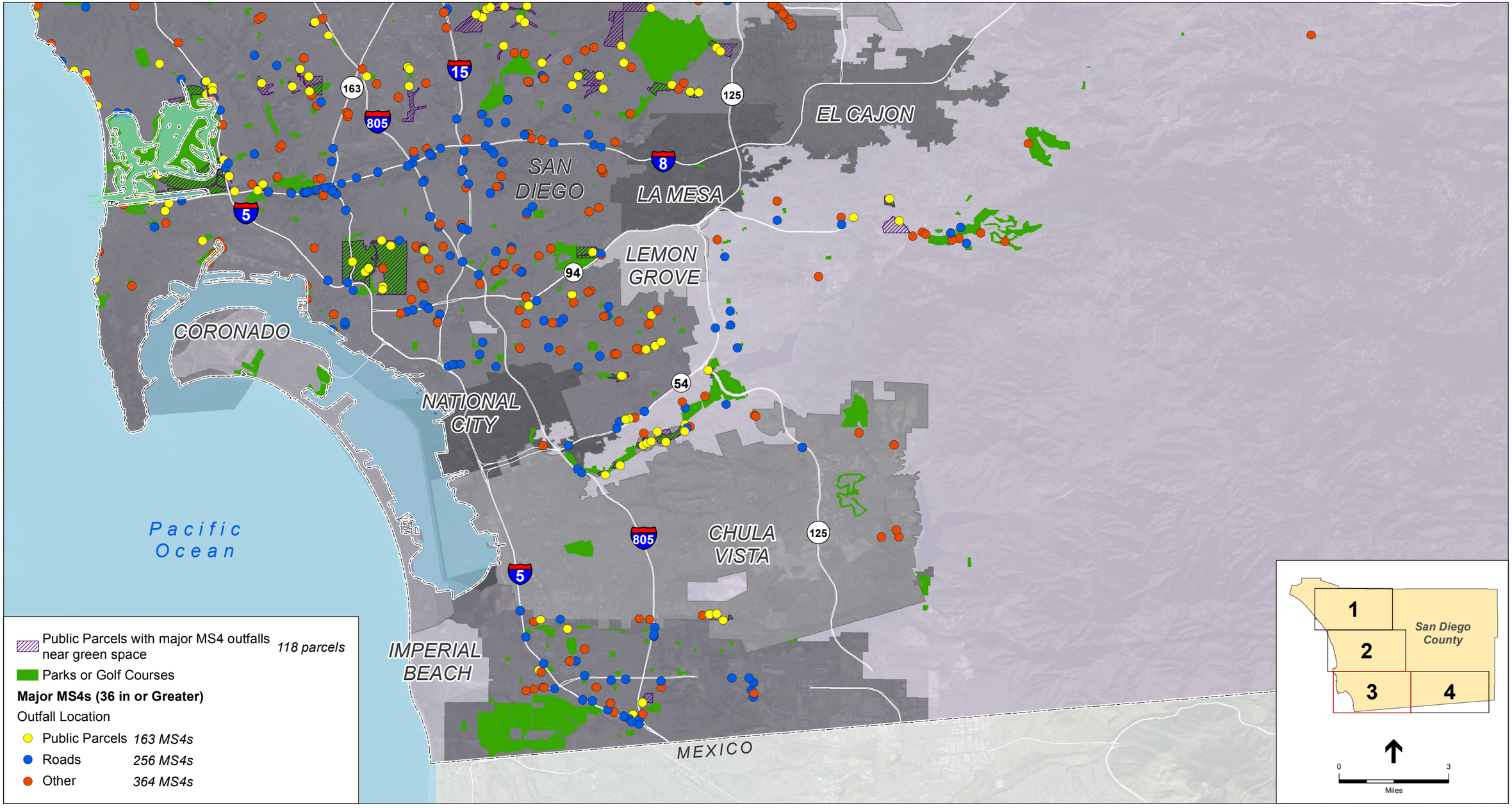
Figure 1-b

Public Parcels with Major MS4 Oufalls
Located within 1/4 Mile of Green Space



SOURCE: ESRI, 2016; SanGIS, 2016

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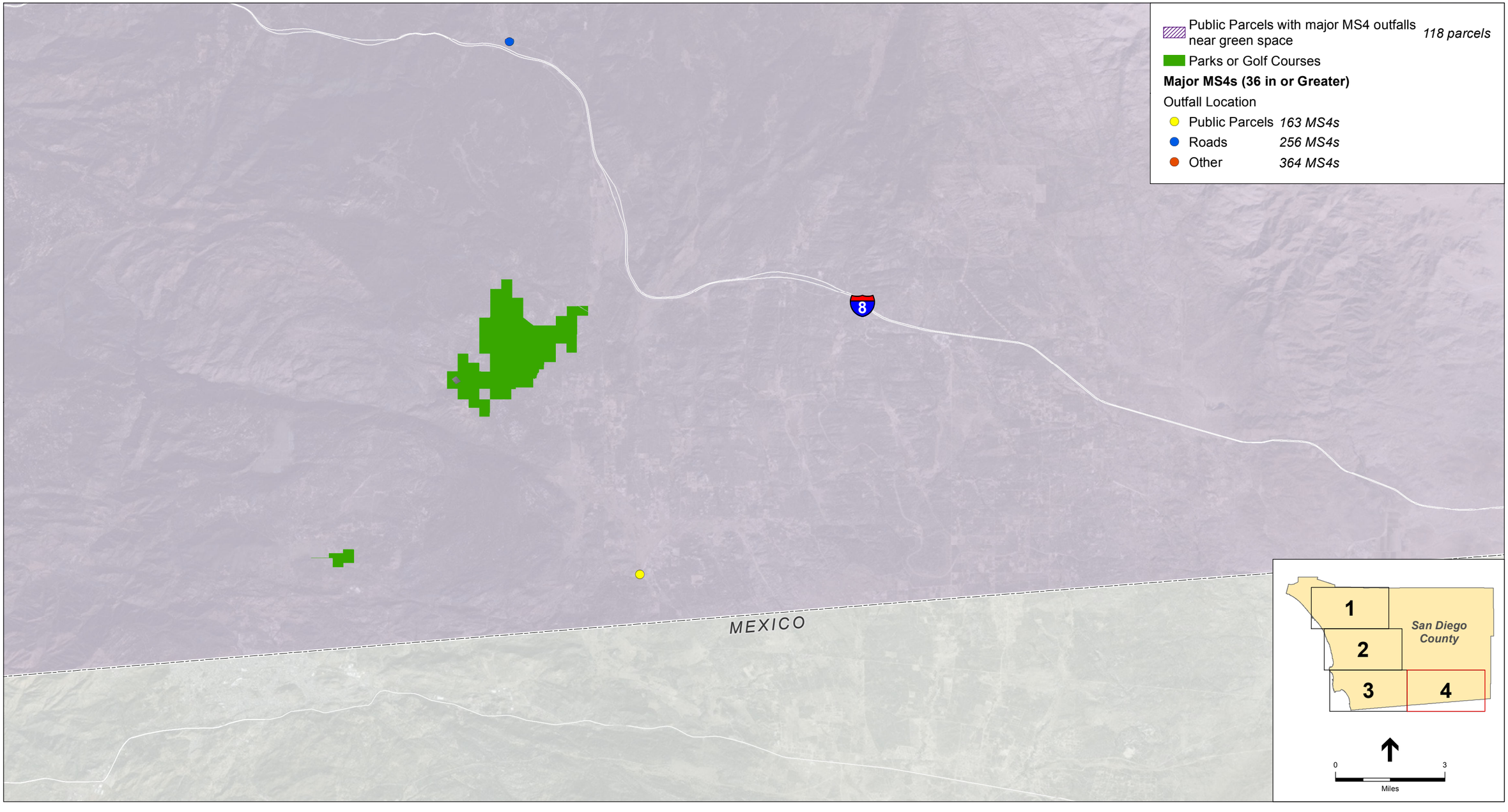
