HABITAT EVALUATION PROJECT

RHT Final Assessment And Analysis Of The NW Power Act Funded By BPA

Lower Columbia River Sub-region

HEP Project Number: 2006-006-00

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Work Element 141

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Table of Contents

List of Tables

Table of Figures

Purpose

The purpose of this document is to identify and discuss HEP protocol and crediting issues encountered by the Regional HEP Team (RHT) in the Lower Columbia River Sub-region (LCRS) and to share the RHT's perspective regarding the factors that contributed to creating the issues. This report also fulfills the Crediting Forum's recommendation that the RHT *identify inconsistencies in technical HEP applications throughout the Region* (NPCC 2011).

RHT Background

The RHT was established in 2004 to fulfill three purposes: to create a region-wide standard for Habitat Evaluation Procedures (HEP) protocols and crediting practices; to independently apply them fairly to all BPA wildlife mitigation projects throughout the Columbia Basin; and to provide HEP technical assistance to agency and tribal project managers and BPA staff. After 2004, the RHT carried out the majority of HEP surveys within the Columbia Basin and conducted HEP and habitat survey training for project managers, BPA staff, and other interested individuals.

In all actions and activities the RHT did the utmost to:

1. Ensure the RHT remained neutral and objective.
2. Ensure consistent application of HEP protocols and scientific principles on all HEP projects.
3. Ensure that HEP projects/sponsors throughout the Columbia Basin and BPA were treated in a consistent, fair manner.
4. Ensure that HEP results were credited appropriately and impartially.

Introduction

The LCRS includes Bonneville Dam, The Dalles Dam, John Day Dam, and McNary Dam (henceforth known as the Lower Four) located on the Lower Columbia River, which forms the north/south border between the State of Oregon and Washington State respectively. The Habitat Evaluation Procedures (HEP) process (Appendix A) was used to determine both construction and inundation (C&I) habitat unit (HU) losses and compensation site HU gains.

Lower Four C&I HU losses were reported in a combined wildlife loss assessment written by L. Rasmussen and P. Wright (1989) from the US Fish and Wildlife Service (USFWS)[1]. The Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), US Forest Service (USFS), US Army Corps of Engineers (USACE), and the Yakama Nation (YN) also contributed significantly towards development of the Lower Four loss assessments.

The Lower Four loss assessment habitat units (HUs) summarized in Figure 1 were evenly divided between Washington State and Oregon State except at McNary Dam where 80% of the HUs were allocated to Washington (Figure 2); as there were more C&I impacts in Washington

[1] Loss assessments for Bonneville, The Dalles, John Day, and McNary Dams were included as separate sections in the combined Lower Four loss assessment (Rasmussen and Wright 1989).

than Oregon (Ashley 2008). HU losses were not allocated to specific project sponsors *in the loss assessments* as occurred at Grand Coulee and Chief Joseph Dams.

