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Acknowledgments

Northeast Bakersfield Open Space Area Biological Resource Evaluation
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Northeast Bakersfield Open Space Project Land Acquisition - Cost/Benefit Approach

Abstract

This paper provides a description of the methodologies and processes used for the creation of a decision/support model for land acquisition decisions on a cooperative open space project between The City of Bakersfield and other local agencies. The model uses a cost/benefit approach using components of habitat ranking, developed through an independently prepared evaluation, and estimated per acre land costs based on percentage slope and proximity. The primary goal was to derive a system for quantifying the best cost/benefit for any given area of the project and use the resultant data to target specific areas for later acquisition.

Note: Abstract submission #155

Background

The project area contains undeveloped open space with grassland vegetation, ravines, rolling hills, and gently sloping plateaus in Northeast Bakersfield. The Kern River Corridor runs along the northern boundary of the project. A relatively steep interface exists between the river corridor and the plateau areas further to the south. This area is commonly referred to as “the bluffs” and is approximately 450 feet from river plain to plateau top. Much of the “bluff” areas are not well suited for urbanization but still provide good habitat for sensitive species in the area.

Within the river corridor adjacent to the project area, there is a major network of recreational land uses including a regional park, zoo, soccer park, golf course, and recreational lake. In addition, other public lands exist along the north and east sides of the project, which when connected, assists in preserving open space.

On November 14, 2001 the City of Bakersfield adopted a General Plan Amendment modifying the Open Space Element of the General Plan. The amendment adopted a set of policy and implementation measures for the acquisition and preservation of approximately 2,500 acres of open space in the northeast area of the City (NBOSA). The open space would be used for passive recreational and habitat preservation purposes. The area contains notable quantities of habitat for sensitive and endangered plant and animal species including the San Joaquin Kit Fox, Blunt-nosed Leopard Lizard, and the Bakersfield Cactus.

One of the policies of the general plan amendment stated:

"Establish open space/trail linkages from the NBOSA (Northeast Bakersfield Open Space Area) to public and quasi public facilities such as California Living Museum (CALM), Hart Park, the soccer park, Lake Ming and the Kern River Corridor."

Figure 1 shows the project boundary relative to these resources. A parks and trails plan, which will link neighborhoods to these amenities, is currently under development as a separate yet related project.

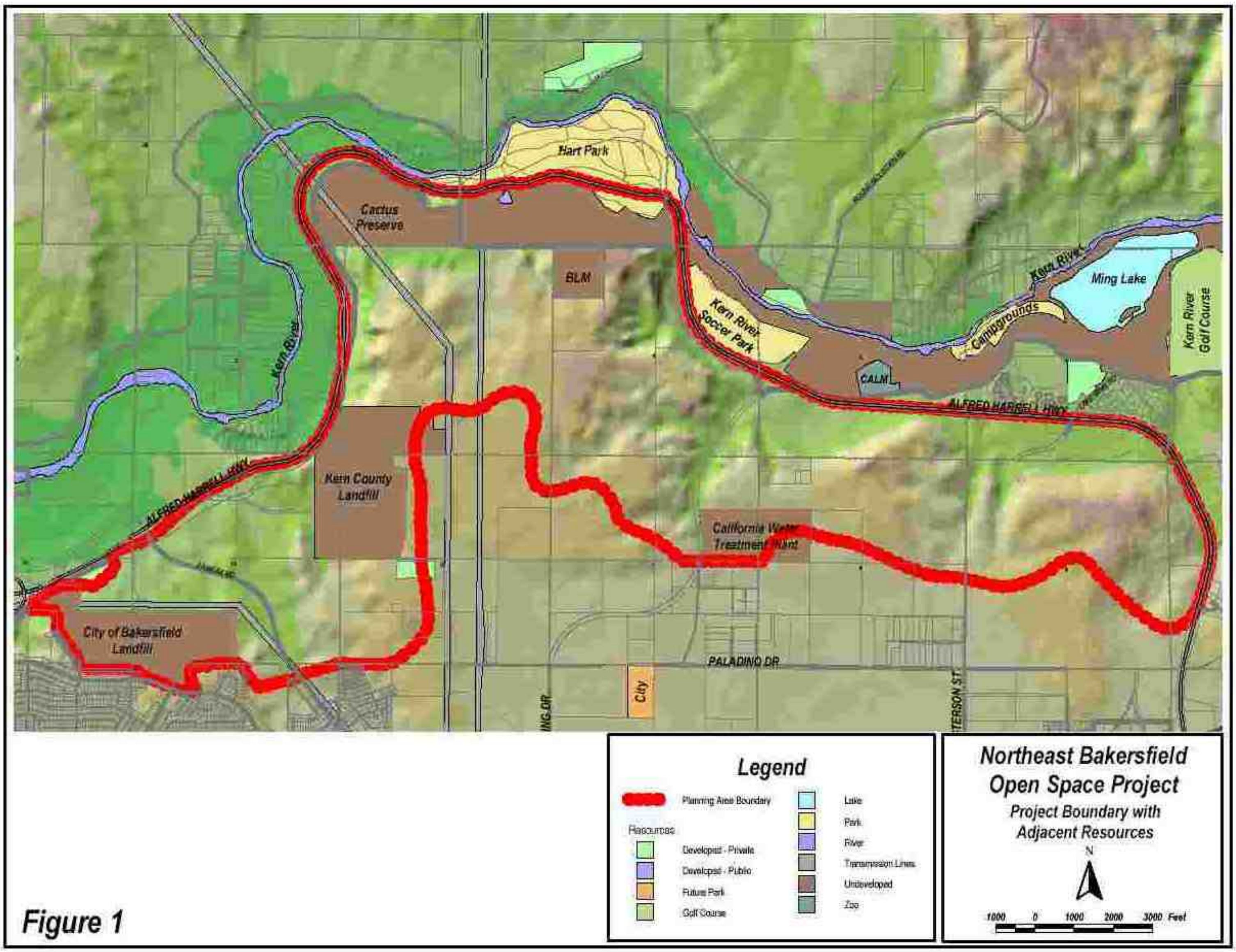

Figure 1

Figure 1

In 1994 a habitat conservation plan (HCP) was implemented as a joint venture between applicable city, county, state and federal agencies. This plan set up a mechanism for the collection of fees to mitigate the loss of habitat due to urban growth within the Metropolitan Bakersfield area. The funds are used to purchase and preserve habitat in other areas as determined appropriate by the trustees responsible for administration of the plan. Since implementation of the HCP over 8,000 acres of habitat have been preserved. In January of 2002 the trustees for the HCP voted to earmark $4,000,000 for the preservation of habitat within the project area.