Figure 1-c

Public Parcels with Major MS4 Oufalls
Located within 1/4 Mile of Green Space



SOURCE: ESRI, 2016; SanGIS, 2016

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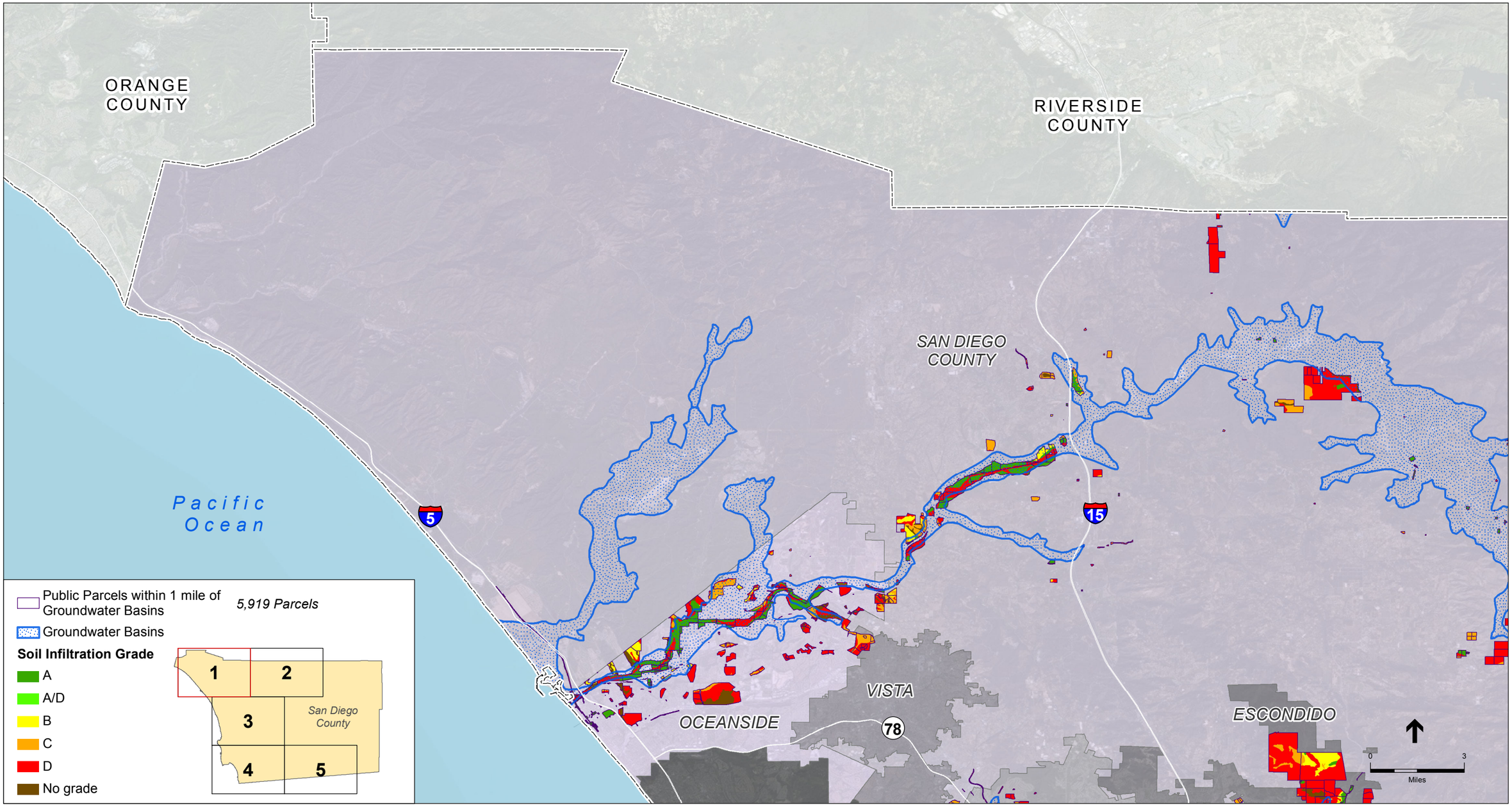
Figure 1-d