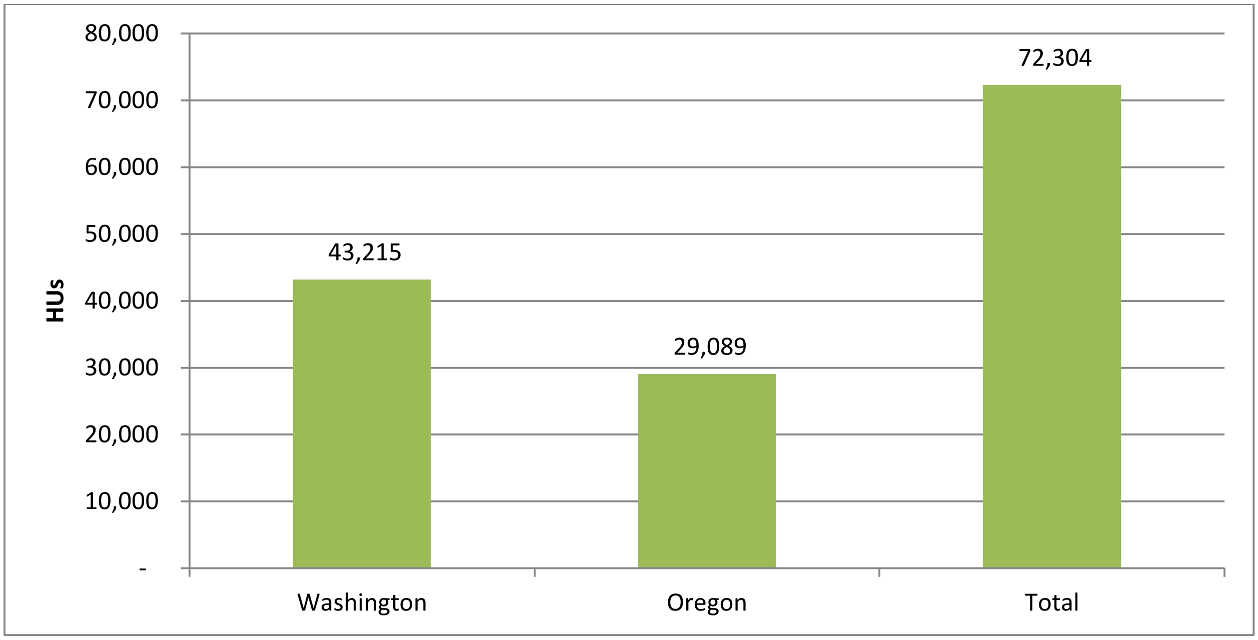

Figure 1 Summarized Lower Four loss HUs and state allocations

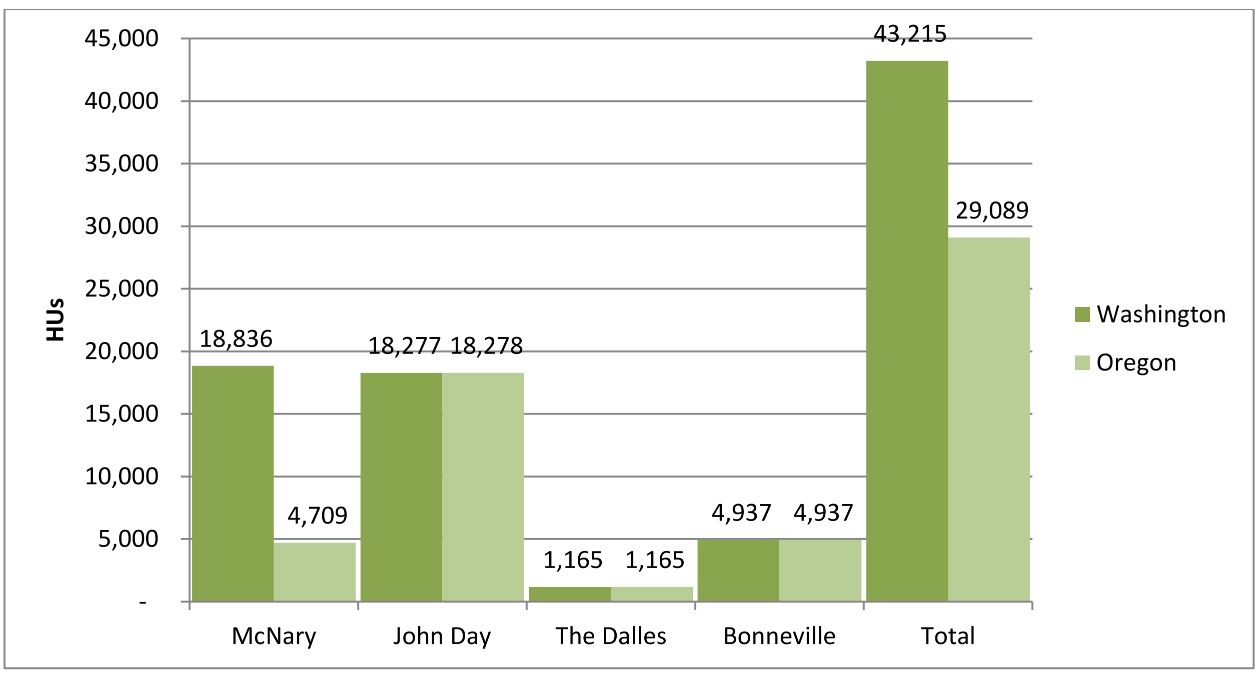

Figure 2 Washington and Oregon Lower Four HU loss allocations by dam

For political and budgetary reasons ODFW did not propose mitigation projects to credit against Lower Four Hu losses during this time period. However, the Confederated Tribes of the Warm Springs Reservation (CTWSR), Confederated Tribes of the Umatilla Indian Reservation

(CTUIR), and US Forest Service (USFS) added compensation sites that were credited against Oregon's share of Lower Four HU losses. The CTWSR acquired the 34,399 acre Pine Creek compensation site[2] (25,613 HUs) and the Forrest Conservation Area (6,253 HUs). The CTUIR added the Wanaket (3,084 HUs) and Isqúulktpe (16,817 HUs) mitigation sites while the USFS included the 1,491 acre Sandy River Delta project[3] (1,484 HUs).