In February 2002 the HCP contracted with BonTerra Consulting of Costa Mesa to perform a biological resource evaluation of the project area. The purpose of the evaluation was to update information and analyze biological resources so that decisions regarding acquisition, preservation, suitability and compatibility with other activities could be based on the latest, most accurate information. BonTerra developed a habitat ranking system that focused on the sensitive and endangered species within the project area, which included the San Joaquin Kit Fox, Blunt-nosed Leopard Lizard, and the Bakersfield Cactus. A total rank was also generated based on the accumulation of the individual ranks.

Purpose

The purpose of this project was to develop a decision support model using geographic information systems (GIS) capabilities and techniques for analyzing potential land acquisitions. The goal was to derive a system that allowed decision makers (HCP trust group) to spatially evaluate the cost/benefit for any given area and use the resultant data to target specific areas for acquisition.

Physical Scope

BonTerra Consulting created a “Priority” coverage that identified areas most appropriate for acquisition based on habitat value. The HCP trustees determined sufficient funds were not available to acquire everything so they narrowed their focus to only the higher priority areas as determined by the evaluation. Some of the considerations determining priority included:

- Roads and freeways should be located at the edge of preserve areas. They represent a substantial barrier for purposes of habitat integrity.
- Existing high value habitat areas shall have priority
- The preserve area(s) should be large enough to support self-sustaining populations.
- Preserve areas shall be connected to other regionally important open space areas.
- Areas adjacent to existing preserves shall be given priority.

Based on the above criteria, as the initial focus, a smaller area was selected for acquisition consideration within the overall project area. This “base” acquisition area was broken into two non-contiguous areas containing approximately 1,370 acres. The areas are adjacent to and connected by a publicly owned 205 acre parcel (County of Kern). This area will hereinafter be referred to as the “base area” as shown on figure 2.

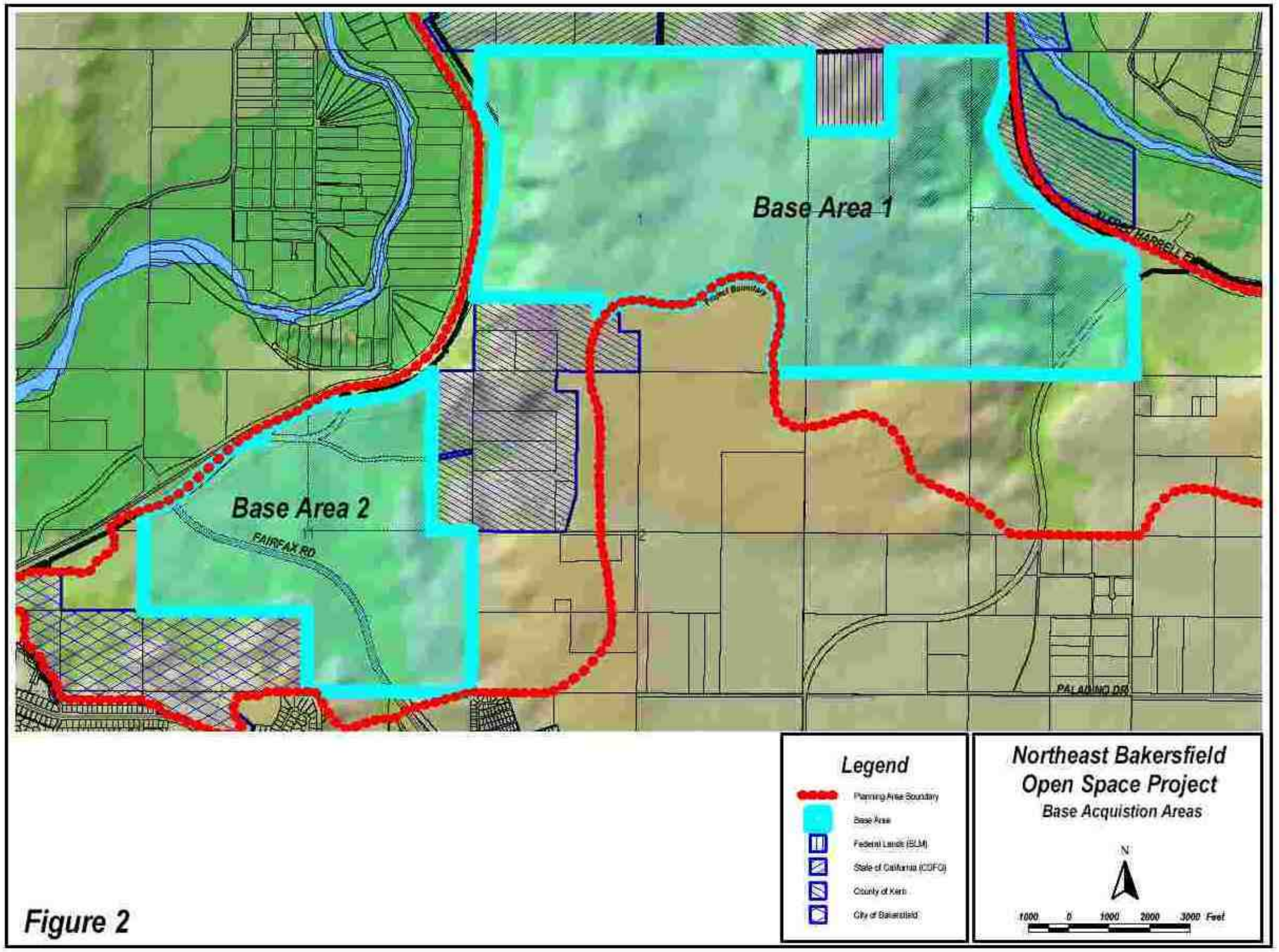

Figure 2

Components of the Project

The primary portion of the project was built using ArcView 3.2. There were some custom scripts written to summarize data, which was subsequently written to a separate database (dbf) file. The summarized data was then imported into Microsoft’s Excel to allow the ability to modify variables and assumptions. For example, formulas were written based on cost per acre assumptions provided by the property appraiser working on the project. If the assumptions for cost per acre changed, then they could be entered and the spreadsheet would automatically recalculate the totals based on these new assumptions.