Public Parcels with Major MS4 Oufalls
Located within 1/4 Mile of Green Space



SOURCE: ESRI, 2016;SanGIS, 2016; NRCS, 2016

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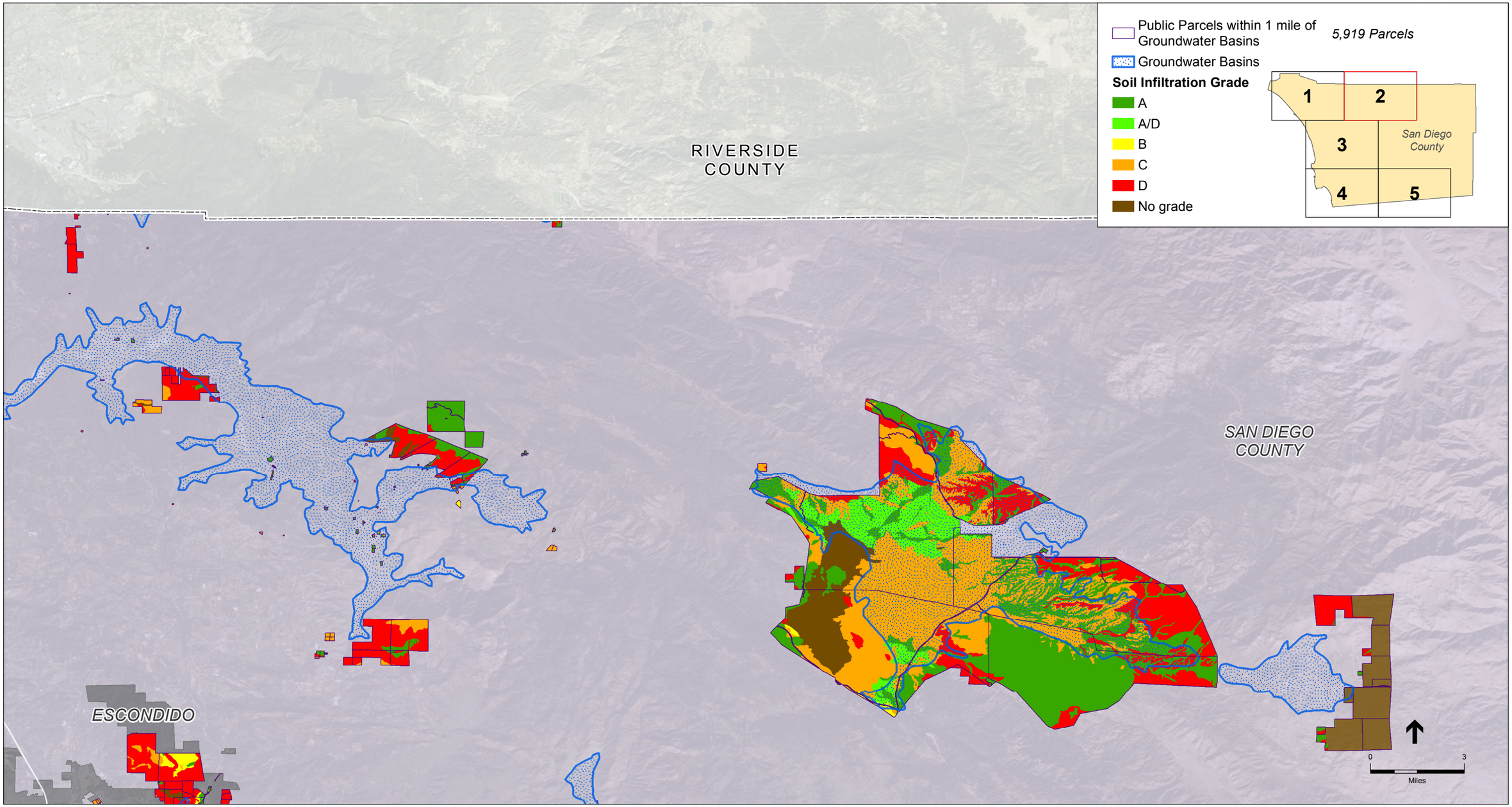
Figure 2-a

