



United States Department of the Interior

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Ecological Services

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October 24, 1995

Lt. Col. James S. Weller, District Engineer
Walla Walla District, Corps of Engineers
210 North Third
Walla Walla, WA 99362-1876

ATTN: Clark Derdeyn, CENPW-PL-ER

Dear Lt. Colonel Weller:

This letter is in reference to the Lower Snake River Fish and Wildlife Compensation Plan, Habitat Evaluation Procedures (HEP). In accordance with a fiscal year 1995 scope-of-work and recently signed Letter of Agreement between the Fish and Wildlife Service (Service) and the Walla Walla District Corps of Engineers (Corps), the Service was to validate preliminary HEP data. One element of the scope-of-work requires the Service to provide a report of our findings. You will find a copy of our final report attached.

The Corps provided recommendations to our draft report through several FAX transmissions. We incorporated many of the recommended changes, particularly in the tabular results. These changes were often needed due to miscalculations, typographic errors or incorrect interpretations of interagency discussions. However, several recommended changes were not incorporated since they were based on outdated information (for example, HSI values which were subsequently changed during interagency meetings or following our review of raw data and model recalculations) or we found a discrepancy with your interpretation of meeting notes. We discussed each of the outstanding discrepancies with Clark Derdeyn, of your staff, and sent him copies of relevant data sheets to ensure you have the most updated information.

The updated information incorporated into our report was relatively minor and has not changed the overall results. We would like an opportunity to provide comments if the Corps proposes to make additional changes in preliminary HSI determinations and/or change the information provided in our report regarding the validation HSI's (for example, changing the rationale for accepting either a validation or preliminary HSI value based on a different interpretation of agreements reached during interagency discussions).

If you have questions regarding the report contact Don Haley at our Moses Lake Suboffice at (509) 765-6125.

Sincerely,

A handwritten signature in cursive script that reads "Liz Block".

for Philip Laumeyer
Field Supervisor

c: Washington Department of Fish & Wildlife, Pasco (Rocky Ross)

Attachment

**Final Report for the
HSI Validation Study for the
Lower Snake River Fish and Wildlife Compensation Plan**

Prepared for:

U.S. Army Corps of Engineers
Walla Walla District

Prepared by:

Donald Haley, Fish and Wildlife Biologist
Upper Columbia River Basin Field Office
U.S. Fish and Wildlife Service
Spokane, Washington

October, 1995

INTRODUCTION

This draft report concerns the quality of wildlife habitat on land acquired as part of the Lower Snake River Fish and Wildlife Compensation Plan (Compensation Plan). This report fulfills the requirements of a 1995 Letter of Agreement and scope-of-work between the U.S. Fish and Wildlife Service (Service) and the Walla Walla District Corps of Engineers (Corps). It has been prepared under the authority of the Fish and Wildlife Coordination Act (Act) (48 Stat. 401, as amended; 16 USC 661 et seq.). However, it does not meet the requirements of Section 2(b) of the Act as a Coordination Act Report.

The Compensation Plan was authorized by Congress as part of the Water Resources Development Act of 1976 (P.L. 94-587). Its purpose is to mitigate adverse impacts to fish and wildlife resources which resulted from the construction of four Snake River dams. One feature of the Compensation Plan is the acquisition/retention and development of 24,150 acres of suitable lands to compensate for lost wildlife habitat and lost fisherman access. These lands include Corps' project lands associated with the four Snake River dams and off-project lands. In Washington, the lands occurring adjacent to existing Corps' project lands will be managed by the Corps and other lands will be managed by the Washington Department of Fish and Wildlife (WDFW). The Corps is funding wildlife habitat protection, developments and improvements on all of these properties.

This report covers 20 of 29 total Compensation Plan parcels, with the majority being off-project sites. These 20 sites were located in seven counties within southeastern and southcentral Washington (Figure 1). The sites evaluated included: Baillie Ranch, Benton City, Campbell, Central Ferry, Couse Creek, Donald Road, Ferry Road, Fisher Gulch, Hartsock, John Henley, Kelly Bar, Naches Road, Nisqually John, Pintler Creek, Revere Ranch, Shumaker, Sulphur Creek, Swank, Whitstran and Windmill Ranch.

In order to determine compensation goals and evaluate Compensation Plan lands and habitat development efforts, Habitat Evaluation Procedures (HEP) were used (these procedures are described in more detail in the Methods section). In 1989, HEP was used to quantify and describe wildlife habitat conditions on some of the on-project and off-project parcels and other areas where vegetation communities existed which were believed to be similar to those which existed along the Snake River prior to dam construction. In 1994, based on a 1989 Letter of Agreement between the Corps, the Service and WDFW, the Corps used this HEP data along with aerial photos to estimate preliminary HEP figures for each of the Compensation Plan parcels. This information helps describe wildlife habitat conditions existing prior to purchase of Compensation Plan lands, project future conditions achieved by habitat development activities and allow quantified comparisons with habitat losses and compensation goals.

Since preliminary HEP determinations for Compensation Plan lands were generally not based on habitat measurements taken at those sites, a decision was made to field check each of the

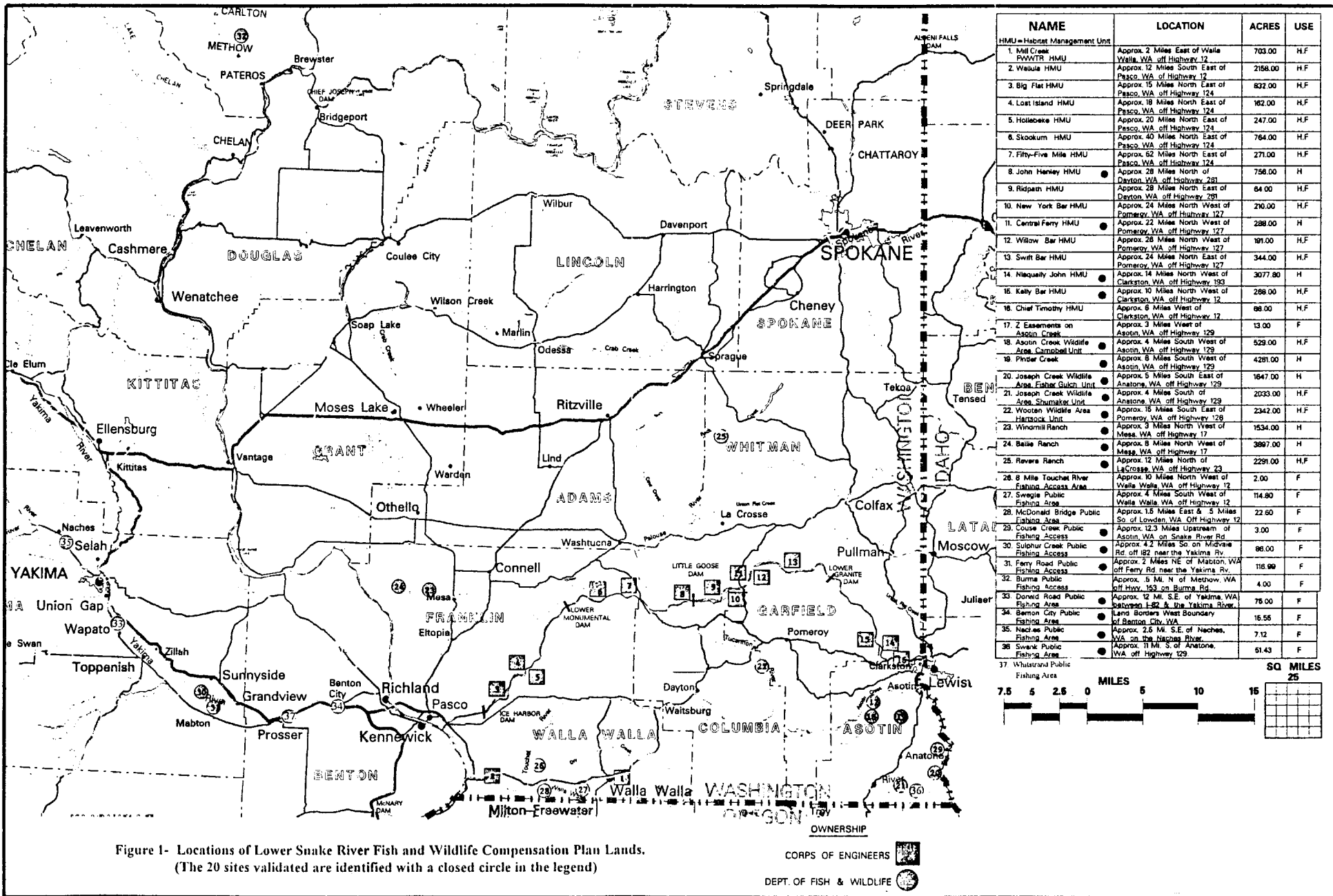


Figure 1- Locations of Lower Snake River Fish and Wildlife Compensation Plan Lands.
(The 20 sites validated are identified with a closed circle in the legend)

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Compensation Plan parcels and evaluate whether the preliminary values were reasonable.