Spatial Analyst extension was used to create an elevation grid of the project using data from the USGS Digital Line Graph (DLG) file. A script was used to extract the line vertices as points and capture the associated elevation data for each point generated. The elevation grid was interpolated from the point data using spatial analyst and a custom kriging algorithm. This method of elevation data creation was used so a higher resolution grid than the standard 30 meter DEM could be created. The grid size selected was 25 feet (625 sq. ft. each). The background shown on figure 1 is derived from this elevation grid.

The “cost” component of the project was derived from slope data. A slope grid (degrees slope) was created from the elevation grid using Spatial Analyst built in “derive slope” function. A shape file was created of the slope grid and a field was added, it was populated with percentage slope (computed using the calculator). Figure 3 shows the slope data for the base area with slope values converted to percentage slope. The shape file was created to allow geo-processing of the data relative to the consultants ranking data, which was also in shape file format.

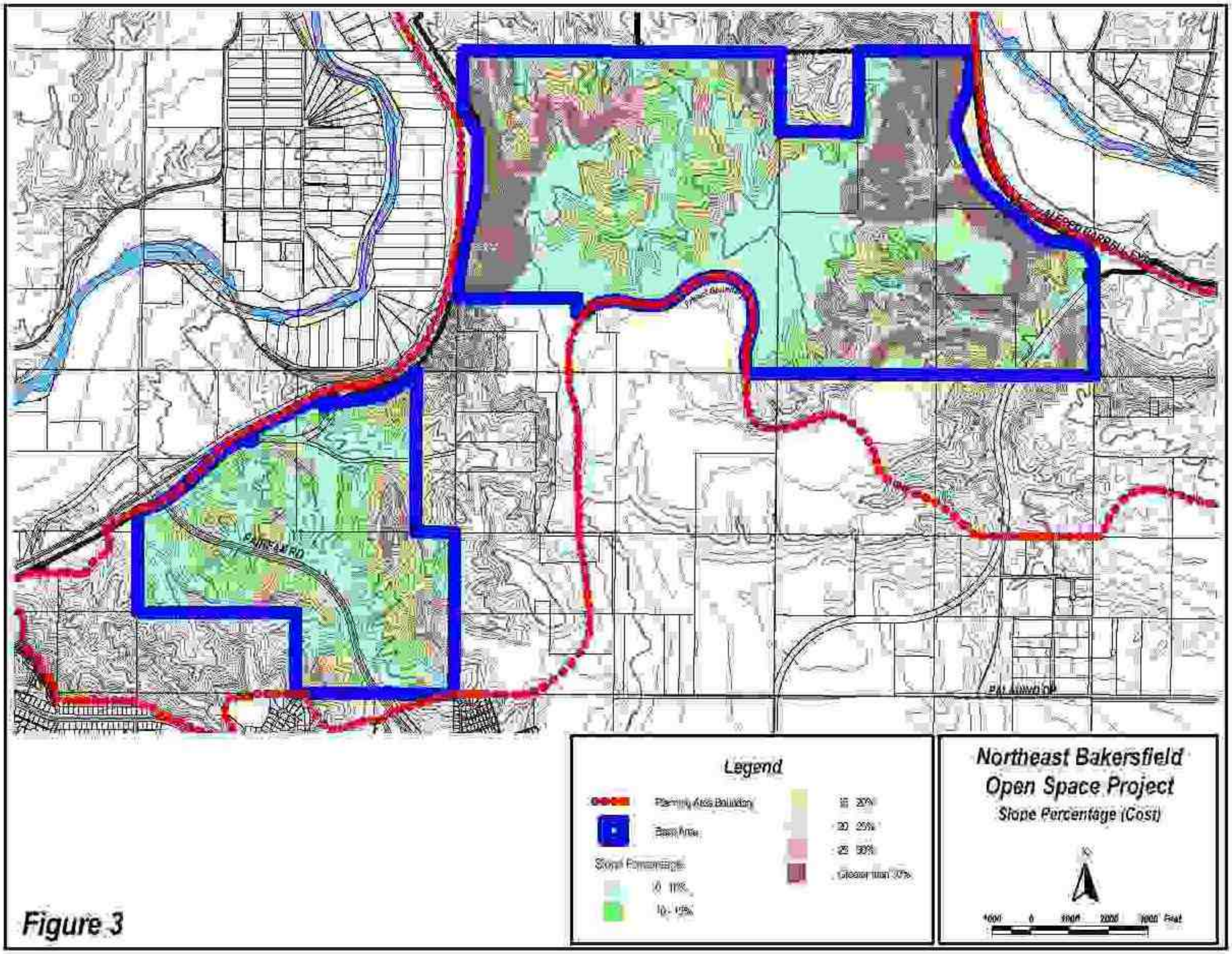

Figure 3

The “benefit” component of the project was based on the habitat ranking developed by BonTerra Consulting. Ranking of habitat was performed independently for the three species listed earlier. Components of ranking for each species included soil compatibility, slope compatibility and vegetation compatibility. Each species was ranked with a value of either 0 or 1 for each of the various components. For example, if the Bakersfield Cactus was rated 0 for soils, 1 for slope and 1 for vegetation then its total rank would be 2. Each species could have a minimum ranking of 0 and a maximum ranking of 3. Total habitat ranking was an accumulation of the overall ranking for each species. Therefore, the total minimum ranking could be 0 with the maximum being 9 (maximum 3 components x 3 species). For the purposes of this project the total rank score was used as the “benefit” component. Figure 4 shows the cumulative habitat ranking analysis prepared by the consultant.