Public Parcels Within a Mile Of a Groundwater Basin



SOURCE: ESRI, 2016;SanGIS, 2016; NRCS, 2016

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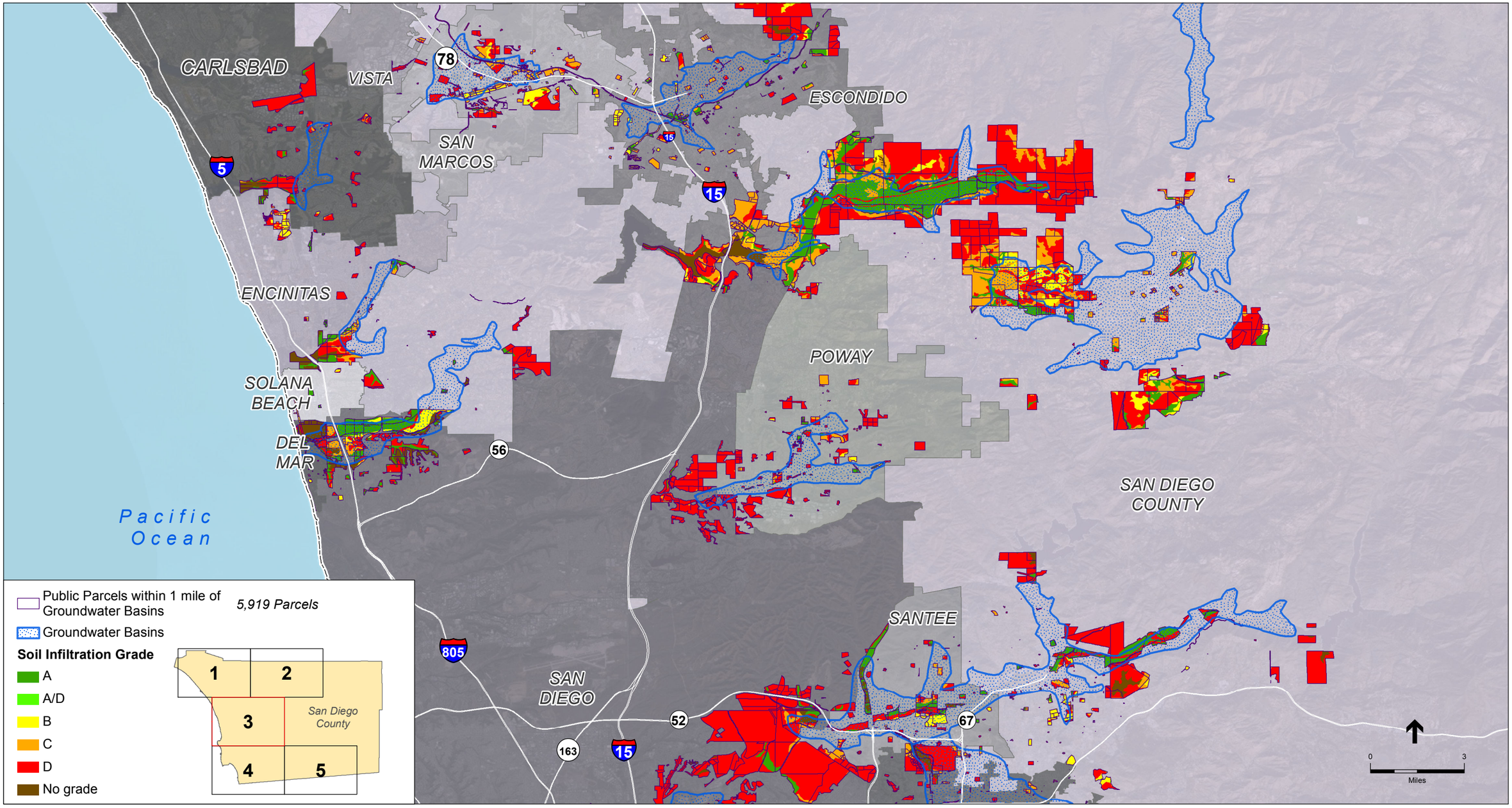
Figure 2-b

Public Parcels with Major MS4 Outfalls Located Within ¼ Mile of Green Space



SOURCE: ESRI, 2016;SanGIS, 2016; NRCS, 2016

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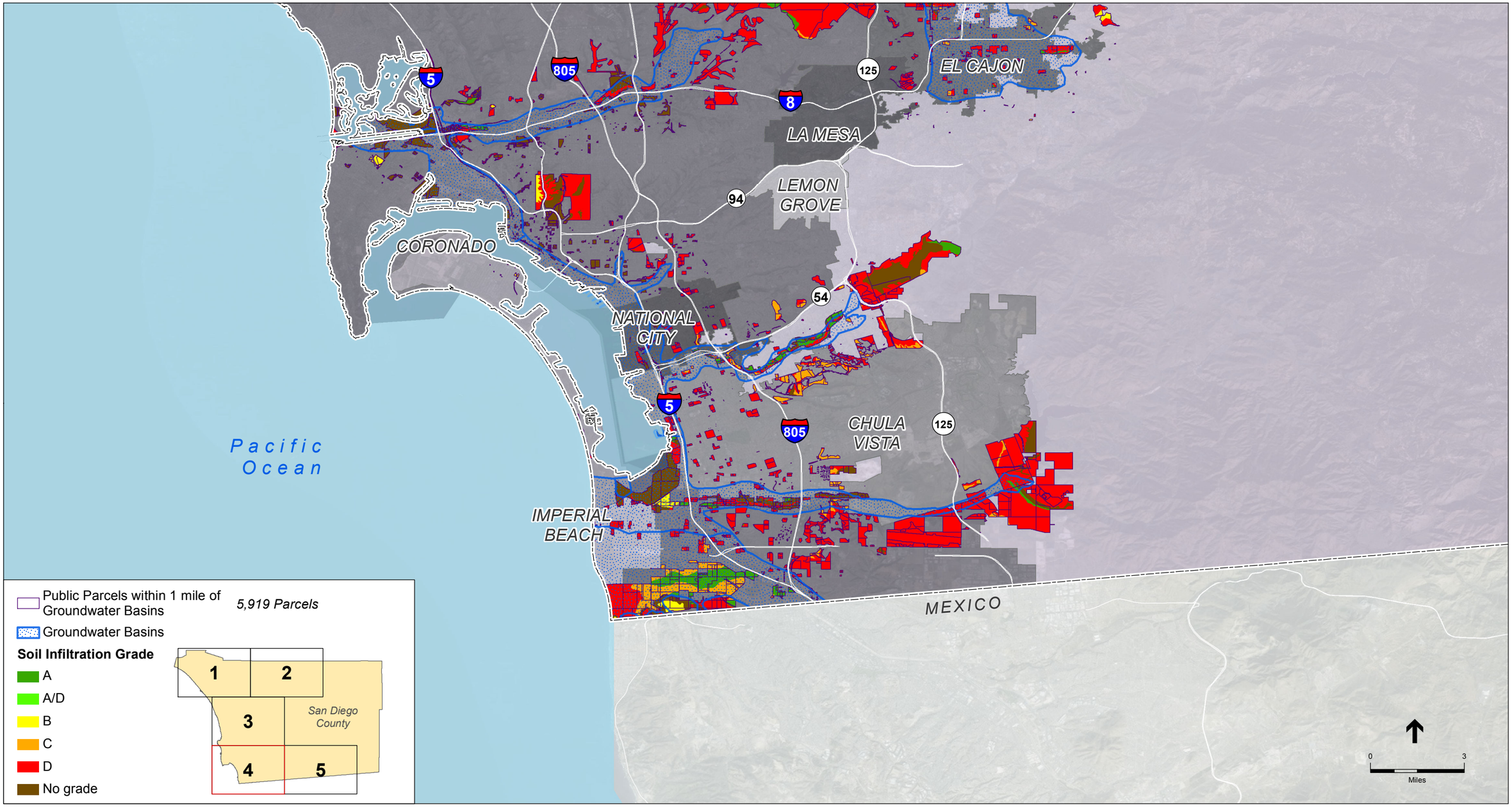
Figure 2-c