However, the Corps determined that detailed HEP measurements for each habitat type at each of the Compensation Plan lands were unwarranted at this time. Furthermore, future intensive HEP assessments are planned for each of these sites for monitoring purposes. Therefore, a field method was needed to quickly evaluate the habitat on the Compensation Plan lands and determine whether the associated preliminary HEP figures were valid. We developed such a validation technique and describe it in the following section.

METHODS

HEP was the primary method used to evaluate and quantify habitat values for the Compensation Plan. HEP is a species-based habitat analysis procedure. The procedure assesses the value of the habitat for certain select species over the life of the project. The species evaluated are selected either to represent entire groups of species (for example, mallards may be used to represent dabbling ducks) or because of some special value they have in the area (for example, popular game birds). For this project, evaluation species included twelve birds and mammals, including: downy woodpecker, yellow warbler, marsh wren, song sparrow, western meadowlark, California quail, ring-necked pheasant, chukar, mallard, Canada goose, mule deer and river otter.

Once species are selected, models which describe a range of habitat values for that species are written. Evaluation species models that were used were those that were agreed upon by the Corps, Service and WDFW. These models generally relate certain aspects of the habitat, such as percent ground cover or height of vegetation, to the value of the habitat for the species. The models rank the habitats on a scale from 0.0 to 1.0, with 0.0 being of no value and 1.0 being of highest value. These scores are known as habitat suitability indices (HSI) and may change over time as the habitat changes. In most models, once the HSI scores are determined for each species, they are multiplied by the number of acres of habitat available to the species to derive a measure which takes into account both the habitat quality and quantity. This measure is called habitat units (HU).

For some species that use multiple cover types for different life requisites, such as pheasant which use different cover types for feeding and nesting, additional calculations are necessary. First, a life requisite suitability index (LR SI) must be calculated for each life requisite. This is then converted to an HSI by comparing the LR SI's to what the optimum mix of LR SI's/cover types should be for that species. For example, for pheasants, the model dictates that in optimal pheasant habitat at least 80 percent of the area should provide nesting cover, at least 30 percent should provide winter cover and at least 50 percent should provide winter food. This optimum mix is called the equivalent optimum area (EOA). Once the HSI's are calculated from each LR SI, HU's can be calculated.

The HU scores can then be altered either by changes in the number of acres of habitat available to a species or by changes in the quality of the available habitat over the life of the project. Habitat units for each species are normally calculated for a number of "target years", which are simply sample points throughout the expected life of the project when the values of the habitat for wildlife are estimated. In most cases, target year 0 is the year just prior to initiation of the project and the last target year occurs at the end of the life of the project. The final output of HEP analysis is the number of HU's available for each species used in the analysis. The total HU's available over the entire life of the project are generally averaged over the project life to yield a value which is the average annual HU's available for each species. The results from the HEP can then be used to compare the future with and without conditions to provide an estimate of the project-related impacts to wildlife. Details regarding the HEP procedures, cover types, assumptions, models and model references can be found in two reports: U.S. Army Corps of Engineers (1991) and U.S. Fish and Wildlife Service (1988).

As mentioned earlier, preliminary HEP figures were generated for each of the Compensation Plan parcels using 1989 HEP data along with aerial photos. The purpose of this study was to validate preliminary HEP data from 20 parcels without using intensive measuring of HEP model variables. Two techniques were employed which have been successfully used in the past to determine HSI values with significantly less effort than using detailed field measurements. These techniques are described in detail by Wakely and O'Neil (1988).

The first technique involves measuring HSI model variables on a discrete scale rather than a continuous one. To do this, the suitability indices (SI) for each variable, which are graphically expressed as curves, are divided into three categories: zero where SI equals 0.0, low where SI is less than 0.5 and high where SI is greater than or equal to 0.5. For example, for canopy cover of shrubs for some evaluation species, 0.0 percent canopy cover would equal zero, less than 35 percent canopy cover may equal low, and greater than or equal to 35 percent canopy cover may equal high. Wakely and O'Neil (1988) recommended assigning the zero suitability rating a score of 0.0, low a score of 0.2, and high a score of 0.9. If it was reasonable to divide the SI curve into four discrete categories, based on a flatter slope, we added a medium category and assigned it a score of 0.5, based on Wakely and O'Neil (1988). Those habitat variables which were already in discrete units, for example, the growth form of emergents for the marsh wren model, would retain their units and corresponding SI scores.

The second technique used to reduce field effort involved the use of ocular estimates of habitat variables rather than precise measurements. Since the habitat variables were divided into only three or four discrete categories, ocular estimates were relatively simple and accurate. For example, for the song sparrow model, the percent canopy cover of shrubs would be either 0.0, less than 25 percent or greater than or equal to 25 percent (see Appendix A). For this model, the observer only needed to determine if: 1) shrub canopy coverage is present and 2) whether or not it is greater than, less than or approximately equal to 25 percent. In order to reduce variability in ocular estimates, the same observer made all estimations. Additionally, a limited number of habitat variable measurements were taken in the field to periodically "calibrate" the ocular

estimates.

To compare the validation technique with the HEP technique using actual habitat variable measurements, an interagency team (Corps, Service, and WDFW) established transects through a variety of cover types at several sites on Corps' project lands on May 16 and 17, 1995. Measured data were collected along the transect for model habitat variables for each of the 12 species which were assumed to use that cover type. At the same time, the Service observer recorded ocular estimates for the same habitat variables using the discrete SI categories developed earlier (Appendix A). As suggested by Wakely and O'Neil (1988), the team assumed that if the two HSI estimates were within 0.2 of each other, the HSIs based on ocular estimate and discrete SI categories were valid. If the HSI estimate was significantly different from the measured HSI the team tried to determine what caused the difference.

For the test transects and the entire study, the team decided it was only necessary to determine cover type HSIs for multi-cover type species, and the life requisite (LR) SI's for ring-necked pheasant and California quail. Determining composite HSI's for these species would have involved additional calculations based on the same cover type acreage data already used for the preliminary HEP. The team believed that evaluating and explaining differences between the preliminary HSI data and the validation technique would be simpler using cover type HSI's and LR SI's for multi-cover type species.

For the test transects measured, the majority of the HSI, covertype HSI, and LR SI values generated using the two methods were within 0.2 of each other. Generally, the team was able to determine the probable reason for the differences when greater than 0.2. Reasons for differences included the following:

- 1) There were problems in determining what should actually be measured for each habitat variable. For example, when estimating herbaceous canopy cover using the ocular method all herbaceous material was considered, while only forbs were included during actual measurements due to unclear data sheets. These problems were solved by determining how habitat variables were measured during the HEP in 1989.
- 2) Overestimates with the ocular method occurred when the measured habitat variable was close to zero. In those cases, the habitat variable was functionally zero; however, the resulting SI was assigned a 0.2 score. Assigning a zero to habitat variables which are functionally zero helped eliminate this situation. For example, if the shrub canopy cover was only about 1 percent then it would be put into the zero category and given an SI of 0.0 when using the song sparrow model.
- 3) At times, the habitat variable estimate was close to the break-off between low and high categories, but the SI had to be scored as either a 0.2 or a 0.9. Since, in those cases, the ocular estimate was not precise enough to determine whether the

variable should have been above or below the break-off, we assigned the SI a score of 0.5.

4) Some of the differences between the two techniques were related to the sample size used in collecting the measured data. Only one random transect for each cover type was measured at each site; whereas, the ocular estimates were made for a much larger portion of the site. As a result, the ocular estimate could more readily account for the variation which occurred across the site.

The team agreed that the validation technique would result in a meaningful evaluation and validation of the preliminary HSI values. In addition to validating preliminary HSI values for pre-purchase habitat conditions, we did the same for the future with development scenarios. The site development plans outlined for each parcel in the Corps' Letter Supplements helped detail specific habitat management activities to be accomplished (for example, shrub and tree plantings or guzzler construction). We assumed that funded habitat developments would be fully successful. Additionally, there may have been changes in management of the Compensation Plan lands since purchase by the Corps, for example, livestock grazing may have been eliminated or reduced. We estimated how the habitat developments and other habitat management changes would affect each of the habitat variables and determined whether they would cause the habitat variable estimates to move from one discrete category to another. We then calculated an HSI, covertype HSI, or LR SI for the future with development condition.

RESULTS

The Service began field work for the HSI validation study on May 24, 1995, completed the majority of it in June and finished it on September 12, 1995. We field checked representative portions of each of the 12 cover types identified by the Corps on cover type overlays and aerial photos for each of the 20 Compensation Plan parcels. Field visits revealed that due to cover-typing errors on aerial photo overlays, cover types were occasionally mislabelled. For example, some palustrine emergent wetlands were labelled as annual forbland or planted perennial grass and Great Basin wildrye grasslands were labelled as low-density shrub steppe. Since acreages were essentially unimportant in this study and future detailed cover-typing will occur on each site, it was determined unnecessary to correct these errors, at this time. However, we did attempt to sample each cover type, whether identified on overlays or not.