Lower Four HU losses and mitigated HUs for each project sponsor and state are compared in Figure 3[4]. The HU data shows that Lower Four Dams are over mitigated by 35,574 HUs (107,878 mitigated HUs – 72,304 loss HUs = 35,574 over-mitigated HUs).

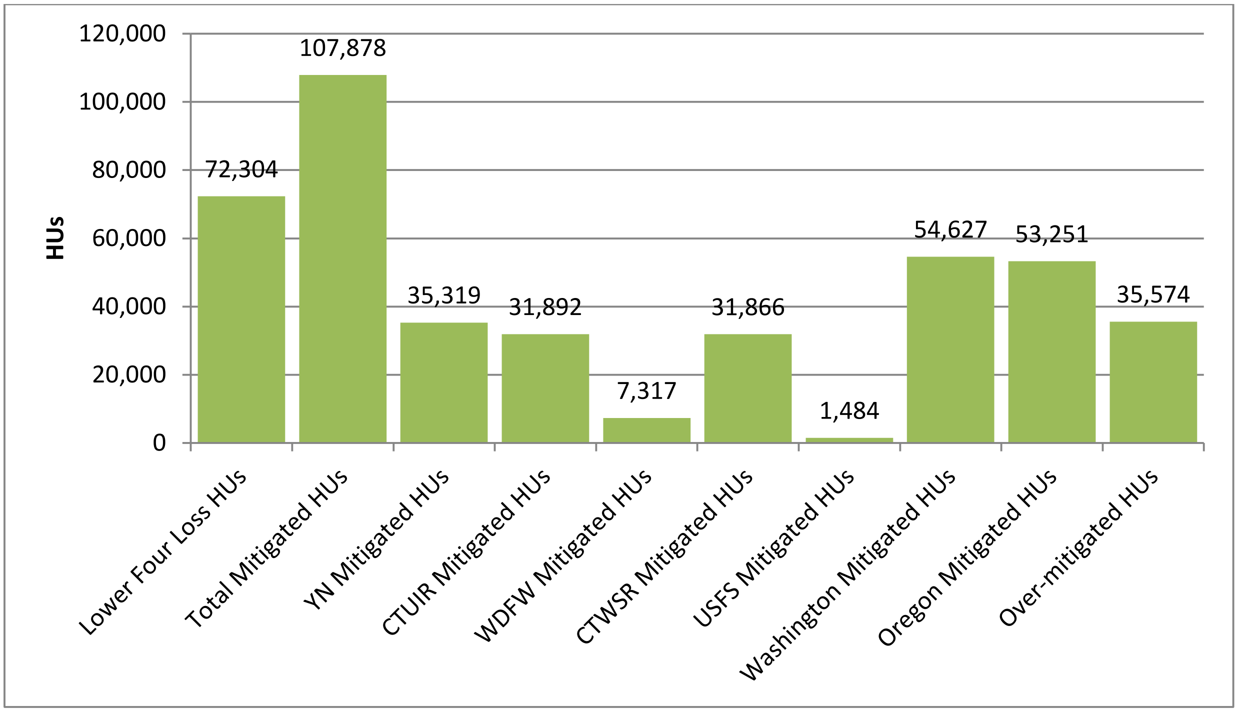

Figure 3 Lower Four HU losses and mitigated HU comparison by project sponsor

Washington and Oregon Lower Four HU losses/allocations and mitigated HUs for each project sponsor and State are illustrated in Figure 4 and Figure 5 respectively. Note that the CTUIR credited HUs against both Washington and Oregon Lower Four HU loss allocations.

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[2] Pine Creek is comprised of two large parcels. The Pine Creek parcel was acquired with "Wildlife" funds while the Wagner Parcel was acquired with "Fish" funds (Tier 1).
[3] The Sandy River Delta site is a "Tier 2" fish project.
[4] The data displayed in Table 3 was compiled by the RHT and includes Pisces data, HEP survey results, and in a few cases, data from project sponsors. Note, however, that not all project sponsors agree with the RHT's conclusions.