Public Parcels Within a Mile Of a Groundwater Basin



SOURCE: ESRI, 2016;SanGIS, 2016; NRCS, 2016

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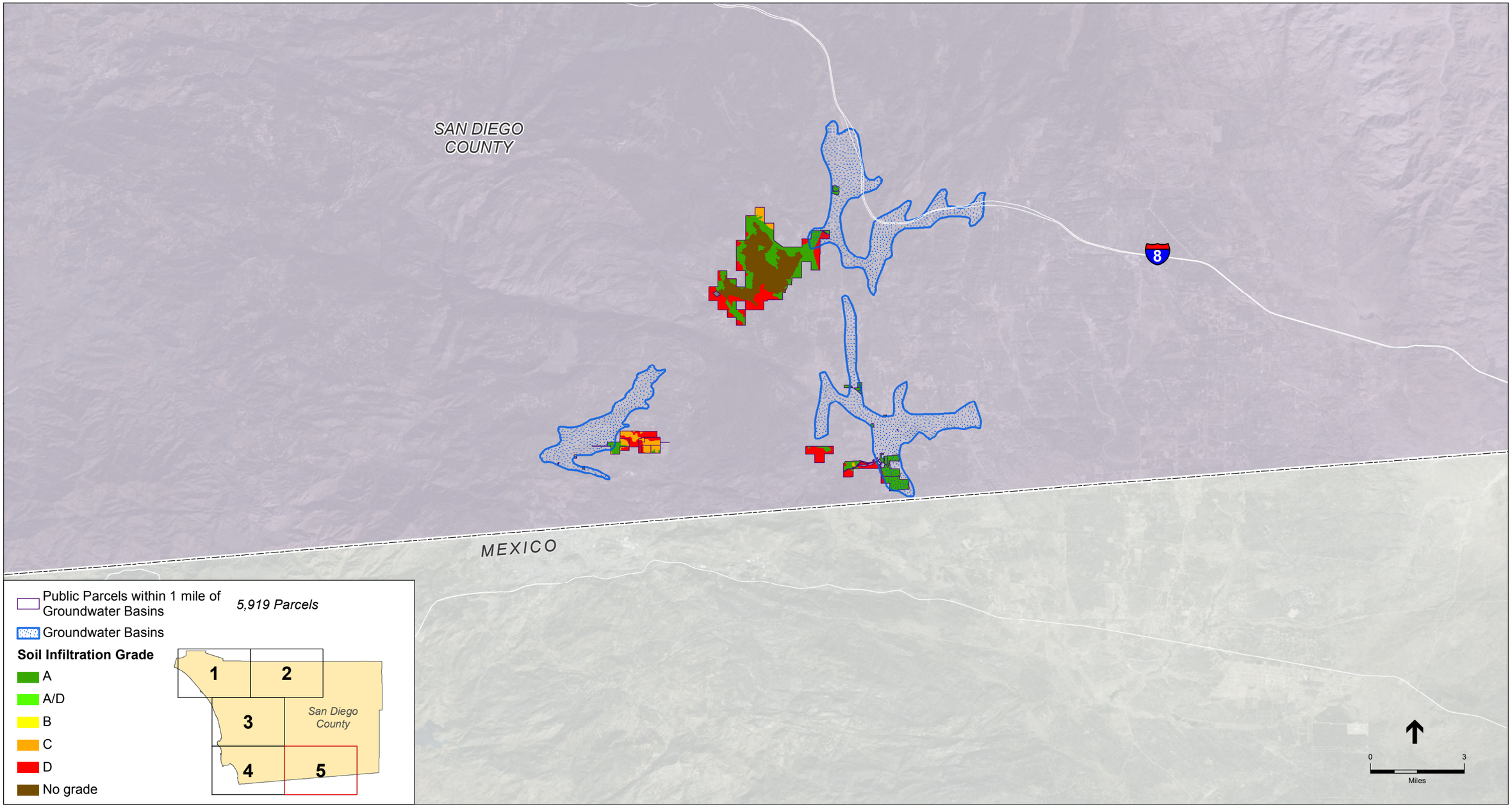
Figure 2-d