Appendix B identifies each of the HSI's, cover type HSI's and LR SI's we estimated using the validation technique. The HSI's for the species which use single cover types are presented in the first two tables in Appendix B. The remaining tables present the cover type HSI's and LR SI's for the remaining species by site. Preliminary HSI's, cover type HSI's and LR SI's within 0.2 of those estimated using the validation technique were assumed to be valid. During the course of this study, some of the preliminary values were changed. Some of these changes were made when

data entry errors, calculation errors or improper assumptions associated with the preliminary HEP were identified as part of the validation process. Any future adjustments to the preliminary HSI values may change the percentage of validated HSI values. The interagency team should be advised of any such future changes in preliminary HSI values, especially if those values are greater than 0.2 units from the validation HSI values.

The number of validation HSI values determined for the 20 Compensation Plan parcels was 1,101. Thirty-nine of these were for pre-purchase conditions on the Baillie Ranch for which there were no corresponding preliminary HSI values. The following calculations do not include these HSI values. A total of 347 validation HSI values (33 percent) were greater than 0.2 units from the preliminary HSI values. There were 183 of 504 validation HSI values for pre-purchase conditions (36 percent) and 164 of 558 future with development validation HSI values (29 percent) which were greater than 0.2 units from preliminary HSI values.

The validation and preliminary HSI's which were further than 0.2 units apart are identified in Appendix B. The interagency team resolved these discrepancies using the following rationale:

- 1) For parcels where habitat variables had been measured as part of the preliminary HEP the preliminary HSI's were assumed to be more accurate.
- 2) Where the difference could be ascribed to vigorous growth of herbaceous vegetation due to high precipitation during the 1995 growing season and/or reductions in grazing intensity, the preliminary HSI values were assumed to be more accurate.
- 3) For all other parcels, the validation HSI's were assumed to be more accurate because they were based on information collected as a result of on-the-ground field surveys and/or errors were identified in the preliminary HEP data.

Of the 347 total HSI values which were greater than 0.2 units apart, the team agreed that 306 (88 percent) should be resolved by using the validation HSI's. Fourteen (four percent) of the discrepancies were ascribed to vigorous vegetation growth. The remaining 27 (eight percent) discrepancies were resolved by assuming the preliminary HSI's were more accurate since measured HEP data had been collected at the site.

DISCUSSION

This study found that 67 percent of the validation HSI values were within 0.2 units of the preliminary HSI values. For the 33 percent of the HSI values that could not be validated, the interagency team was able to propose explanations for many of the differences and make recommendations about which HSI values to use. If the Corps agrees to use the proposed resolutions for each invalidated difference (either the validation or preliminary HSI value), the

determination of compensation resulting from acquisition and management of the 20 sites evaluated, should be more accurate than figures used to date.

Based on the findings and recommendations of this study, the Corps should recalculate the HU totals for the 20 parcels covered by this report. This information should be presented to the interagency team and other interested parties. While the techniques used for the preliminary and validation HSI determinations are each useful for determining roughly how the acquisition and management of Compensation Lands may mitigate for losses, they fall short of the precision found using measured HEP techniques. For example, we noted obvious differences in the habitat quality between some sites, although the validation HSI values did not reflect this. The validation technique was not sensitive enough to detect these differences, since each variable's estimate had to be placed within only three or four categories. Also, the validation technique was not applied to over one-third of the Compensation Plan lands.

However, we understand that measured HEP procedures are to be conducted on each site following implementation of initial habitat management activities. These procedures would be accomplished within a two year time period for each of the Compensation Plan parcels and would be repeated every ten years to monitor habitat changes. We recommend that the detailed HEP determinations be conducted following additional detailed cover typing using the Corps' recently obtained infrared aerial photography. We support the use of this intensive method of habitat evaluation and anticipate we would continue to actively participate in the HEP procedures.

In addition to the above, the following comments relate to specific concerns we have regarding certain variables and certain sites. Of the 111 validation LR SI's for ring-necked pheasant winter cover, 55 (50 percent) were greater than 0.2 units from the preliminary LR SI values, with the validation values often much less than the preliminary ones. Examining the individual variables for this life requisite SI revealed that the large variation in values was caused primarily by the variation in estimates of the percent canopy cover of vegetation which is persistent throughout the winter. The variation in the estimates is due in part to observer bias, and also the result of the fact that the measurements were conducted during the spring and fall. Field data (measured data along transects and ocular estimates) should be collected on several Compensation Plan parcels during late winter to confirm the values used for this variable.

We projected a future habitat condition for the Baillie Ranch based on the Letter Supplement and habitat development plan for the site. However, several years have passed since implementation of this plan and grazing pressure remains extremely high on much of the site. We believe that with continued heavy grazing, some of the HSI values which were projected to stay the same or improve over time would actually decline or stay the same, respectively. Planned future HEP assessments should identify any problems with projections of future HSI values. At that time, we recommend these projections be modified to reflect current management.

We noted a similar problem with heavy grazing at the Ferry Road site, except that implementation of grazing management actions has begun and the site is much smaller (117 acres). Grazing is

being used there to maintain a grazing and brooding area for Canada geese. The current level of grazing, however, is detrimental to the grassland and pasture habitat and not beneficial to Canada geese. If this level of grazing continues, we recommend that the HSI increases projected for future habitat conditions for pasture and grassland should be reduced to at least the pre-purchase HSI levels.

During field visits to some sites, we noted that management activities were not always in the exact location as identified in the Letter Supplement. Also, there were sometimes either fewer or more management activities being applied to the site than identified in the Letter Supplement. We assume that the agencies managing the Compensation Plan parcels may continue to deviate from the management plans occasionally as opportunities for habitat improvement occur, failures in some management activity require changes, new information on species' requirements and habitat management becomes available, etc. The above scenarios give additional support for the use of periodic HEP assessments to monitor the success or failure of management activities and changes in projected HSI values.

At least three sites (Benton City, Naches Road and Swank) contained islands (Canada goose nesting habitat) but did not have Canada goose habitat cover-typed. We recommend that the Corps determine whether islands, at these and any other sites, normally exist or are inundated during the goose nesting season. HSI values for the Canada goose model should be determined for those sites with islands present throughout the nesting season.

LITERATURE CITED

U.S. Army, Corps of Engineers. 1991. Special Report - Lower Snake River Fish and Wildlife Compensation - Wildlife Habitat Compensation Evaluation for the Lower Snake River Project. Unpublished report. Prepared by Walla Walla District, Corps of Engineers, U.S. Fish and Wildlife Service, and Washington Department of Fish and Wildlife. Walla Walla, WA. 59 pp.

U.S. Fish and Wildlife Service. 1988. Interim report - Lower Snake River Project wildlife compensation evaluation. Unpublished report. Prepared by V. Saab, Boise Field Office, Boise, ID. 17 pp + appendices.

Wakely, J.S. and L. J. O'Neil. 1988. Techniques to increase efficiency and reduce effort in applications of the Habitat Evaluation Procedures (HEP). Technical Report EL-88-13, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. 52 pp.

APPENDIX A

Description of each species' model and discrete categories for each variable
used with the HSI validation techniques for 20
Lower Snake River Compensation Plan Lands

Species model descriptions and discrete habitat variables

Downy woodpecker- This species' habitat includes palustrine forest (PF) and a small amount of upland forest. The model evaluates food and reproduction needs. Optimum feeding habitat is represented by low to moderate stand densities (50 to 100 ft²/acre dbh or 10 to 20 12-inch trees/acre) and at least 5 6-inch dbh snags/acre. SI goes down with > 150 ft²/acre or 30 12-inch trees.

SI₁ - basal area of trees - no trees = 0, < 20 ft²/ac = .2, > 20 ft²/ac = .9 (note- 25 ft² basal area/acre = 60 inches of dbh/acre or five 12-inch trees/acre.

SI₂ - number of snags > 6" dbh/acre - no snags = 0, 1 = .2, 2 or 3 = .5, 4 or more = .9

HSI = lowest SI value

Yellow warbler- Scrub/shrub wetland (PSS) comprises the primary habitat in the study area. The model measures reproductive habitat suitability, which is assumed to meet all habitat needs. Optimum habitat conditions occur with moderate to high shrub densities (60 to 80%) which average at least 7 feet in height. Hydrophytic shrubs (willow, cottonwood, elderberry, and olive) increase the value of PSS for yellow warblers with 100% cover optimal.

SI₁ - live deciduous shrub canopy cover < 20 ft tall - no shrubs = 0, < 20 % = .2, > 20 % and < 50 % = .5, > 50 % = .9

SI₂ - shrub height- no shrubs = 0, < 2 ft = .2, > 2 ft and < 4 ft = .5, and > 4 ft = .9

SI₃ -% shrub canopy which is hydrophytic - < 25 % = .2, > 25 % and < 75 % = .5, > 75 % = .9

HSI = (SI₁ * SI₂ * SI₃)^{1/2}

Marsh wren- This is the representative species using emergent wetlands (PEM). The cover and reproductive requirements of the bird are addressed with this model and assumes other habitat needs are met if these are satisfied. Optimum vegetation types are cattail or bulrush dominated wetlands with a closed canopy (> 80%) of herbaceous cover (except Equisetum), water depth > 5 inches and no woody canopy cover.