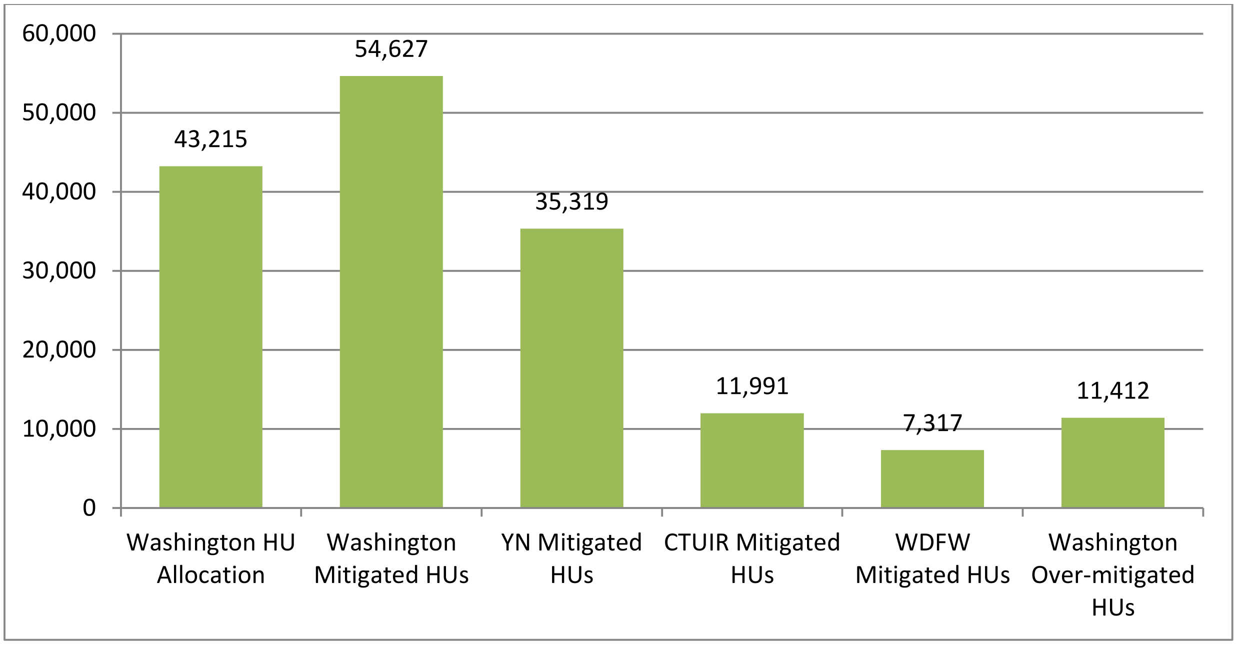

Figure 4 Washington HU allocation and mitigated HUs by project sponsor

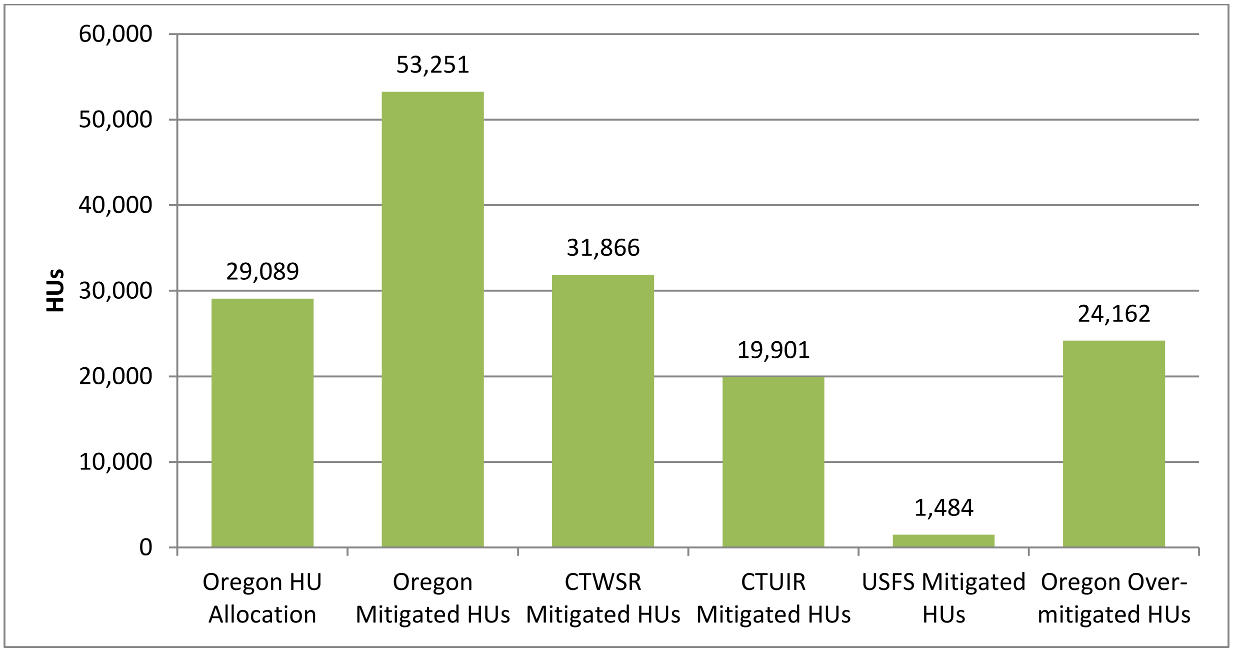

Figure 5 Oregon HU allocation and mitigated HUs by sponsor

The Lower Four HU data displayed in Figures 3, 4, and 5 does not include pre-Act HUs. Giger (1991) stated that the Pacific Northwest Utilities Conference Committee (PNUCC) reported that more than 56,200 acres of "mitigation" lands should be credited against Lower Four dam losses. Although Giger (1991) believed PNUCC's overall acreage estimate was "inaccurate and misleading", he pointed out that some of the parcels identified by PNUCC should be considered "mitigation" lands.

Historical language in the NPCC's Program supported crediting pre-Act mitigation; however, over time the language disappeared for no expressly stated reason. Even so, it appears that those involved early on in Lower Columbia River wildlife mitigation clearly believed that pre-Act HUs should be credited against Lower Four HU losses. As such, LCRS mitigated HU totals are likely under-reported.

Nearly all wildlife mitigation credited towards the Lower Four Dams occurred during the 1990s and early 2000s well before establishment of NPCC's Crediting Forum and release of the Crediting Forum's Report/Guidelines (NPCC 2011) (Appendix B). As a result, only a small number of baseline and follow-up HEP surveys were conducted using appropriate "paired" cover type/species matrices (Appendix C) and proper HEP model stacking (Appendix D). Consequently, baseline HEP results were largely credited inappropriately.

HEP Model Species Matrix History and Background

Compensation site cover type/species matrices should, to follow HEP protocols properly, be constructed based on cover type/HU losses described in hydro facility loss assessments. When compensation site and loss assessment cover types are identical (i.e., in-kind, the same number and type of HEP species), the same models are used to evaluate compensation site cover types as were used to evaluate cover types listed in the credited hydro facility's loss assessment matrix. Likewise, when compensation site cover types are dissimilar or out-of-kind habitats[5], compensation site cover types are "paired" with loss assessment cover types to determine the number of HEP species models ("stacking") to use to evaluate compensation site cover types.