Public Parcels Within a Mile Of a Groundwater Basin



SOURCE: ESRI, 2016;SanGIS, 2016; NRCS, 2016

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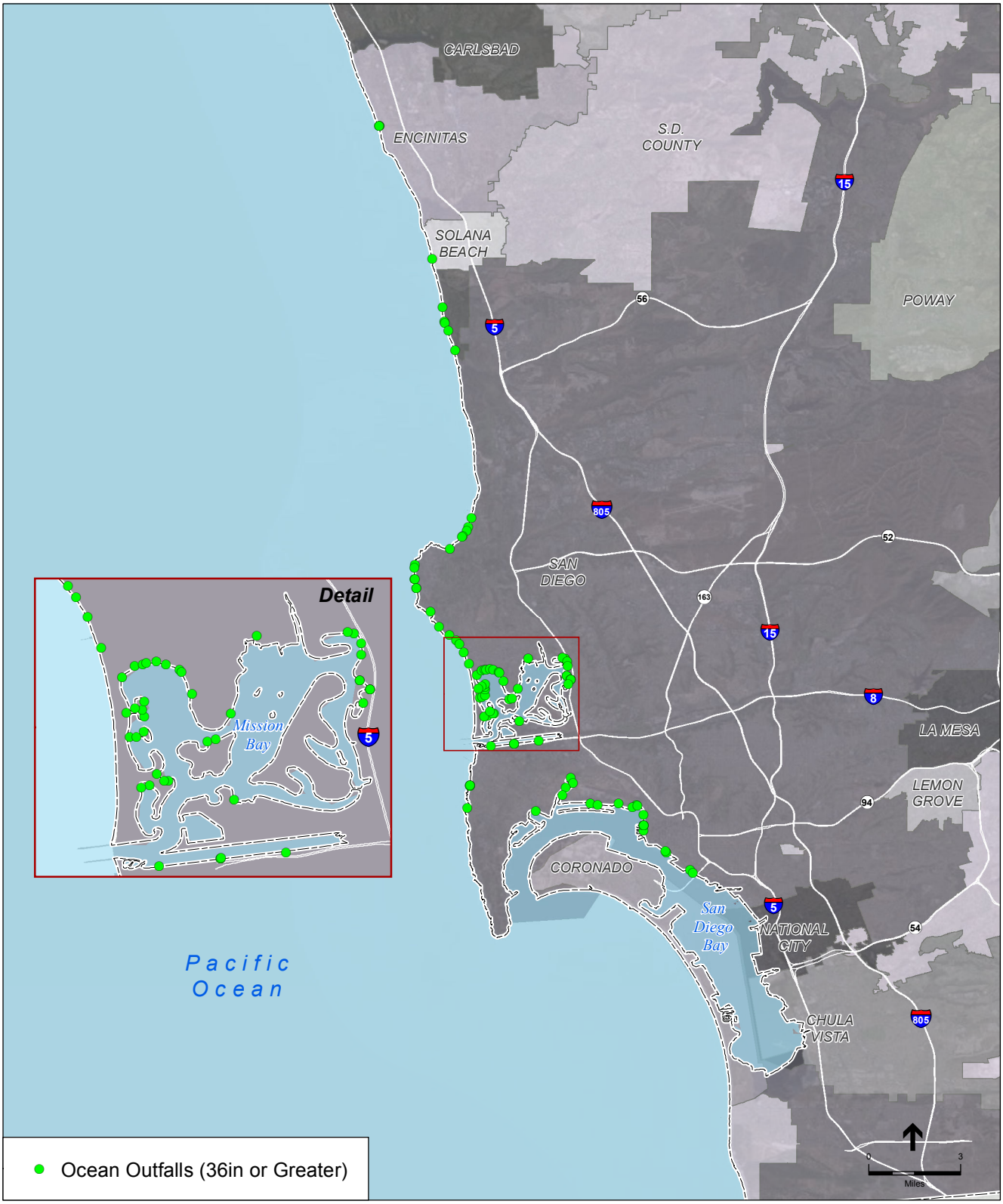
Figure 2-e

Public Parcels Within a Mile Of a Groundwater Basin



SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

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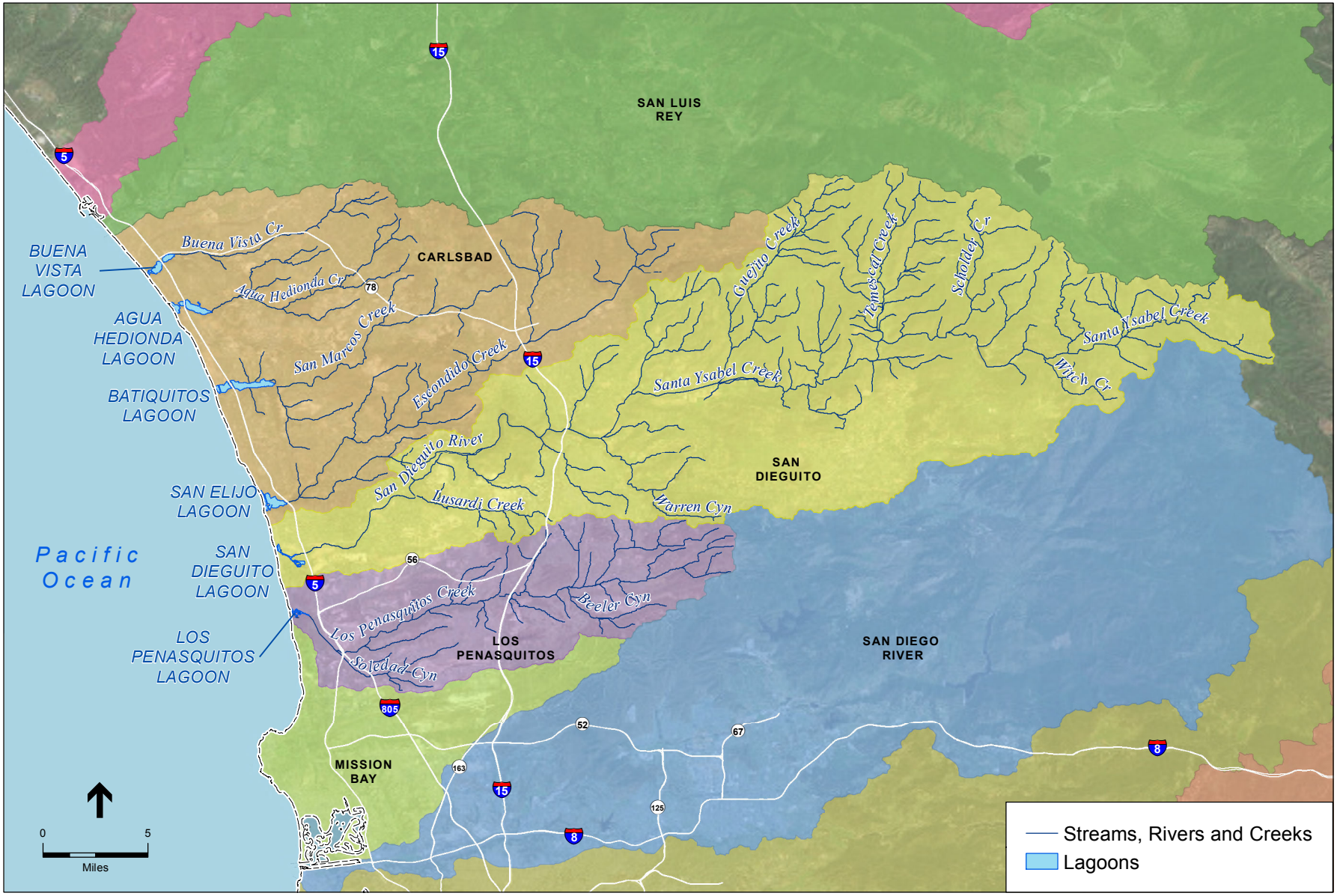
Figure 3