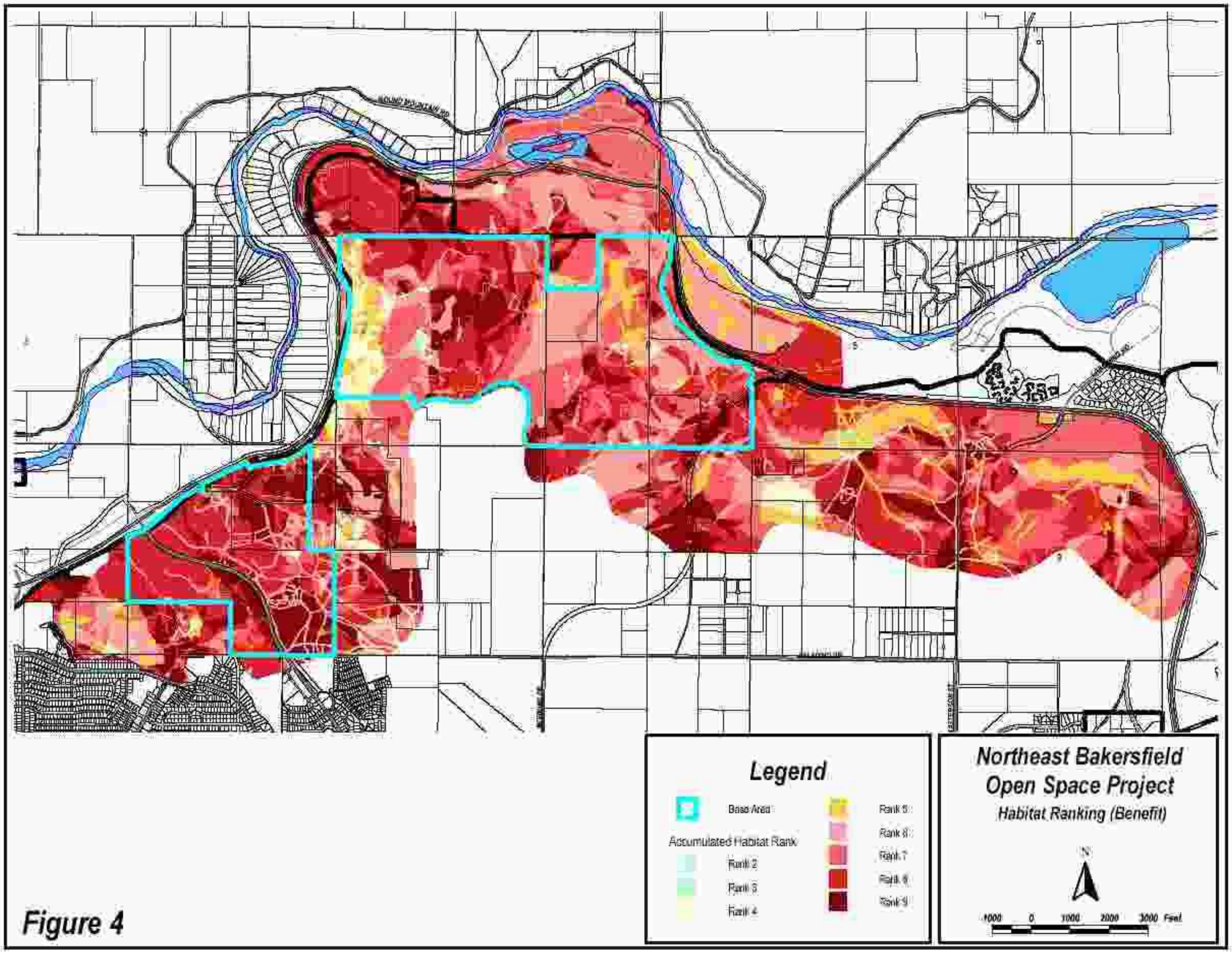

Figure 4

Slope is used on both the benefit and cost side of the model but is used in different ways. Slope on the cost side deals with the idea that land costs will decrease in value as slope increases because urban development of steep slope areas is less desirable and more difficult (i.e. expensive). Slope used as a component on the benefit side deals with the compatibility of slope as a habitat component. All of the sensitive species considered in the evaluation benefit from at least some slope.

In order to approach individual property owners with an acquisition proposal, data needed to be broken down on a parcel by parcel basis. Therefore, a cadastre layer was added as a component of the project, this allowed the data to be clipped to each individual property and summed independently. Figure 5 shows the individual properties being targeted hereinafter referred to as “base area properties.”