Loss assessment HEP models may be used to evaluate dissimilar compensation site cover types if the HEP species models are biologically appropriate. If not suitable, loss assessment HEP models may be modified to fit compensation site habitat conditions or other HEP models may be substituted in place of loss assessment models to satisfy stacking requirements. In all cases the credited hydro facility's loss assessment matrix is paramount to developing compensation site cover type/species matrices by providing both HEP evaluation species models and establishing HEP model stacking for each cover type.

Throughout the Region, project sponsors sought and used BPA funding to acquire "out-of-kind" habitat/cover types i.e., types other than those lost to dam construction and inundation and not associated with a specific loss assessment. In some cases acquisitions were purchased in packages that required an "all or nothing" agreement.

These out-of-kind habitat/cover types were, in many instances, appropriately evaluated with HEP model species that were not listed in the credited hydro-facility's loss assessment, leading to HEP model substitutions. Since using out-of-kind HEP models conflicts with "In-kind"

[5] Dissimilar cover types are those project cover types that are not listed in the credited hydro facility's cover type matrix.

compensation (Appendix E), much of the mitigation accomplished across the Region is "equal" compensation; that is: "a HU[6] is a HU."

HEP protocol and crediting related issues experienced by the RHT in the Lower Columbia River Sub-region generally included:

1. Applying appropriate cover type/species matrices and associated HEP model stacking
2. Crediting HUs to hydro facilities

Issues varied by project sponsor with little overlap. As a result, issues specific to WDFW, YN, and CTUIR are discussed separately in this document.

Washington Department of Fish and Wildlife

Background

The Washington Interim Agreement set the stage for WDFW's position on allocating loss HUs associated with the Lower Four Columbia River Dams. WDFW's position was that the 1993 Washington Wildlife Mitigation Agreement allocated 48% of the losses to WDFW for the people of the State of Washington. The 1993 Agreement states in Section 5.a.iv., "expenditures and obligations by BPA to implement projects approved by BPA shall be consistent with the following percentages of the annual and total budget amounts". It goes on further to state "48% of the annual and total budget amounts shall be available for projects proposed by WDFW and approved by BPA" (NPCC 2011). WDFW further interpreted this to mean that the State of Washington was entitled to mitigate 48% of the loss HUs.