SI₁ - growth form of dominant (>30 %) emergents - cattail, cordgrass, bulrush = 1.0, bluejoint, reed canarygrass = .5, buttonbush = .1, other = 0

SI₂ - canopy cover of persistent and nonpersistent emergent species - zero = 0, < 50 % = .1, between 50 % and 75 % = .5, > 75 % = .9

SI₃ - mean water depth - zero = 0, < 3 " = .2, > 3 " = .9

SI₄ - woody canopy cover - 100 % = 0, > 65 % = .2, between 35 % and 65 % = .5, < 35 % = .9

$$HSI = (SI1 * SI2 * SI3)^{1/3} * SI4$$

Song sparrow- Song sparrows are found primarily in mesic shrubland (MS) and shrub understory of riparian forests (PF). MS consists of hackberry, hawthorn, chokecherry and blackberry. Optimum habitat conditions occur with a moderate to high shrub canopy (40 to 80%) which averages between 4 1/2 to 11 feet tall and is less than 1/4 mile from water or PF.

SI₁ - shrub canopy cover (all woody < 20 ft tall) - zero = 0, < 20 % = .2, > 20 % = .9

SI₂ - shrub height - zero = 0, < 3 ft = .2, > 3 ft = .9

SI₃ - distance to water - > 1/2 mile = 0, between 1/4 and 1/2 mile = .2, < 1/4 mile = .9

$$HSI = \text{minimum of } (SI1 * SI2)^{1/2} \text{ or } SI3$$

River otter- This species is presumed to primarily use the 250 ft. band along shorelines and all islands (SHOR). Optimum shoreline cover is at least 80 % cover of rocks, riprap, log jams, undercut banks, docks, & vegetation other than pasture (P), grassland (G), or annual formland or planted perennial grass (AFG) (note- ocular estimates were used for this model during preliminary HEP analyses) with less than 35 feet from water to cover. Potential den sites (hollow log, tree roots, rock ledges, abandoned beaver, muskrat, marmot burrows) were optimal if less than an average of 35 feet from water.

SI₁ - denning site availability - > 250 ft = .1, between 35 and 250 ft = .5, < 35 ft = 1.0

SI₂ - distance to cover - > 225 ft = 0, between 225 and 150 = .2, < 150 = .9

SI₃ - cover density - zero = 0, 1-20 % = .2, between 21 and 50 % = .4, between 51 and 80 % = .7, > 80 % = 1.0

$$HSI = (SI1 * SI2 * SI3)^{1/3}$$

Canada goose- This model evaluates nesting and brood-rearing habitat within 330 feet of the shoreline (SHOR100). Optimum nesting conditions are at least 1 island with high shoreline ratio(long and narrow) and moderate canopy cover. Optimal brood-rearing habitat consisted of at least one acre of pasture (P) or forblands (AFG), which is accessible to goslings and has little shoreline cover and minimal or no cover surrounding the P or AFG. Brood-rearing habitat must be within 1 mile of a nesting tub or island.

SI₁ - nest island suitability - no islands or tubs w/in 1 mile segment = 0, 1 island w/ no vegetation or at least 1 tub = .3, 1 island w/ low shoreline/area ratio and/or high or minimal canopy cover = .6, 1 island w/ high shoreline/area ratio and moderate canopy cover = 1.0

SI₂ - brood-rearing habitat - cut banks, riprap or broad expanses of other cover types or no pasture/forb = 0, at least 1 acre accessible habitat w/ moderate shoreline cover and/or moderate cover surrounding pasture or suitable herbaceous forage present for only part of

brooding period = .5, at least 1 acre of accessible habitat w/ little or no shoreline cover and minimal to no cover surrounding pasture and suitable herbaceous forage present = 1.0

HSI = minimum of SI1 or SI2

Mallard- This model evaluates brood-rearing habitat of palustrine open-water (POW) with shoreline consisting of wetland/riparian cover types (PEM, PSS, PF), mesic shrublands (MS), and forblands (AFG). Optimum conditions occurred with 100% shoreline cover of these cover types. Those areas accessible only by walking or boat were assumed to be optimal, from a disturbance standpoint. (note- visual estimates from aerial photos)

SI₁ - % shoreline cover - zero = 0, between 0 and 30 % = .2, between 30 and 70 % = .5, > 70 % = .9

SI₂ - disturbance level - continuous (park) = .1, frequent (easy walking distance from major road or high maintenance habitat management unit (HMU) = .3, occasional (located near a secondary road) = .6, accessible by walking or boat = .9

HSI = SI1 * SI2

Western meadowlark- Habitat for this common species was considered to include all nonagricultural upland cover types (G, SSH, SSL, AFG). Optimum conditions occur with at least 70 % herbaceous cover (with at least 60 % grass) with an average plant height of between 8 and 16 inches. Optimum shrub canopy is < 5 % and average distance to perch sites (tall plant, post, or wire at least 20 inches tall) is < 100 feet.

SI₁ - % herbaceous canopy cover - zero = 0, < 50 % = .2, > 50 % = .9

SI₂ - % herbaceous canopy cover which is grass - zero = 0, < 50 % = .2, > 50 % = .9

SI₃ - mean herbaceous plant height - zero or greater than 30 inches = 0, < 4" or between 24 and 30 " = .2, between 4 and 24" = .9

SI₄ - distance to perch site - > 150 ft = .2, < 150 ft = .9

SI₅ - % shrub canopy cover - > 40 % = 0, < 40 % and > 25 % = .2, < 25 % = .9

Cover type HSI = (SI1 * SI2 * SI3 * SI4)^{1/2} * SI5

Mule deer- Mule deer use all vegetated nonagricultural cover types in the area including G, MS, PF, PSS, SSH, SSL and AFG. The model evaluates winter food requirements. Optimum cover of shrubs < 5 feet tall is between 50 and 60% with between 40 and 60 % preferred shrub (rabbitbrush, sagebrush, willow, rose and bitterbrush) canopy cover. Herbaceous canopy is optimum when greater than 30 %.

SI₁ - % canopy cover of shrubs < 5 ft. in height - zero = 0, < 30 % = .2, > 30 % = .9

SI₂ - % canopy cover of preferred shrubs < 5 ft - zero = 0, < 20 % = .2, > 20 % = .9

SI₃ - % herbaceous canopy - zero = 0, < 20 % = .2, > 20 % = .9

$$\text{Cover type HSI} = \frac{3(\text{SI}_1 * \text{SI}_2)^{1/2} + \text{SI}_3}{4}$$

Chukar- Habitat evaluated consisted of shrubsteppe and grass (SSH, SSL, G). Optimal vegetation conditions include between 25 and 75 % herbaceous cover, < 25 % shrub canopy cover and < 1/2 mile to mesic shrub (MS). Optimum topographic conditions include mountainous terrain and < 1 mile to exposed rocky areas (5 acres or greater in size).

SI₁ - % herbaceous canopy cover - zero = 0, < 10 % or > 95 % = .2, between 10 % and 95 % = .9

SI₂ - % shrub canopy cover - > 75 % = 0, between 50 and 75 % = .2, < 50 % = .9

SI₃ - distance to exposed rock - > 1.5 miles = .2, < 1.5 miles = .9

SI₄ - distance to mesic shrublands - > 1 mile = 0, between 3/4 and 1 mile = .2, < 3/4 mile = .9

SI₅ - topographic class - level = 0, rolling = .4, rolling with ridges and rims = .8, mountainous = 1.0

$$\text{Cover type HSI} = [\text{minimum of } (\text{SI}_1^2 * \text{SI}_2)^{1/3} \text{ or } (\text{SI}_1 * \text{SI}_2)^{1/2}] * (\text{minimum of SI}_3 \text{ or SI}_4 \text{ or SI}_5)$$

Ring-necked pheasant- Habitat included all upland and wetland vegetated cover types except grassland (AC, MS, P, PEM, PF, PSS, SSH, SSL, AFG). The three life requisites (LR) evaluated with this model included reproduction, winter cover, and winter food. For nesting cover, optimal conditions included a herbaceous canopy of 50 to 90% with an average height of 24 to 32 inches. For agricultural land (AC) or pasture (P), optimal conditions occurred when there was no mowing or plowing during the nesting season. For winter cover, AC and P are not included and optimal conditions occurred with 30 to 70 % canopy of persistent vegetation which is > 20 inches tall and < 5 feet tall and < 650 feet to winter food (AC, MS, AFG). For the winter food LR, the optimal cover type was AC. Each of these life requisites must be present for usable pheasant habitat.