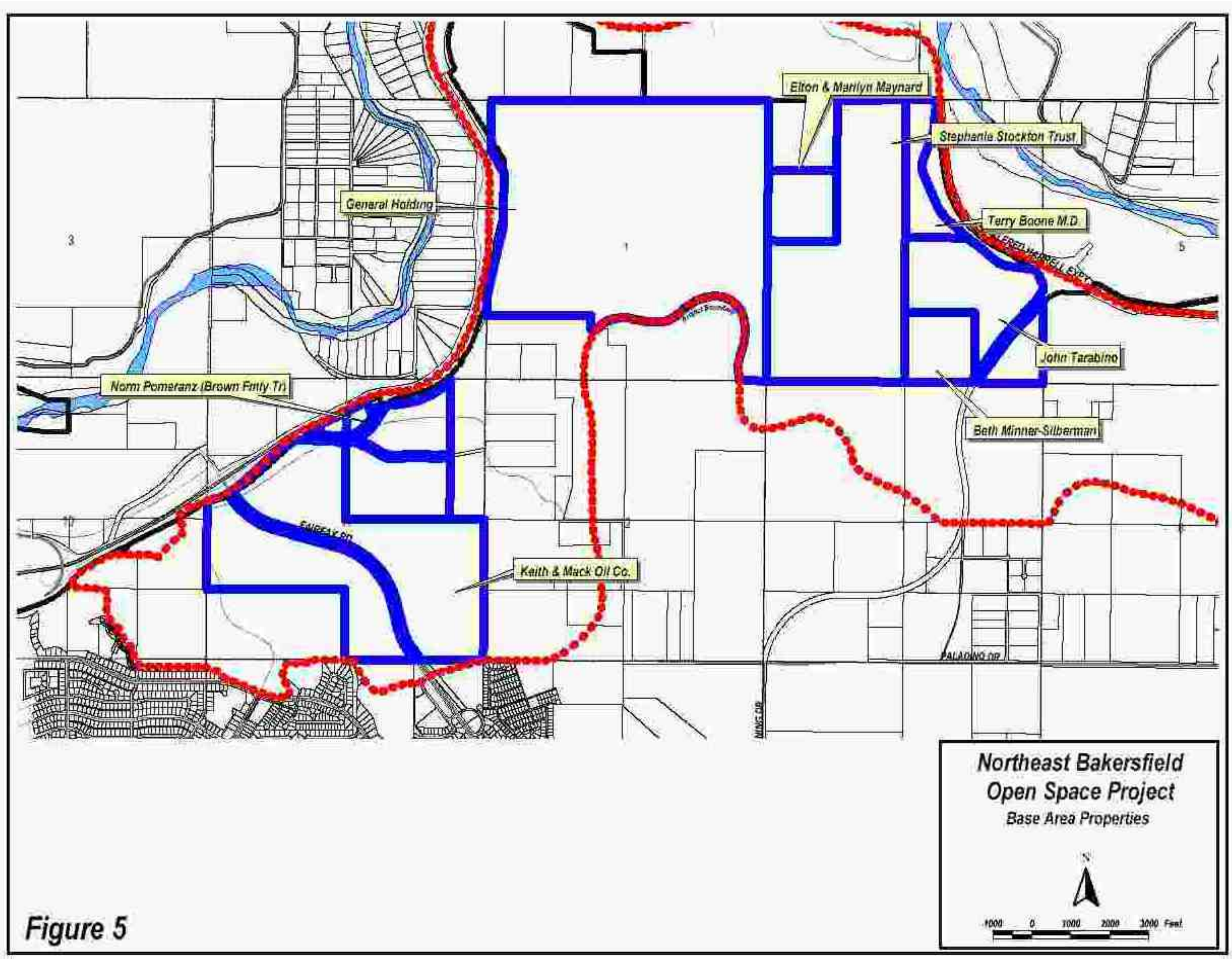

Figure 5

Other data used included a theme showing existing public lands (state, federal, and local), existing preserves, and other resources that may need to be considered for connectivity purposes such as parks, rivers, lakes, campgrounds, sports complexes, trails systems, and other related recreational resources (see figure 1). A geo-referenced aerial photo provided an additional resource (flown in January 2002). Additional information needed included base map data such as cadastre, roads, and public land survey (sections).

Methodologies and Processes

Data was created based on the intersection of the habitat rank (benefit), slope (cost), and base area properties. The geo-processing extension, supplied by ESRI, was used to create a cost/benefit theme based on these criteria as shown on figure 6. A method was devised to establish a weighted ranking or scoring system based on the combination of the slope (cost) and habitat ranking (benefit) data. This was done by adding two columns to the attribute table. The first column, called slope rank, was populated with a value ranging from 1 to 6 where 1 represented slopes of 10% or less up to 6, which represents slopes greater than 30%. The other values were sequentially higher based on slope range increase at 5% intervals. For example, the slope range between 10-15% had a value of 2; 15-20% had a value of 3, etc. The second column contained the actual weighted score and was computed by multiplying the habitat rank by the slope rank. Therefore the highest possible score was 54 (9 - highest habitat rank x 6 - highest slope rank). The higher the weighted rank value, the greater the overall benefit (higher number for slope rank means lower cost, higher number for habitat rank means best habitat).