BPA's position was that Interim Agreement governed only the allocation of funds to the parties under the agreement. The agreement did not address HU distribution among the parties, and all parties did not agree on an HU allocation. Therefore, BPA was not obligated to provide oversight or monitor the number of HUs mitigated by each project sponsor.

Interim Agreement funding allocations were developed with the intent to generally reflect the magnitude of losses by jurisdiction. This translated into a roughly 50/50 split between the State of Washington and tribes and a tribal split based on ceded territories. As such, each tribe could determine where the most suitable locations were to mitigate the impacts to populations occurring within their jurisdiction. The Treaty Tribes held that losses that occurred within a tribe's individual aboriginal territories must be mitigated in locations where their members can access the benefits of the projects.

WDFW primarily used extant wildlife areas (WAs) as Lower Four wildlife mitigation sites, because local county commissioners opposed further acquisition of private land by state and federal government agencies, which removed property from county tax rolls. In addition, WDFW

[6] HU = habitat unit

was faced with significant internal funding issues and considered BPA mitigation funds as a viable option to bolster/replace limited WDFW WA management funds.

Through the mid to late 1990s WDFW and BPA entered into several agreements (Appendix F) whereas BPA provided operation and maintenance (O&M) funding for WDFW's Shillapoo, Desert, and Sunnyside Wildlife Areas[7] in exchange for partial but permanent baseline HU credit based on the WDFW crediting formula (Appendix G). In addition, BPA received full permanent baseline HU credit for funding the purchase of 822 acres[8] that was added to the Shillapoo Wildlife Area and for providing WDFW funds to pay Washington Department of Natural Resource (WDNR) lease payments for approximately 15,000 acres located on the Wenas Wildlife Area. BPA also received full permanent baseline protection credit for roughly 1,400 acres of land owned by the Bureau of Land Management, but managed by WDFW as part of the Wenas Wildlife Area.

Discussion

Since HUs were not allocated to specific project sponsors in the Lower Four loss assessments, WDFW voiced concern to the Washington Coalition (Coalition)[9] that a mechanism/agreement was needed to allocate Lower Four loss HUs fairly between project sponsors. The Coalition proposed WDFW mitigate 48% of the Lower Four loss HUs since WDFW received approximately 48% of the 1993 Washington Wildlife Mitigation Agreement funding, which was based on Washington State's estimated mitigation HU share for the entire State. This equaled 21,329 HUs as shown in Table 1.

Nearly all Washington Coalition Members supported the proposed allocation of Lower Columbia HUs. However the Yakama Nation did not agree and asserted that Lower Columbia habitat units could be credited by any entity with wildlife management jurisdiction in Washington State (T. Hames, pers. comm.). Due to the lack of consensus between Coalition members no formal agreement was reached.

Table 1 WDFW's proposed 48% share of Lower Four loss HUs and crediting projections

Hydro Project	Indicator Species	Losses	Gain HUs[a]	Net Unmitigated HUs	20 Year Projected HUs[b]	Unmitigated HUs
McNary	Mallard (nesting)	2,672	1,180	1,492	1,180	1,492
	Western meadowlark	1,332	378	954	378	954
	Canada goose	1,338	353	985	353	985

[7] All Shillapoo Wildlife Area HU gains were credited towards Lower Four Dams. In contrast, HU gains generated on the Desert and Sunnyside Wildlife Areas were credit against both Lower and Upper Columbia River hydro facilities. Compensation sites HUs are no longer credited against more than one hydro facility as per NPCC Crediting Forum guidelines (NPCC 2011).

[8] Egger and Herzog parcels

[9] Washington Wildlife Mitigation Agreement (1993) coalition members included representatives from WDFW, CTUIR, USFWS, CCT, YN, and STOI. BPA was not a coalition member.

