APPENDIX F

San Geronimo Watershed – Future Potential Total Impervious Area (TIA)
GIS – Methods

Prepared by: Sebastian Araya, Stillwater Sciences, Berkeley-California
July 6, 2009

Task:
calculate future TIA conditions for the San Geronimo Watershed by Reach Sub basin.

Data sources:
1. Parcel Data including build-out potential: alt_parc.shp
2. Watershed boundary (derived from USGS 10mDEM)
3. Impervious Surfaces: ImperviousAreas_v2.shp
4. Reach Contributing Areas (derived from 10mDEM WS modeling)

Initial Scope:
Caveats:
We do not have (nor does the county) actual footprints of future developments, nor expected square footage within each parcel. In addition, we also do not know if new roads and parking lots will be constructed.

We do not have a time-stamp on future development. In other words, while we know the maximum number of units allowed to be developed in each parcels, we do not know when those constructions can occur. We also do not know if 'green building practices' will be in place.

Given all those constrictions we can only estimate a "potential growth" of impervious areas by, (1) determining what the existing ground conditions are in a given parcel (existing impervious square feet), (2) determining the average TIA of a single unit, and multiplying that by the number of additional units for that parcel. For parcels without existing units, the average unit size for that landuse category (based on GIS) was used as the TIA multiplier.

Average Building footprint by Landuse
Agriculture: 874 sq.ft.
Commercial:1,289 sq.ft.
Community Open Space & Facilities: 1,840sq.ft.
Institutional: 2,955 sq.ft.
Multi Family Commons: 242 sq.ft.
Multi Family Residential: 1,096 sq.ft.
Open Space - Public: 2,113 sq.ft.
Road: 1,099 sq.ft.
Rural: 550 sq.ft.
Single Family Residential: 2,900 sq.ft.
Utility: 2,065 sq.ft.

Assumptions:
1. Minimum TIA in a parcel to be considered occupied by a building = 600 impervious sqft. This assumption is designed to weed-out all data processing artifacts from the calculations. Because we multiply the existing TIA-sqft in a given parcel by the number of additional units zoned/allowed in that parcel, the idea with this assumption is to avoid multiplying the number of additional units with a TIA square footage that represents the product of an 'artifact' (for example, a an erroneous layer intersection due to scale or projection issues, in which a parcel is

assigned with a small portion of a building footprint located in the adjacent parcel). Usually these artifact polygons can have areas that are extremely low to represent a residential, commercial, or institutional building footprint. Therefore, in this analysis a threshold of 600sqft was used to filter out artifact polygons. Those parcels reporting less than 600sqft of TIA where treated as 'empty', in which the average building footprint area for the parcel's landuse was assigned as the future size of buildings in that parcel.

Geoprocess:

1. Clip **alt_parc.shp** to WS boundary --> SGV_Buildout_inWS_v2
2. Identify impervious areas in **SGV_Buildout_inWS_v2** layer --> SGV_Buildout_inWS_Impervious_v2
3. Attribute **SGV_Buildout_inWS_v2** with impervious information
4. Attribute **SGV_Buildout_inWS_v2** with Landuse/zoning information

Calculating Increase TIA

From the total amount of parcels inside the watershed (2052), 362 parcels have more units zoned/allowed than are currently in place.
["MG1_UNITS" > "EXUNITS"]
That means that given the data for this analysis, 'future conditions' calculations should concern only those 362 parcels.

Table opeartions:

1. Buildout increase (POTADUNITS) = [MG1_UNITS] - [EXUNITS]
2. Assumed impervious area (Assumed_im)= select [ImpervSqFt] < 600; then calculate field Assumed_im =
    - Agriculture: 874 sq.ft.
    - Community Open Space & Facilities: 1,840sq.ft.
    - Institutional: 2,955 sq.ft.
    - Multi Family Residential: 1,096 sq.ft.
    - Open Space – Preserve*: 1976 sq.ft.
    - Open Space - Public: 2,113 sq.ft.
    - Rural: 550 sq.ft.
    - Single Family Residential: 2900 sq.ft**.

    * There is no building footprint in this class. The area is derived from the average of the other two 'open space' classes.

    ** This footprint is not derived from GIS. It comes from Marin County suggestion based on the follwing:

    1. Given that many of the developable lots are very small or very steep, 2,000 square feet seems a reasonable footprint site.
    2. 500 square feet as a reasonable driveway size.
    3. 400 square feet for a garage, studio, or other outbuilding.

3. Potential impervious area* (POT_TIA) =
Case 1: "Assumed_Im" = -999 AND "EXUNITS" > 0 : ([ImpervSqFt])+(([ImpervSqFt] / [EXUNITS]) * [POTADUNITS])
Case 2: "Assumed_Im" = -999 AND "EXUNITS" = 0 : ([ImpervSqFt])+([ImpervSqFt] * [POTADUNITS])

Case 3: "Assumed_Im" <> -999 AND "EXUNITS" = 0 : [Assumed_Im] * [POTADUNITS]
Case 4: (OUTLIERS) [ImpervSqFt] +([POTADUNITS] * [Assumed_Im])

- these are large parcels with a significant amount of TIA area as a result of a road passing through or/and the presence of artifacts. The resulting increase in TIA was assuming a building footprint equal to the total amount of TIA contained in the road segments and artifacts, and therefore resulted in an elevated predicted buildout. To correct this issue, the average area of building for that landuse (agriculture) was used instead to calculate the potential TIA.

*Note: over predictions happen when the EXUNITS value is less than what is seen on the ground (a parcel where the existing unit is one but you can see 2 building footprints). In that case the associated TIA for that parcel represents more units than those indicated by the existing unit field, hence when calculating the future buildout the 'TIA per unit' calculation gets skewed.

Calculating Potential TIA by Basin

Geoprocessing:

1. generate centroids for those parcels with potential buildout:
   potential_buildout_v3.shp → potential_buildout_v3_centroids.shp
2. Identify the centroids with the sub-basins
3. Calculate a field for potential impervious area increase (potential conditions minus current conditions).
   POT_ImpInc = [POT_TIA] - [ImpervSqFt]
4. Generate Excel Table and calculate Potential TIA for each subbasin
   Existing Impervious areas + Potential impervious area increase
5. Join results from excel table to final analysis shapefile:
   Potential_TIA_by_ReachBasin_v4.shp