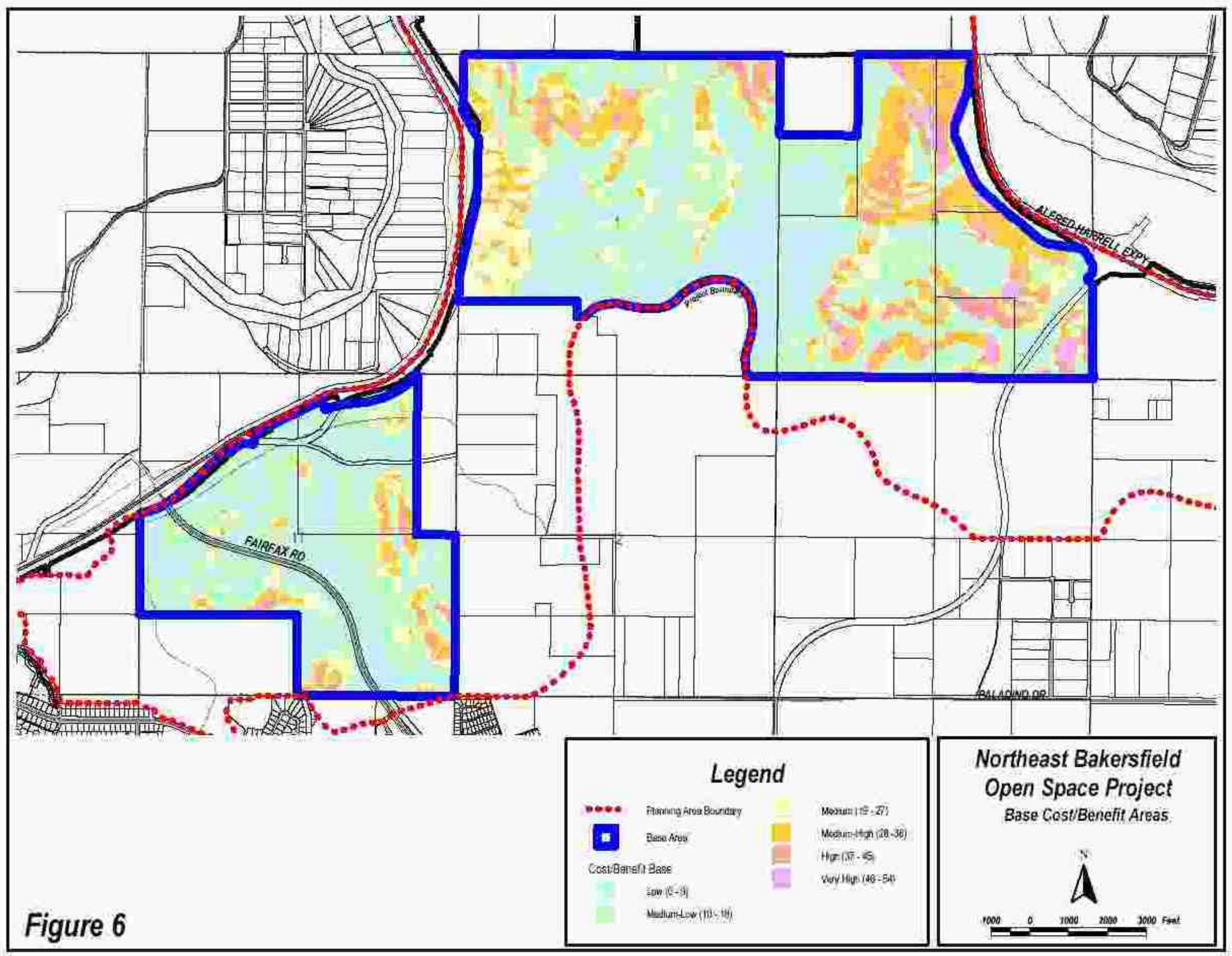

Figure 6

A script was written to create a summary table of the base area. Later the same script was run against a targeted area to compile summary statistics for comparison to the base. The script creates a cross-tab style table that sums acreage based on owner and the six categories of slope rank. Each slope rank has a separate cost per acre assumption, which was provided by the property manager based on property appraisals and sales history in the area. The script also adds a record for total acres by slope rank and a column for total acres by owner. In addition a column was provided to compute the average habitat rank for each owner and the average habitat rank for all records. Figure 7 shows the result of the script as it was run against the base area. A button was added to the main view of the project to run the script.

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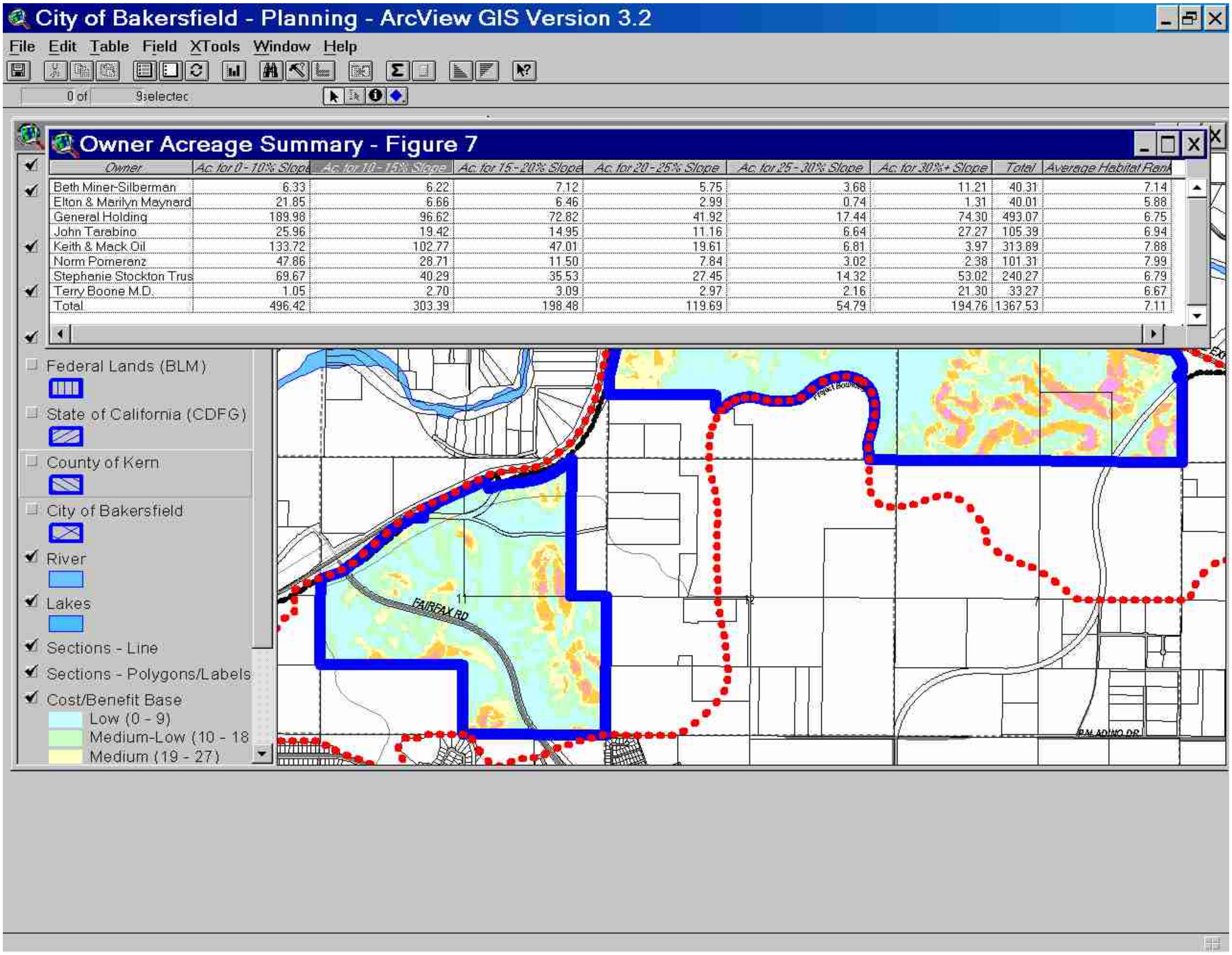


Owner	Ac for 0-10% Slope	Ac for 10-15% Slope	Ac for 15-20% Slope	Ac for 20-25% Slope	Ac for 25-30% Slope	Ac for 30%+ Slope	Total	Average Habitat Rank
Beth Miner-Silberman	6.33	6.22	7.12	5.75	3.68	11.21	40.31	7.14
Elton & Marilyn Maynard	21.85	6.66	6.46	2.99	0.74	1.31	40.01	5.88
General Holding	189.98	96.62	72.82	41.92	17.44	74.30	493.07	6.75
John Tarabino	25.96	19.42	14.95	11.16	6.64	27.27	105.39	6.94
Keith & Mack Oil	133.72	102.77	47.01	19.61	6.81	3.97	313.89	7.88
Norm Pomeranz	47.86	28.71	11.50	7.84	3.02	2.38	101.31	7.99
Stephanie Stockton Trus	69.67	40.29	35.53	27.45	14.32	53.02	240.27	6.79
Terry Boone M.D.	1.05	2.70	3.09	2.97	2.16	21.30	33.27	6.67
Total	496.42	303.39	198.48	119.69	54.79	194.76	1367.53	7.11