--Reproduction LR - MS, PF, PSS, SSH, SSL, AFG

SI₁ - % herbaceous canopy cover - zero = 0, < 20% = .2, > 20 % = .9

SI₂ - average height of herbaceous canopy - < 4 in and greater than 40 in = 0, between 4 and 14 inches or 36 and 40 in = .2, between 15 and 36 in = .9

SI₃ - mowing category - mowed often during nesting season = 0, mowed or plowed before June 15 = .3, not mowed or plowed during nesting season = 1.0

Reproduction LR SI = (SI1 * SI2)^{1/2}

Reproduction LR SI (AC and P) = SI3

--Winter Cover LR - all cover types with persistent cover in form of herbs (AFG and PEM) and shrubs (MS, PF, PSS, SSH, SSL)

SI₁ - % canopy cover persistent winter vegetation > 20 inches in height - zero or 100 % = 0, between 0 and 15 % or 80 and 100 % = .2, between 15 and 80 % = .9

SI₂ - distance to nearest winter food (AC, MS, AFG) - > 1/2 mile = 0, between 1,800 ft. and 1/2 mile = .2, < 1,800 ft. = .9

Winter cover LR SI = SI1 * SI2

--Winter Food LR - all cover types except pasture and emergent wetlands (AC, MS, PF, PSS, SSL, SSH, G, AFG)

SI₁ - winter food type - PSS, SSL, SSH, G = .3, PF = .4, MS = .5, AFG = .7, AC = 1.0

Winter food LR SI = SI1

California quail- Habitat included all cover types except PEM, POW, and shoreline (SHOR). The life requisites evaluated included food, escape cover, and winter roost cover. For the food LR, optimal conditions occurred with 25 to 75 % herbaceous cover, < 150 ft. to escape cover (MS, PF, PSS, G, SSL, SSH, AFG), and < 1,000 ft. to roost cover (MS, PF, PSS, SSH). For escape cover LR, optimal conditions occurred with densest vegetation and with closest roost cover. Specifically, herbaceous cover should be > 50% with an average height of 24 inches, shrub cover should be at least 30 % with an average height of at least 3 feet, and the distance to winter roost cover should be < 1,000 feet. For the winter roost cover LR, only MS, PF, PSS and SSH were considered to provide necessary habitat. Shrub canopy should be at least 20 % with an average height of 5 feet and the distance to escape cover should be < 150 feet. Each of these life requisites must be present for usable quail habitat.

--Food LR-

SI₁ - distance to escape cover - > 500 ft. = 0, between 300 and 500 ft = .2, < 300 ft = .9

SI₂ - distance to roost cover - > 1,600 ft = 0, between 1,300 and 1,600 = .2, < 1,300 = .9

SI₃ - % herbaceous cover - zero = 0, < 10 % or > 90 % = .2, between 10 and 90 % = .9

Food LR SI (AC) = Minimum of SI1 or SI2

Food LR SI (other cover types) = (Minimum of SI1 or SI2) * (.75 * SI3)

-- Escape cover LR - (all but AC) G, MS, PSS, PF, SSH, SSL, AFG

SI₁ - % herbaceous canopy - zero = 0, < 25 % = .2, > 25 % = .9

SI₂ - average herbaceous canopy height - < 10 in. = 0, between 10 and 20 inches = .2, > 20 in = .9

SI₃ - % shrub canopy cover - zero = 0, < 10 % = .2, > 10 % = .9

SI₄ - shrub height - zero = 0, < 20 in = .2, > 20 in = .9

SI₅ - distance to winter roost - > 1,600 ft. = 0, between 1,300 and 1,600 ft. = .2, < 1,300 ft = .9

Escape cover LR SI = [Maximum of (SI1 * SI2)^{1/2} or (SI3 * SI4)^{1/2}] * SI5

--Winter roost cover LR - MS, PF, PSS, SSH

SI₁ - % shrub canopy cover - zero = 0, < 10 % = .2, > 10 % = .9

SI₂ - shrub height - zero = 0, < 48 in. = .2, > 48 in. = .9

SI₃ - distance to escape cover - > 500 ft. = 0, between 300 and 500 ft = .2, < 300 ft = .9

Winter Roost LR SI = (SI1 * SI2)^{1/2} * SI3

APPENDIX B

**Validation HSI's, cover type HSI's and LR SI's for
Pre-purchase and Future Habitat Conditions for 20
Lower Snake River Compensation Plan Lands**

Table 1- Validation HSI's for single covertime species with pre-purchase habitat conditions.

<u>Site Name</u>	downy woodpecker	yellow warbler	marsh wren	river otter	mallard	Canada goose
Baillie Ranch	0.0	0.5	0.41	--	0.45	0.3
Benton City	0.9	--	--	0.43	--	--
Campbell	0.5**a	--	--	0.56	--	--
Central Ferry	--	--	--	--	--	--
Couse Creek	0.1**a	--	--	0.45	--	--
Donald Road	0.9	0.9	0.33	0.77**a	0.54**a	--
Ferry Road	0.2**a	--	--	0.26	--	0.0**a
Fisher Gulch	0.5**	--	--	0.26	--	--
Hartsock	0.9**a	--	--	0.68**b	--	--
John Henley	--	--	--	--	--	--
Kelly Bar	0.2	--	--	--	--	--
Naches Road	0.2**d	0.85	--	0.45	--	--
Nisqually John	0.9**c	--	--	--	--	--
Pintler Creek	0.5**c	--	--	--	--	--
Revere Ranch	0.9	0.9**d	0.42	0.56	0.54**c	--
Shumaker	0.0	--	--	0.55	--	--
Sulphur Creek	0.2**a	--	0.24	0.24	0.0	0.0
Swank	0.0**a	--	--	0.45	--	--
Whitstran	0.2**c	0.64	0.69**c	0.43	0.54**c	--
Windmill Ranch	0.9	0.67	0.33	--	0.3	0.5**c

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

** preliminary HSI data not available since covertime not originally recognized; use validation HSI values

^a difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^b difference is unexplained, but assume preliminary HSI values are closer since measured HEP data collected here

^c difference likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^d difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing; assume preliminary HSI values are closer

Table 2- Validation HSI's for single covertime species with future habitat conditions.

<u>Site Name</u>	downy woodpecker	yellow warbler	marsh wren	river otter	mallard	Canada goose
Baillie Ranch	0.5	0.5	0.41	--	0.45**	0.3
Benton City	0.9	--	--	0.43	--	--
Campbell	0.9	--	--	0.56	--	--
Central Ferry	--	--	--	--	--	--
Couse Creek	0.9	--	--	0.45	--	--
Donald Road	0.9	0.9	0.18	0.77**	0.54**	--
Ferry Road	0.9	--	--	0.26	--	0.3
Fisher Gulch	0.9**	--	--	0.26	--	--
Hartsock	0.9	--	--	0.68* ^b	0.54**	--
John Henley	--	--	--	--	--	--
Kelly Bar	0.5	--	--	--	--	--
Naches Road	0.9	0.85	--	0.45	--	--
Nisqually John	0.9** ^a	--	--	--	--	--
Pintler Creek	0.9** ^a	--	--	--	--	--
Revere Ranch	0.9	0.9	0.42	0.56	0.54* ^c	--
Shumaker	0.5	--	--	0.55	--	--
Sulphur Creek	0.9	--	0.40* ^b	0.24	0.27	0.3
Swank	0.2**	--	--	0.45	--	--
Whitstran	0.9	0.64* ^c	0.69* ^c	0.43	0.54* ^c	--
Windmill Ranch	0.9	0.9	0.33	--	0.3	0.5* ^c

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

** preliminary HSI data not available since covertime not originally recognized; use validation HSI values

^a difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^b difference is unexplained, but assume preliminary HSI values are closer since measured HEP data collected here

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 3- Baillie Ranch validation HSI's, coertype HSI's and LR^a SI's for the pre-purchase and future habitat conditions. The Corps assigned 0.0's for all pre-purchase HSI's since this parcel is leased and receives no mitigation credit.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.0	0.0	--	0.34	--	--	--
mule deer	0.23	0.0	--	0.05	0.2	--	0.23	--	--	--
chukar **	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67	0.45	--	--	0.2	--	0.9	--	--	1.0
wintercover LR	0.18	0.18	--	--	0.02	--	0.18	0.81	--	--
winter food LR	0.4	0.3	--	--	0.3	--	0.7	--	--	--
California quail-food LR	0.61	0.61	--	0.33	0.03	--	0.61	--	--	--
escape LR	0.95	1.0	--	--	0.1	--	0.45	--	--	--
winter roost LR	0.85	0.9	--	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9 ^{*b}	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.18 ^{***}	0.24	--	0.54 ^{*c}	--	--	--
mule deer	0.33 ^{*b}	0.33	--	0.05 ^{***}	0.2	--	0.23	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67	0.9	--	--	0.2 ^{*c}	--	0.95 ^{*d}	--	--	1.0
wintercover LR	0.45 ^{*c}	0.45 ^{*c}	--	--	0.18	--	0.18	0.81	--	--
winter food LR	0.4	0.3	--	--	0.3	--	0.7	--	1.0	--
California quail-food LR	0.61 ^{*b}	0.61 ^{*b}	--	0.33 ^{***}	0.19	--	0.61	--	--	--
escape LR	1.0	1.0	--	--	0.25	--	0.45 ^{*b}	--	--	--
winter roost LR	0.9	0.9	--	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

** insufficient exposed rock for chukar requirements

*** grassland coertype was not evaluated with the preliminary HEP

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^c difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^d difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing pressure; assume preliminary HSI values are closer