Hydro Project	Indicator Species	Losses	Gain HUs[a]	Net Unmitigated HUs	20 Year Projected HUs[b]	Unmitigated HUs
	Spotted sandpiper	523	0	523	0	523
	Yellow warbler	126	274	-148	274	-148
	Downy woodpecker	145	0	145	0	145
	Mink	480	259	221	259	221
	California quail	2,425	1,000	1,425	1,000	1,425
	Total	**9,041**	**3,444**	**5,597**	**3,444**	**5,597**
John Day	Great blue heron	765	0	765	0	765
	Canada goose	1,922	99	1,823	99	1,823
	Spotted sandpiper	765	0	765	0	765
	Yellow warbler	260	0	260	0	260
	Black-capped chickadee	209	48	161	48	161
	Western meadowlark	1,214	696	519	1,629	-415
	California quail	1,518	0	1,518	0	1,518
	Mallard	1,776	283	1,493	292	1,484
	Mink	345	274	71	274	71
	Dabbling duck[c]	0	33	-33	33	-33
	Total	**8,774**	**1,432**	**7,342**	**2,375**	**6,399**
The Dalles	Great blue heron	102	0	102	0	102
	Canada goose	105	0	105	0	105
	Spotted sandpiper	128	0	128	0	128
	Yellow warbler	41	10	31	10	31
	Black-capped chickadee	44	29	15	29	15
	Western meadowlark	59	169	-110	169	-110
	Mink	79	1	78	1	78
	Downy Woodpecker[d]	0	29	-29	29	-29
	California Quail[d]	0	18	-18	18	-18
	Total	**558**	**256**	**302**	**256**	**302**
Bonneville	Great blue heron	1,032	446	586	446	586
	Canada goose	587	581	6	581	6
	Spotted sandpiper	664	0	664	0	664
	Yellow Warbler	39	0	39	0	39
	Black-capped chickadee	245	113	132	113	132
	Mink	389	89	300	103	286
	Total	**2,956**	**1,229**	**1,727**	**1,242**	**1,714**
Total HUs		**21,329**	**6,361**	**14,968**	**7,317**	**14,012**

[a] Includes baseline/follow-up HUs from lands acquired with BPA funds and 10 year HU projections on lands acquired with Washington State funds.

[b] Includes baseline/follow-up HUs from lands acquired with BPA funds and 20 year HU projections on lands acquired with Washington State funds.

[c] Dabbling duck was added to the John Day loss assessment.

[d] Downy woodpecker and California quail were added to The Dalles loss assessment.

Only a small portion of the HU gains listed in Table 1 were due to land acquisitions. The majority of HUs were generated on property owned or managed by WDFW that were not acquired with BPA funds. BPA provided operations and maintenance (O&M) funding and, in return, received HU credits.

WDFW continued to maintain the State was entitled to 48% of the Lower Four loss HUs and continued to credit compensation project HU gains against Lower Four HU losses as did both the CTUIR and YN. The YN aggressively pursued wildlife habitat acquisitions/easements on the Yakama Reservation[10] that, from WDFW's perspective, resulted in a disproportionate number of Lower Four C&I loss HUs being mitigated by the YN. By 2003, combined HU gain estimates for all Lower Four Dams exceeded combined C&I HU losses listed in the loss assessments. As a result, BPA advised WDFW that BPA's mitigation objective in the Lower Columbia had been met, due largely to YN mitigation efforts, at which point WDFW ceased crediting against Lower Four Dams.

Prior to Crediting Forum guidelines (NPCC 2011), WDFW followed crediting guidance provided by the Columbia Basin Fish and Wildlife Authority's (CBFWA) Wildlife Committee (WC), which recommended that HU gains be credited towards HU losses at a hydro facility within 50 miles of a compensation site or the nearest hydro facility[11]. WDFW deviated from this policy when WDFW's 48% share of HUs for a particular species were mitigated at a given dam or if a HEP survey evaluation model was not listed in a Lower Four loss assessment (Rasmussen and Wright 1989).

For example, if WDFW's share of Canada goose (*Branta Canadensis*) HUs were mitigated at John Day Dam, WDFW credited the remaining compensation site Canada goose HU gains against the nearest Lower Four Dam with unmitigated goose HUs. Similarly, WDFW substituted biologically appropriate HEP models found in Upper Columbia River Sub-region loss assessments to evaluate Lower Four compensation site cover types when needed. This included primarily the sage grouse (*Centrocercus urophasianus*) HEP Model (Ashley 1997) and mule deer (*Odocoileus hemionus*) HEP model (Ashley and Berger 1999). As a result, WDFW credited compensation site HU gains against multiple Lower Columbia River Dams as well as Grand Coulee and Chief Joseph Dams located in the Upper Columbia River Sub-region[12].

WDFW continues to assert that a process or agreement should have been established to ensure Washington State's share of Lower Four loss HUs were distributed proportionately/equitably between the three Washington jurisdictions i.e., WDFW, YN, and

[10] The YN was not under the same state mandated "process" constraints or political pressure WDFW faced. Therefore, the Tribe was able to purchase/lease land at a much faster pace than WDFW.
[11] The Wildlife Committee did not address crediting HUs against more than one dam.
[12] At the time, WDFW's crediting paradigm was that mitigation was "equal compensation" i.e., a HU is a HU. Therefore, evaluation species substitution or crediting HUs to multiple hydro facilities was not an issue.