Based on the weighted rank value, a selection was made for areas with rankings greater than a pre-determined threshold. For the purposes of this report, the threshold used was 27, which is one-half the maximum value for the weighted ranking. The selected areas (highlighted) were used as a visual reference to edit the cadastre layer and subdivide portions that were of high interest. The high value subdivided portion is known as the “targeted acquisition area.” In addition to high ranking areas, other considerations included all the other priority concerns listed earlier such as connectivity to public lands and other preserves, areas large enough to be self-supporting, and proximity to major roads. The targeted acquisition areas were then used to clip the cost/benefit theme, which created a targeted cost/benefit theme. Figure 8 shows the targeted cost/benefit area using this methodology. The table summary script described earlier was run against this revised theme to create a table of summaries by property owner, slope and average habitat ranking. Figure 9 shows the results of the script as it was run against the targeted acquisition area.

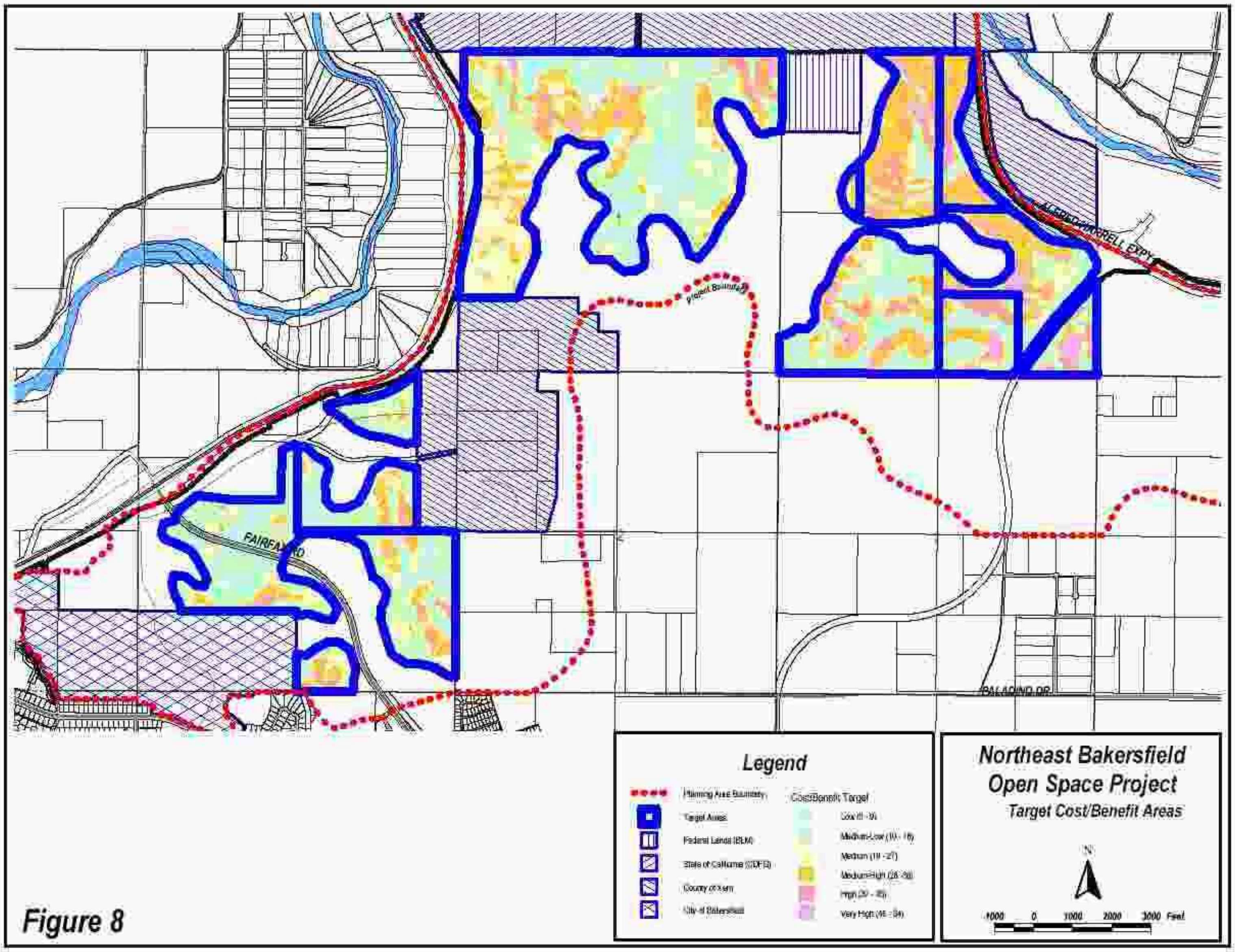
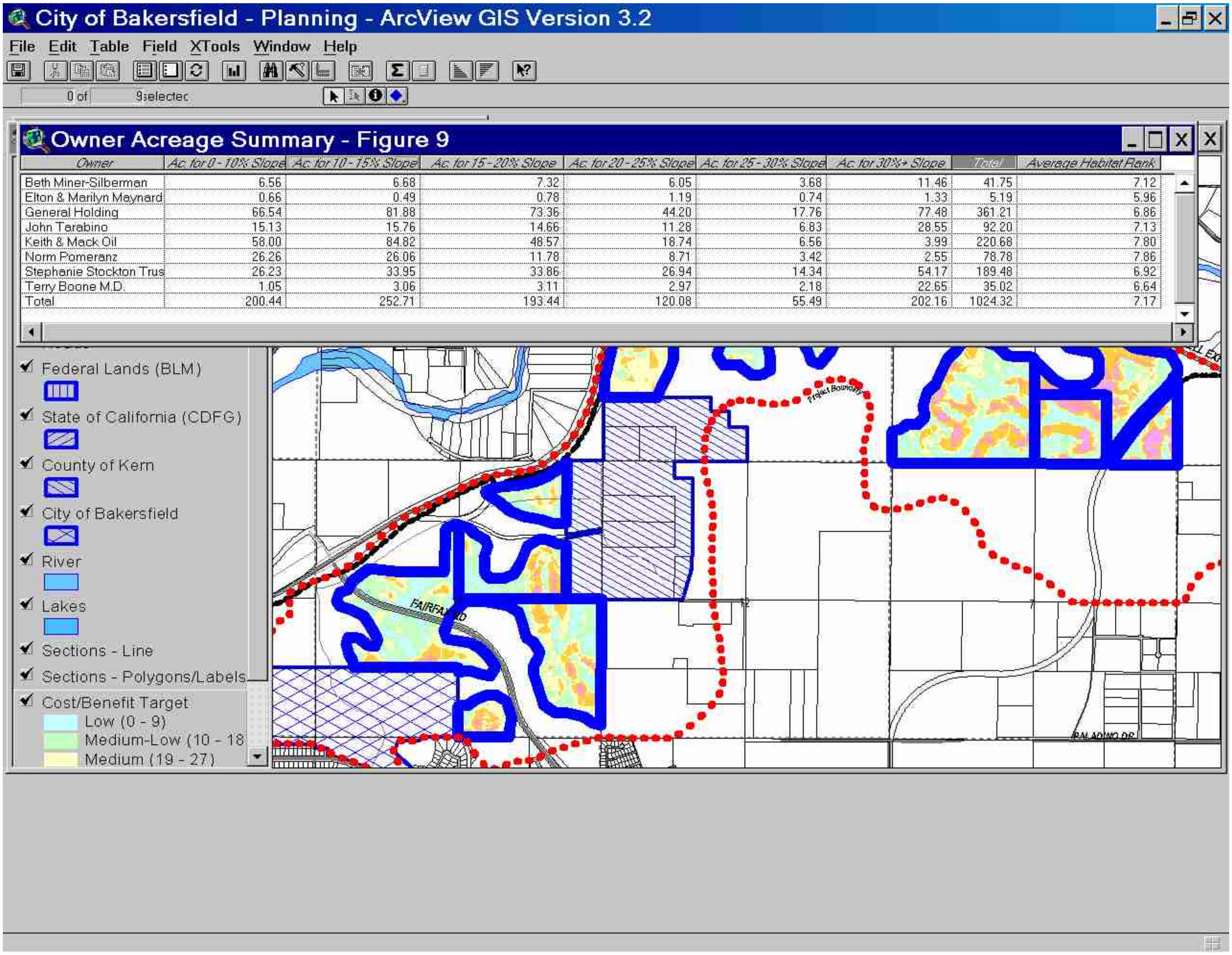