Table 4- Benton City validation HSI's, covertime HSI's and LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE- PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub**	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.73* ^b	--	--	--	--	--	--
mule deer	0.73* ^c	--	0.4	0.40	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67* ^c	--	0.42	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.18* ^c	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.61	--	0.34* ^c	0.68* ^c	--	--	--	--	--	--
escape LR	1.0	--	0.95	--	--	--	--	--	--	--
winter roost LR	0.9* ^c	--	0.86	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.73* ^b	--	--	--	--	--	--
mule deer	0.73* ^c	--	0.4	0.4	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67* ^c	--	0.42	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.18* ^c	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.61	--	0.61	0.68* ^c	--	--	--	--	--	--
escape LR	1.0	--	1.0	--	--	--	--	--	--	--
winter roost LR	0.9* ^c	--	0.9	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

** this covertime was not sampled so must use preliminary HSI values

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing pressure; assume preliminary HSI values are closer

^c difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

Table 5 - Campbell validation HSI's, coertype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
Species										
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	0.34	--	0.3	--	--	--
mule deer	0.73 ^{*b}	--	0.46 ^{*c}	0.13 ^{*b}	0.38	--	0.23	--	--	--
chukar	--	--	--	0.72	0.72	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67 ^{*b}	--	0.67	--	0.67 ^{*d}	--	0.9 ^{*d}	--	--	--
wintercover LR	0.18 ^{*b}	--	0.18 ^{*b}	--	0.18	--	0.18	--	--	--
winter food LR	0.4	--	0.5	--	0.3	--	0.7	--	--	--
California quail-food LR	0.61 ^{*b}	--	0.61	0.14	0.14	--	0.68	--	--	--
escape LR	1.0	--	0.95	--	0.13	--	0.81 ^{*d}	--	--	--
winter roost LR	0.9	--	0.85	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	0.34	--	0.41 ^{*b}	--	--	--
mule deer	0.55	--	0.73	0.28	0.38	--	0.23	--	--	--
chukar	--	--	--	0.72	0.72	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.42 ^{*b}	--	0.67	--	0.67 ^{*c}	--	0.9 ^{*b}	--	--	--
wintercover LR	0.18	--	0.45 ^{*b}	--	0.18	--	0.18	--	--	--
winter food LR	0.4	--	0.5	--	0.3	--	0.7	--	--	--
California quail-food LR	0.34 ^{*b}	--	0.61	0.14 ^{*c}	0.14 ^{*c}	--	0.68	--	--	--
escape LR	1.0	--	0.95	--	0.45 ^{*c}	--	0.81 ^{*d}	--	--	--
winter roost LR	0.9	--	0.85	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^d difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing pressure; assume preliminary HSI values are closer

Table 6- Central Ferry validation HSI's, coverytype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	--	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.16	--	--	--	--	--	--
mule deer	--	--	--	0.23	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	--	--	--	--	--	--	--	--	--	--
wintercover LR	--	--	--	--	--	--	--	--	--	--
winter food LR	--	--	--	--	--	--	--	--	--	0.3
California quail-food LR	--	--	--	0.0	--	--	--	--	--	--
escape LR	--	--	--	--	--	--	--	--	--	--
winter roost LR	--	--	--	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	--	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.36	--	--	0.57	--	--	--
mule deer	--	--	--	0.23	--	--	0.23	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	--	--	--	--	--	--	0.9* ^b	--	--	0.0
wintercover LR	--	--	--	--	--	--	0.18	--	--	--
winter food LR	--	--	--	--	--	--	0.7	--	--	--
California quail-food LR	--	--	--	0.61* ^c	--	--	0.68	--	--	--
escape LR	--	--	--	--	--	--	0.0	--	--	--
winter roost LR	--	--	--	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b assumes appropriate management to prevent decadent conditions from developing

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 7- Couse Creek validation HSI's, covertime HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.93 ^{*b}	--	0.57	0.13	--	--	--	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.95 ^{*b}	--	0.95 ^{*b}	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.18 ^{*b}	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.68	--	0.61	0.61 ^{*b}	--	--	--	--	--	--
escape LR	1.0 ^{*b}	--	0.9 ^{*b}	--	--	--	--	--	--	--
winter roost LR	1.0	--	0.9	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.93 ^{*b}	--	0.93 ^{*b}	0.13	--	--	--	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.95 ^{*b}	--	0.95 ^{*b}	--	--	--	--	--	--	--
wintercover LR	0.18 ^{*b}	--	0.18 ^{*b}	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.68	--	0.61	0.61 ^{*b}	--	--	--	--	--	--
escape LR	1.0 ^{*b}	--	0.9 ^{*b}	--	--	--	--	--	--	--
winter roost LR	1.0	--	0.9	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

Table 8 - Donald Road validation HSI's, covertime HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	--	--	--	--	--	--
mule deer	0.73 ^{*b}	0.29 ^{*b}	0.46	0.2	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.42	0.14 ^{*b}	0.9 ^{*b}	--	--	--	--	0.45 ^{*b}	--	0.3
wintercover LR	0.18	0.81	0.18 ^{*b}	--	--	--	--	--	--	--
winter food LR	0.4	0.3	0.5	--	--	--	--	--	1.0	--
California quail-										
food LR	0.61	0.14 ^{*b}	0.68	0.34 ^{*b}	--	--	--	--	0.18	--
escape LR	1.0 ^{*c}	1.0	0.95 ^{*c}	--	--	--	--	--	--	--
winter roost LR	0.85 ^{*c}	0.9	0.85 ^{*b}	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	--	--	--	--	--	--
mule deer	0.73 ^{*b}	0.29 ^{*b}	0.46	0.2	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.42	0.14 ^{*b}	0.9 ^{*b}	--	--	--	--	0.45 ^{*b}	--	1.0 ^{*c}
wintercover LR	0.18	0.81	0.18 ^{*b}	--	--	--	--	--	--	--
winter food LR	0.4	0.3	0.5	--	--	--	--	--	1.0	--
California quail-										
food LR	0.61	0.14 ^{*b}	0.68	0.34 ^{*b}	--	--	--	--	0.18	--
escape LR	1.0 ^{*c}	1.0	0.95 ^{*c}	--	--	--	--	--	--	--
winter roost LR	0.85 ^{*c}	0.9	0.85 ^{*b}	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 9- Ferry Road validation HSI's, coverytype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.08 ^{*b}	--	--	0.08 ^{*b}	--	--	--
mule deer	0.2 ^{*b}	--	--	0.05 ^{*b}	--	--	0.05	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.2 ^{*b}	--	--	--	--	--	0.0 ^{*b}	--	--	0.3
wintercover LR	0.18 ^{*b}	--	--	--	--	--	0.0 ^{*b}	--	--	--
winter food LR	0.4	--	--	--	--	--	0.7	--	--	--
California quail-food LR	0.34 ^{*b}	--	--	0.0 ^{*b}	--	--	0.14 ^{*b}	--	--	--
escape LR	1.0	--	--	--	--	--	0.0	--	--	--
winter roost LR	0.9	--	--	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	--	--	0.73	--	--	--
mule deer	0.43	--	--	0.28	--	--	0.05	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.32 ^{*b}	--	--	--	--	--	0.9 ^{*b}	--	--	0.3
wintercover LR	0.18 ^{*b}	--	--	--	--	--	0.0	--	--	--
winter food LR	0.4	--	--	--	--	--	0.7	--	1.0	--
California quail-food LR	0.61	--	--	0.61 ^{*c}	--	--	0.14 ^{*c}	--	0.9 ^{*c}	--
escape LR	1.0	--	--	--	--	--	0.6 ^{*b}	--	--	--
winter roost LR	0.9	--	--	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 10 - Fisher Gulch validation HSI's, coertype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9 ^{*b}	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	0.77 ^{*b}	--	--	--
mule deer	0.38 ^{*b}	--	0.46	0.23	--	--	0.4 ^{*b}	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.9 ^{*b}	--	0.9 ^{*c}	--	--	--	0.95 ^{*b}	--	--	--
wintercover LR	0.18 ^{*b}	--	0.18 ^{*c}	--	--	--	0.18 ^{*b}	--	--	--
winter food LR	0.4 ^{*b}	--	0.5	--	--	--	0.7 ^{*b}	--	--	--
California quail-food LR	0.68 ^{*b}	--	0.68 ^{*c}	0.0	--	--	0.61 ^{*b}	--	--	--
escape LR	1.0 ^{*b}	--	1.0	--	--	--	0.81 ^{*b}	--	--	--
winter roost LR	0.9 ^{*b}	--	0.85	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9 ^{*b}	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	0.77 ^{*b}	--	--	--
mule deer	0.9 ^{*b}	--	0.9	0.23	--	--	0.4 ^{*b}	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.9 ^{*b}	--	0.9 ^{*c}	--	--	--	0.95 ^{*b}	--	--	--
wintercover LR	0.45 ^{*b}	--	0.45	--	--	--	0.18 ^{*b}	--	--	--
winter food LR	0.4 ^{*b}	--	0.5	--	--	--	0.7 ^{*b}	--	--	--
California quail-food LR	0.68 ^{*b}	--	0.68	0.0	--	--	0.61 ^{*b}	--	--	--
escape LR	1.0 ^{*b}	--	1.0	--	--	--	0.81 ^{*b}	--	--	--
winter roost LR	0.9 ^{*b}	--	0.85	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is unexplained, but assume preliminary HSI values are closer since measured HEP data collected here