Major MS4 Outfalls to the Ocean



SOURCE: ESRI, 2016; SanGIS, 2016

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Figure 4

Creeks Systems with Lagoon Outlets

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Figure 5

Site #1

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Figure 6

Site #2

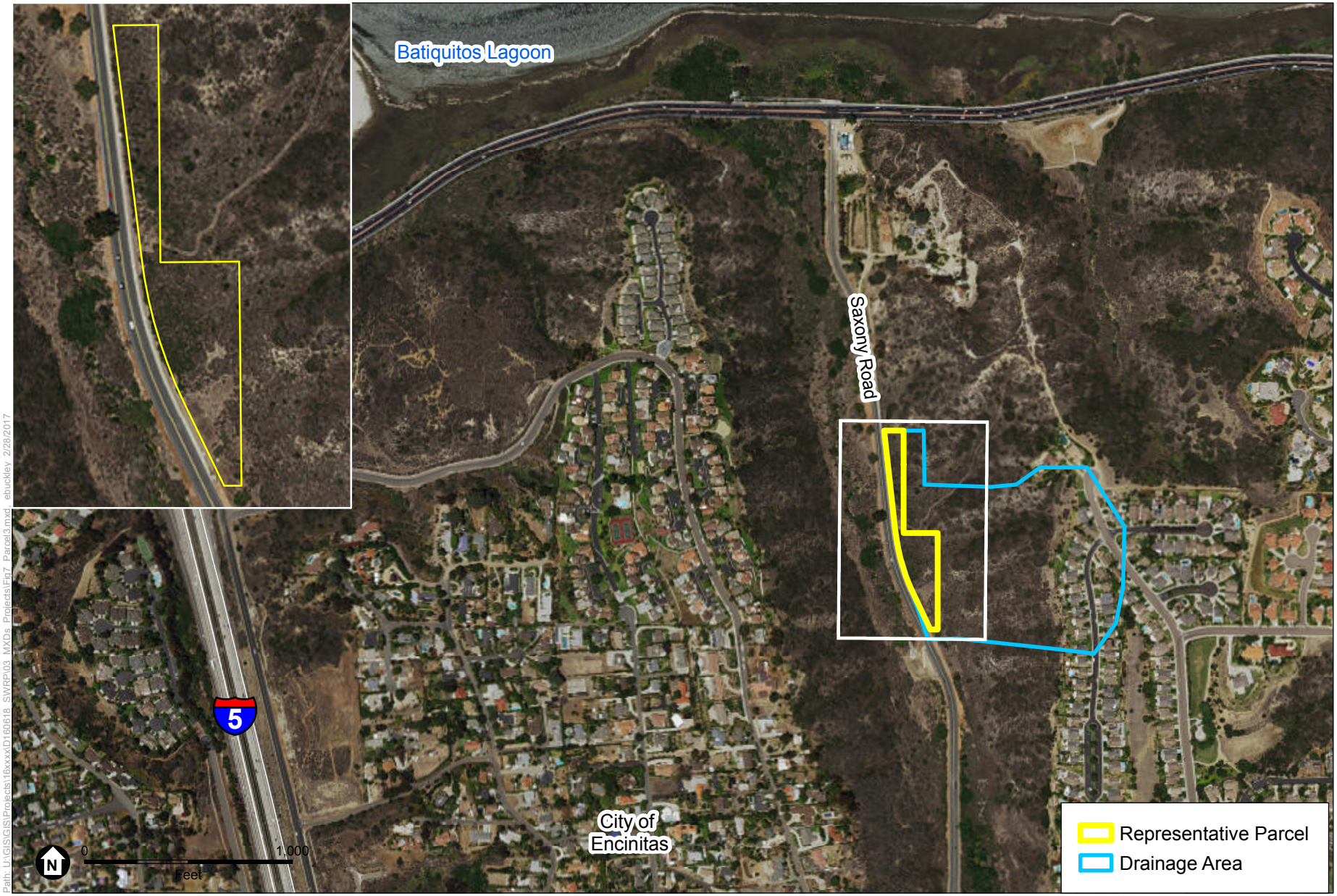

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Figure 7

Site #3

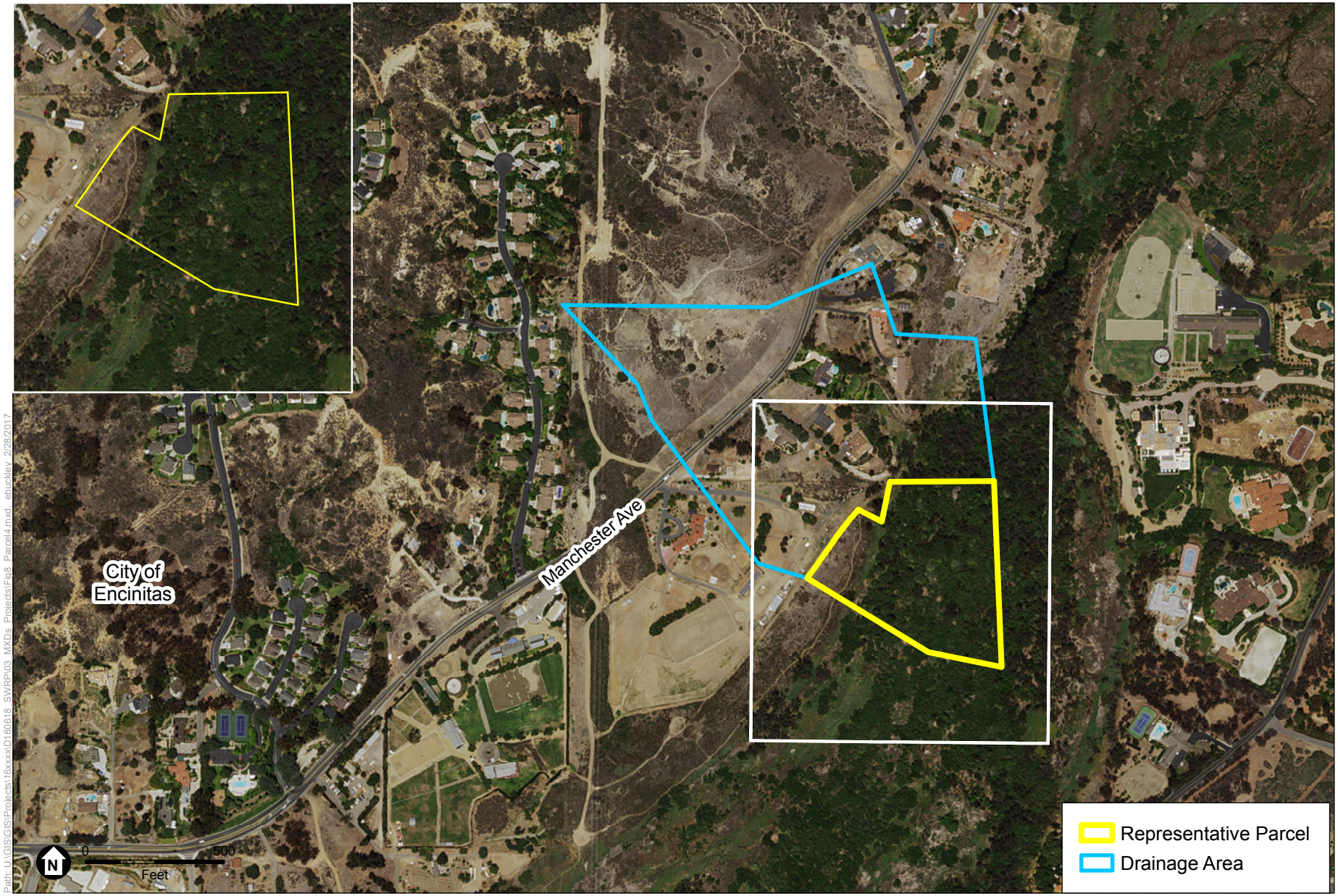

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Figure 8

Site #4

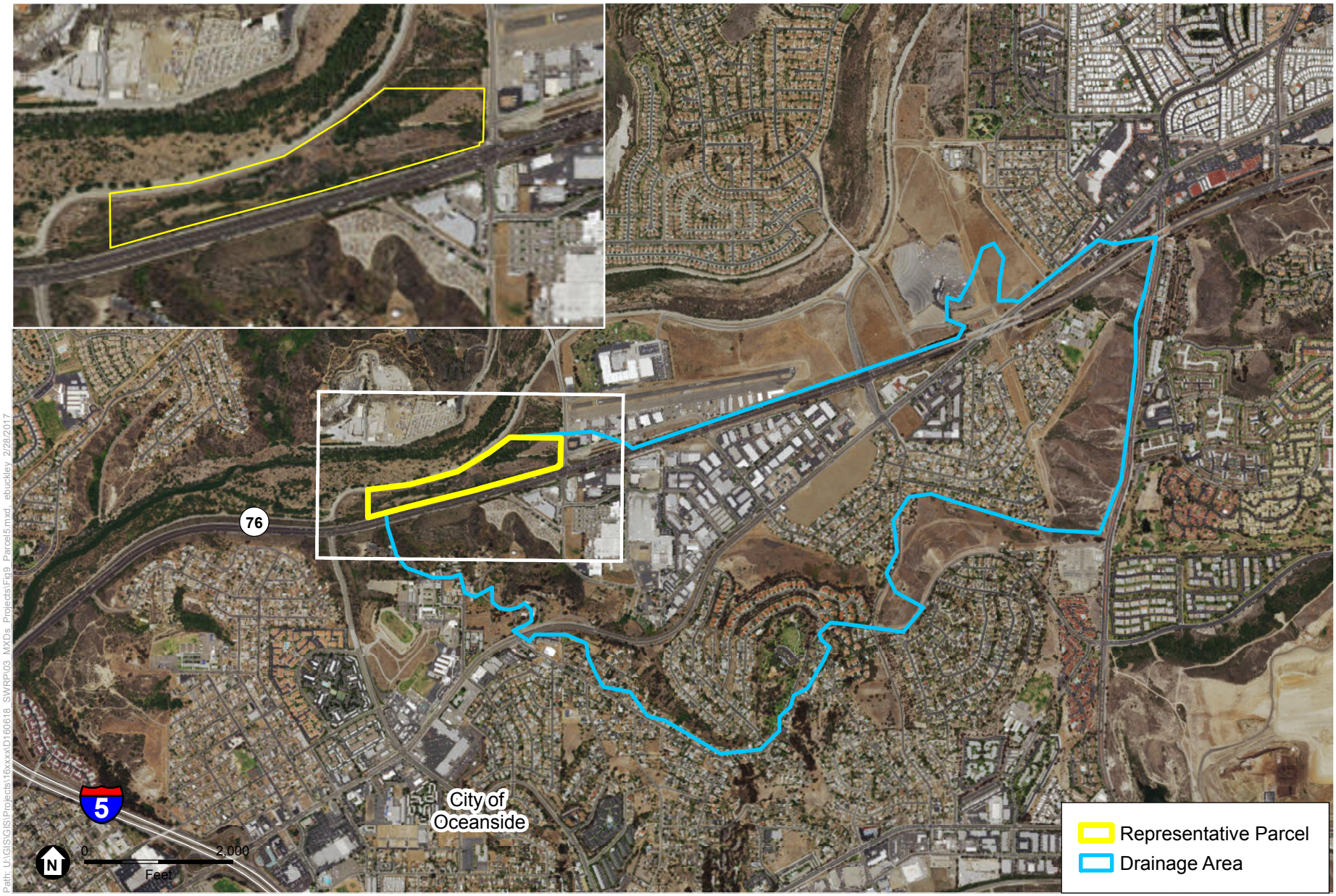

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Figure 9

Site #5