FAIRFAX RD
ALFRED HARRELL EXPY
Project Boundary
PALADINO DR
Legend
Planning Area Boundary
Target Areas
Federal Lands (BLM)
State of California (CDFG)
County of Kern
City of Bakersfield
Cost/Benefit Target
Low (0 - 9)
Medium-Low (10 - 18)
Medium (19 - 27)
Medium-High (28 - 36)
High (37 - 45)
Very High (46 - 54)
Northeast Bakersfield
Open Space Project
Target Cost/Benefit Areas
N
1000 0 1000 2000 3000 Feet

Figure 8



Owner	Ac. for 0 - 10% Slope	Ac. for 10 - 15% Slope	Ac. for 15 - 20% Slope	Ac. for 20 - 25% Slope	Ac. for 25 - 30% Slope	Ac. for 30%+ Slope	Total	Average Habitat Rank
Beth Miner-Silberman	6.56	6.68	7.32	6.05	3.68	11.46	41.75	7.12
Elton & Marilyn Maynard	0.66	0.49	0.78	1.19	0.74	1.33	5.19	5.96
General Holding	66.54	81.88	73.36	44.20	17.76	77.48	361.21	6.86
John Tarabino	15.13	15.76	14.66	11.28	6.83	28.55	92.20	7.13
Keith & Mack Oil	58.00	84.82	48.57	18.74	6.56	3.99	220.68	7.80
Norm Pomeranz	26.26	26.06	11.78	8.71	3.42	2.55	78.78	7.86
Stephanie Stockton Trus	26.23	33.95	33.86	26.94	14.34	54.17	189.48	6.92
Terry Boone M.D.	1.05	3.06	3.11	2.97	2.18	22.65	35.02	6.64
Total	200.44	252.71	193.44	120.08	55.49	202.16	1024.32	7.17

The summary tables are independently imported into a custom Excel spreadsheet using the data/refresh data command. The data is imported into a specified range and a separate worksheet within the Excel project. This allows applicable formulas to be tied to the data and when it is refreshed with new data, the spreadsheet automatically recalculates based on the new values. Initially a query was built to import external data into the spreadsheet that was tied to the summary dbf file created by the script. After the initial creation of the query, the summary data could be updated by using the refresh data command. The analysis is performed on a separate worksheet within the project. Formulas were written to link the appraisers cost per acre assumptions to the acreage breakdown by owner and percentage slope. If the assumptions were changed for cost per acre then the spreadsheet could automatically be recalculated based on the revised costs. A high, medium, and low cost per acre were used to give decisions makers a range of potential costs for each potential acquisition. The cost of acquisition was then calculated for each slope category and summed into a single cost estimate for each targeted property. Two additional columns of data were added for comparison purposes. The first column computed average cost per acre; this number could then be compared against the base area cost per acre. The second column added a cost/benefit ratio where the average cost per acre was divided by the average habitat ranking, the lower the number the better the benefit was derived. Table 1 shows the estimated costs derived using the base area. Table 2 shows the estimated costs derived using the targeted cquisition area.

Conclusions

A comparison of Table 1 and 2 (the base vs. the target acquisition area) yields some interesting results. Based on the average cost per acre, a savings of approximately 12% is realized over the base area and the habitat value actually increases marginally. In addition other priority considerations such as connectivity to other preserve and public lands, areas large enough to be self supporting and proximity to major road have still been maintained. The entire model allows for changes in assumptions and modification of target areas, which can easily be recalculated and plugged into the spreadsheet to develop tables for comparison to the base area or other potential proposals.

Application

The property manager for the HCP Trust Group has used this information successfully to negotiate sales price for some of the target acquisition properties. There are currently two properties in escrow and three additional properties are under negotiation. The model allows the Trust Group to purchase the best habitat for the species of concern for the lowest cost.