Table 11- Hartsock validation HSI's, covertime HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.5	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.16	--	--	--	--	--	--
mule deer	0.9 ^{*b}	--	0.9 ^{*c}	0.23	--	--	--	--	--	--
chukar	--	--	--	0.36	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.42 ^{*c}	--	0.42	--	--	--	--	--	--	0.3
wintercover LR	0.18 ^{*c}	--	0.45 ^{*c}	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.61 ^{*c}	--	0.61 ^{*c}	0.0	--	--	--	--	--	--
escape LR	1.0	--	1.0	--	--	--	--	--	--	--
winter roost LR	0.9	--	0.4	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.16	--	--	0.77 ^{*b}	--	--	--
mule deer	0.9 ^{*b}	--	0.9	0.23	--	--	0.25	--	--	--
chukar	--	--	--	0.36 ^{*c}	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67	--	0.9 ^{*c}	--	--	--	0.95 ^{*c}	--	--	--
wintercover LR	0.45 ^{*c}	--	0.81	--	--	--	0.18	--	--	--
winter food LR	0.4	--	0.5	--	--	--	0.7	--	--	--
California quail-food LR	0.61	--	0.61	0.61	--	--	0.61	--	--	--
escape LR	1.0	--	1.0	--	--	--	0.40 ^{*b}	--	--	--
winter roost LR	0.9	--	0.85	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^c difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

Table 12 - John Henley validation HSI's, coverype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
Species										
song sparrow	--	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.16	0.19	--	--	--	--	--
mule deer	--	--	0.38	0.23	0.44	--	--	--	--	--
chukar	--	--	--	0.0	0.0	--	--	--	--	--
ring-necked pheasant-reproduction LR	--	--	0.9 ^{*b}	--	0.32	--	--	--	--	0.3 ^{*b}
wintercover LR	--	--	0.18 ^{*b}	--	0.18	--	--	--	--	--
winter food LR	--	--	0.5	--	0.3	--	--	--	--	--
California quail-food LR	--	--	0.67	0.0	0.0	--	--	--	--	--
escape LR	--	--	1.0	--	0.0	--	--	--	--	--
winter roost LR	--	--	0.9	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	--	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.36	0.34	--	--	--	--	--
mule deer	--	--	0.38 ^{*b}	0.23	0.54	--	--	--	--	--
chukar	--	--	--	0.36	0.36	--	--	--	--	--
ring-necked pheasant-reproduction LR	--	--	0.9 ^{*b}	--	0.42	--	--	--	--	--
wintercover LR	--	--	0.81	--	0.81 ^{*c}	--	--	--	--	--
winter food LR	--	--	0.5	--	0.3	--	--	--	--	--
California quail-food LR	--	--	0.67	0.61	0.61	--	--	--	--	--
escape LR	--	--	1.0	--	0.45	--	--	--	--	--
winter roost LR	--	--	0.9	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 13 - Kelly Bar validation HSI's, covertime HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	--	--	--	--	--	--
mule deer	0.73 ^{*b}	--	0.73 ^{*b}	0.05	--	--	--	--	--	--
chukar	--	--	--	0.49 ^{*d}	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.2	--	0.2	--	--	--	--	--	--	--
wintercover LR	0.45	--	0.18 ^{*b}	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-										
food LR	0.34 ^{*c}	--	0.14	0.0	--	--	--	--	--	--
escape LR	0.9 ^{*c}	--	0.9	--	--	--	--	--	--	--
winter roost LR	0.81 ^{*c}	--	0.81	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.73	--	0.80	0.13	--	--	--	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.32 ^{*b}	--	0.32	--	--	--	--	--	--	--
wintercover LR	0.45 ^{*b}	--	0.18 ^{*b}	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-										
food LR	0.61 ^{*c}	--	0.61	0.07	--	--	--	--	--	--
escape LR	0.9 ^{*c}	--	0.9	--	--	--	--	--	--	--
winter roost LR	0.81 ^{*c}	--	0.81	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^d difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing pressure; assume preliminary HSI values are closer

Table 14- Naches Road validation HSI's, covertime HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.29	0.73	--	0.2	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.2	0.32	--	--	--	--	--	--	--	--
wintercover LR	0.04	0.81 ^{*b}	--	--	--	--	--	--	--	--
winter food LR	0.4	0.3	--	--	--	--	--	--	--	--
California quail-										
food LR	0.14 ^{*b}	0.34 ^{*b}	--	0.34 ^{*b}	--	--	--	--	--	--
escape LR	0.95 ^{*c}	1.0 ^{*c}	--	--	--	--	--	--	--	--
winter roost LR	0.85 ^{*c}	0.85 ^{*c}	--	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.37	0.73	--	0.2	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.2	0.32	--	--	--	--	--	--	--	--
wintercover LR	0.04	0.81 ^{*b}	--	--	--	--	--	--	--	--
winter food LR	0.4	0.3	--	--	--	--	--	--	--	--
California quail-										
food LR	0.14 ^{*c}	0.34 ^{*c}	--	0.34 ^{*b}	--	--	--	--	--	--
escape LR	0.95 ^{*c}	1.0 ^{*c}	--	--	--	--	--	--	--	--
winter roost LR	0.85 ^{*c}	0.85 ^{*c}	--	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 15- Nisqually John validation HSI's, covertype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.33 ^{*b}	0.33	--	--	--	--	--
mule deer	0.49	--	0.9 ^{*b}	0.19	0.38	--	--	--	--	--
chukar	--	--	--	0.72 ^{*b}	0.72	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.45	--	0.42 ^{*b}	--	0.42	--	--	--	--	--
wintercover LR	0.18	--	0.81 ^{*b}	--	0.45	--	--	--	--	--
winter food LR	0.4	--	0.5	--	0.3	--	--	--	--	--
California quail-										
food LR	0.68 ^{*c}	--	0.61 ^{*c}	0.0	0.34 ^{*b}	--	--	--	--	--
escape LR	1.0 ^{*c}	--	1.0	--	0.21 ^{*b}	--	--	--	--	--
winter roost LR	0.9 ^{*c}	--	1.0	--	0.38	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.54	0.33	--	--	--	--	--
mule deer	0.93 ^{*b}	--	0.9	0.38	0.46	--	--	--	--	--
chukar	--	--	--	0.76	0.72	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.9 ^{*c}	--	0.42	--	0.9 ^{*b}	--	--	--	--	--
wintercover LR	0.45 ^{*c}	--	0.81	--	0.45	--	--	--	--	--
winter food LR	0.4	--	0.5	--	0.3	--	--	--	--	--
California quail-										
food LR	0.68 ^{*c}	--	0.61	0.68 ^{*b}	0.61	--	--	--	--	--
escape LR	1.0 ^{*c}	--	1.0	--	0.81	--	--	--	--	--
winter roost LR	0.9 ^{*c}	--	1.0	--	0.38	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 16- Pintler Creek validation HSI's, covertime HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.41 ^{*b}	0.34	--	--	--	--	--
mule deer	0.28	--	0.6 ^{*b}	0.25	0.38	--	--	--	--	--
chukar	--	--	--	0.76 ^{*b}	0.72	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.5	--	0.67 ^{*c}	--	0.67 ^{*c}	--	--	--	--	--
wintercover LR	0.04 ^{*b}	--	0.18 ^{*b}	--	0.18	--	--	--	--	--
winter food LR	0.4	--	0.5	--	0.3	--	--	--	--	--
California quail-food LR	0.61	--	0.61 ^{*b}	0.0	0.0	--	--	--	--	--
escape LR	1.0	--	1.0	--	0.0	--	--	--	--	--
winter roost LR	1.0	--	0.9 ^{*b}	--	0.28	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.41	0.34	--	--	--	--	--
mule deer	0.73	--	0.9	0.25	0.38	--	--	--	--	--
chukar	--	--	--	0.76	0.72	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67 ^{*b}	--	0.9 ^{*c}	--	0.67 ^{*c}	--	--	--	--	--
wintercover LR	0.18	--	0.45 ^{*b}	--	0.18	--	--	--	--	--
winter food LR	0.4	--	0.5	--	0.3	--	--	--	--	--
California quail-food LR	0.61	--	0.61	0.38 ^{*b}	0.61	--	--	--	--	--
escape LR	1.0	--	1.0	--	0.45	--	--	--	--	--
winter roost LR	1.0	--	0.9	--	0.38	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 17- Revere Ranch validation HSI's, covertype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass**	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.16	0.36* ^d	--	--	--	--	--
mule deer	0.40	0.75* ^b	0.9	0.23	0.2	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.9* ^c	0.95* ^c	0.67	--	0.2	--	--	--	--	--
wintercover LR	0.18* ^b	0.18* ^b	0.18* ^b	--	0.18	--	--	0.18	--	--
winter food LR	0.4	0.3	0.5	--	0.3	--	--	--	1.0	--
California quail-food LR	0.61	0.61	0.61	0.0	0.0	--	--	--	0.0* ^d	--
escape LR	1.0	1.0	1.0	--	0.0* ^b	--	--	--	--	--
winter roost LR	0.9	0.9	0.85	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26* ^c	0.36	--	--	--	--	--
mule deer	0.47	0.93* ^b	0.9	0.23	0.28	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.9* ^b	0.95* ^b	0.9* ^d	--	0.32	--	--	--	--	--
wintercover LR	0.18* ^b	0.81	0.45* ^d	--	0.45	--	--	0.81	--	--
winter food LR	0.4	0.3	0.5	--	0.3	--	--	--	1.0	--
California quail-food LR	0.61	0.61	0.67	0.61	0.68	--	--	--	0.5* ^d	--
escape LR	1.0	1.0	1.0	--	0.38* ^b	--	--	--	--	--
winter roost LR	0.9	0.9	0.85	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

** this covertype was not sampled so must use preliminary HSI values

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

^c difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing pressure; assume preliminary HSI values are closer

^d difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^e difference is unexplained, but assume preliminary HSI values are closer since measured HEP data was collected here

Table 18- Shumaker validation HSI's, coverytype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34 ^{*c}	--	--	--	--	--	--
mule deer	0.4	--	0.9 ^{*c}	0.23	--	--	--	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67 ^{*b}	--	0.9 ^{*b}	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.18	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.68	--	0.61 ^{*c}	0.0	--	--	--	--	--	--
escape LR	1.0	--	1.0	--	--	--	--	--	--	--
winter roost LR	0.9	--	0.9	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.75	--	0.9	0.23	--	--	--	--	--	--
chukar	--	--	--	0.72	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.9 ^{*b}	--	0.9	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.45 ^{*d}	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.68	--	0.61	0.61	--	--	--	--	--	--
escape LR	1.0	--	1.0	--	--	--	--	--	--	--
winter roost LR	0.9	--	0.9	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is likely due to vigorous vegetative growth from high spring precipitation and/or reduced grazing pressure; assume preliminary HSI values are closer

^c difference is unexplained, but assume preliminary HSI values are closer since measured HEP data collected here

^d difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

Table 19 - Sulphur Creek validation HSI's, coverytype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	--	--	--	--	--	--
mule deer	0.25	--	--	0.25	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.45	--	--	--	--	--	--	--	--	--
wintercover LR	0.18	--	--	--	--	--	0.04	--	--	--
winter food LR	0.4	--	--	--	--	--	--	--	--	--
California quail-food LR	0.61	--	--	0.14* ^b	--	--	--	--	--	--
escape LR	1.0	--	--	--	--	--	--	--	--	--
winter roost LR	0.9	--	--	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.9	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	--	--	--	--	--	--
mule deer	0.4	--	--	0.25	--	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.45	--	--	--	--	--	--	--	--	--
wintercover LR	0.18	--	--	--	--	--	0.18* ^b	--	--	--
winter food LR	0.4	--	--	--	--	--	--	--	--	--
California quail-food LR	0.61	--	--	0.61* ^b	--	--	--	--	--	--
escape LR	1.0	--	--	--	--	--	--	--	--	--
winter roost LR	0.9	--	--	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

Table 20- Swank validation HSI's, coverytype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.42 ^{*b}	--	0.45 ^{*b}	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.27	--	0.2	0.05 ^{*b}	--	--	--	--	--	--
chukar	--	--	--	0.9 ^{*b}	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.32	--	0.2	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.18	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5	--	--	--	--	--	--	--
California quail-food LR	0.61	--	0.34 ^{*b}	0.61 ^{*b}	--	--	--	--	--	--
escape LR	0.71 ^{*b}	--	0.95 ^{*b}	--	--	--	--	--	--	--
winter roost LR	0.85	--	0.67 ^{*b}	--	--	--	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.42 ^{*b}	--	0.45 ^{*b}	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.34	--	--	--	--	--	--
mule deer	0.2 ^{*b}	--	0.2	0.05 ^{*b}	--	--	--	--	--	--
chukar	--	--	--	0.55 ^{*b}	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.2	--	0.2	--	--	--	--	--	--	--
wintercover LR	0.18	--	0.18	--	--	--	--	--	--	--
winter food LR	0.4	--	0.5 ^{*b}	--	--	--	--	--	--	--
California quail-food LR	0.61	--	0.34 ^{*b}	0.34 ^{*b}	--	--	--	--	--	--
escape LR	0.71 ^{*b}	--	0.95 ^{*b}	--	--	--	--	--	--	--
winter roost LR	0.85	--	0.67 ^{*b}	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

Table 21- Whitstran validation HSI's, coverytype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	--	0.06 ^{*b}	--	--	--	--	--
mule deer	0.36	0.73	0.73 ^{*b}	--	0.63 ^{*b}	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67	0.2 ^{*b}	0.32	--	0.31	--	--	--	--	--
wintercover LR	0.18	0.18 ^{*b}	0.81	--	0.81 ^{*b}	--	--	0.45 ^{*b}	--	--
winter food LR	0.4	0.3	0.5	--	0.3	--	--	--	--	--
California quail-food LR	0.61	0.34 ^{*b}	0.14 ^{*b}	--	0.61 ^{*b}	--	--	--	--	--
escape LR	1.0	1.0	1.0	--	0.81 ^{*b}	--	--	--	--	--
winter roost LR	0.9	0.9 ^{*b}	0.85 ^{*b}	--	--	--	--	--	--	--
	FUTURE HABITAT CONDITIONS									
song sparrow	0.9	--	0.9	--	--	--	--	--	--	--
western meadowlark	--	--	--	--	0.06 ^{*b}	--	--	--	--	--
mule deer	0.44	0.73	0.73 ^{*b}	--	0.63 ^{*b}	--	--	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-reproduction LR	0.67	0.32	0.32	--	0.31	--	--	--	--	--
wintercover LR	0.18	0.18 ^{*b}	0.81	--	0.81 ^{*b}	--	--	0.45 ^{*b}	--	--
winter food LR	0.4	0.3	0.5	--	0.3	--	--	--	--	--
California quail-food LR	0.61	0.61	0.14 ^{*b}	--	0.61 ^{*b}	--	--	--	--	--
escape LR	1.0	1.0	1.0	--	0.81 ^{*b}	--	--	--	--	--
winter roost LR	0.9	0.9 ^{*b}	0.85 ^{*b}	--	--	--	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site

Table 22- Windmill Ranch validation HSI's, covertype HSI's or LR^a SI's for the pre-purchase and future habitat conditions.

Species	PRE-PURCHASE HABITAT CONDITIONS									
	riparian forest	palustrine scrub-shrub	mesic shrub	grassland	shrub-steppe low	shrub-steppe high	annual forb/grass	palustrine emergent	cropland	pasture
song sparrow	0.42 ^{*b}	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.26	0.24	0.08	0.41 ^{*b}	--	--	--
mule deer	0.38	0.73 ^{*b}	--	0.23	0.29	0.55 ^{*d}	0.23	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.9 ^{*b}	0.9 ^{*b}	--	--	0.32	0.2	0.9 ^{*b}	--	--	0.3 ^{*c}
wintercover LR	0.18 ^{*b}	0.45	--	--	0.45	0.81 ^{*d}	0.18	0.45 ^{*d}	--	--
winter food LR	0.4	0.3	--	--	0.3	0.3	0.7	--	1.0	--
California quail-										
food LR	0.61 ^{*b}	0.61 ^{*b}	--	0.14	0.19	0.33 ^{*d}	0.68 ^{*b}	--	0.9	--
escape LR	0.81	1.0	--	--	0.45	0.81	0.85 ^{*b}	--	--	--
winter roost LR	0.81	0.9	--	--	--	0.38 ^{*d}	--	--	--	--
FUTURE HABITAT CONDITIONS										
song sparrow	0.42 ^{*b}	--	--	--	--	--	--	--	--	--
western meadowlark	--	--	--	0.41	0.24	0.08	0.54	--	--	--
mule deer	0.46	0.73	--	0.23	0.29	0.63 ^{*d}	0.3	--	--	--
chukar	--	--	--	--	--	--	--	--	--	--
ring-necked pheasant-										
reproduction LR	0.9 ^{*b}	0.9 ^{*b}	--	--	0.32	0.5	0.9 ^{*d}	--	--	0.3
wintercover LR	0.45 ^{*b}	0.81	--	--	0.45	0.81	0.18	0.81	--	--
winter food LR	0.4	0.3	--	--	0.3	0.3	0.7	--	1.0	--
California quail-										
food LR	0.68	0.61	--	0.61	0.61	0.33 ^{*d}	0.68	--	0.9	--
escape LR	0.9	1.0	--	--	0.81	0.9	0.85 ^{*c}	--	--	--
winter roost LR	0.81	0.9	--	--	--	0.38	--	--	--	--

* indicates the validation HSI was greater than 0.2 units from the preliminary HSI

^a LR refers to life requisite and is reported as a suitability index (SI)

^b difference is unexplained, but assume preliminary HSI values are closer since measured HEP data collected here

^c difference is likely due to certain assumptions or error when assigning preliminary HSI values; assume validation HSI values are closer

^d difference is unexplained, but assume validation HSI values are closer since site was field checked and could more readily account for the variation which occurred across the site