CTUIR. Note the disproportionate low number of Lower Four loss HUs mitigated by WDFW (Figure 6) - considering that WDFW represented Washington's general public interest.

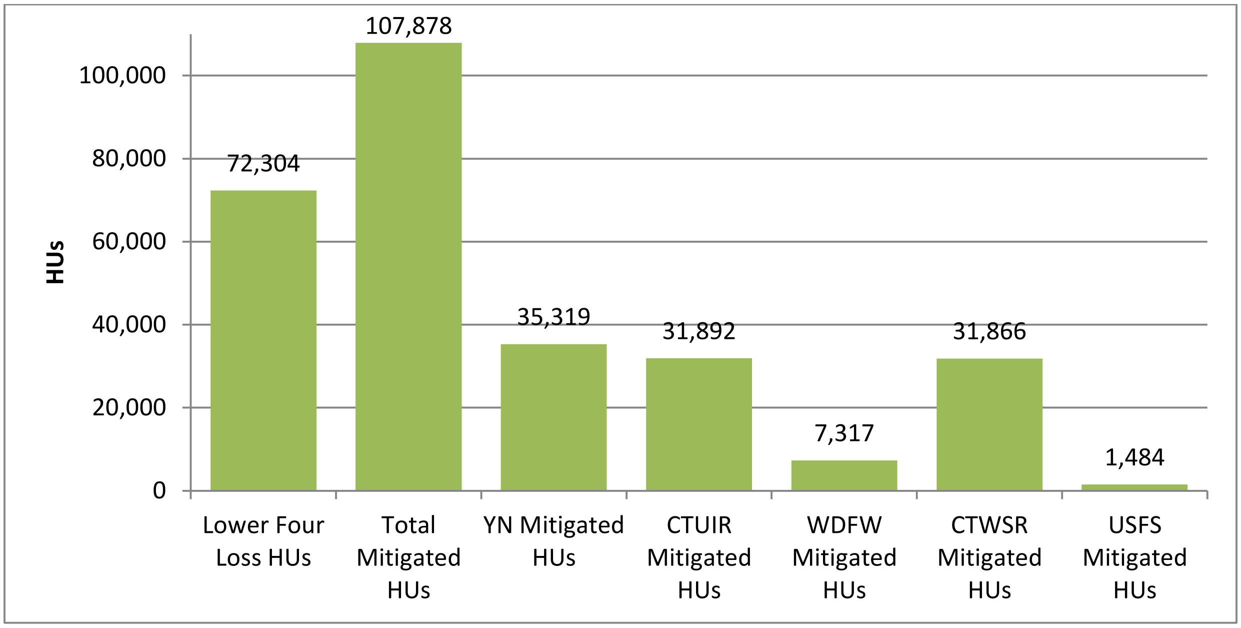

Figure 6 Lower Four HU losses and mitigated HU comparison

WDFW further contends that without an agreement between the project sponsors, BPA should have taken an active role in monitoring project sponsors' HU crediting balances to safeguard "fairness" for all parties (P. Dahmer et al. pers. comm.). On the other hand, BPA has insisted that any mitigation funding it provides—regardless to what entity it's provided to—should be credited for all HUs accruing from the funding. Moreover, BPA claimed that Northwest Power Act guidance directs that when two means of achieving the same biological objective present themselves, BPA should use the least cost method (the RHT's opinion is that both WDFW's use of extant wildlife areas and the YN's land management rights leases on lands located on the Yakama Reservation were cost effective relative to the number of HUs gained and applied toward BPA's Lower Four mitigation obligation).

WDFW Closing Comments

WDFW maintains the State has not been adequately compensated for C&I losses associated with the Lower Four Columbia River Dams. To date, WDFW has credited 7,317 HU gains towards Lower Four C&I losses and proposes that the State is entitled to the balance of its projected 48% share of Washington States' Lower Four HUs (14,012 HUs). BPA maintains its legal obligation is to mitigate fish and wildlife, and it has done that.

Yakama Nation

Background

Since 1990, the Yakama Nation (YN) purchased/protected[13] over 21,631 acres of terrestrial and wetland habitat under the YN's Wetlands and Riparian Restoration Project (WRRP). This project is a comprehensive effort, funded in part by Bonneville Power Administration, to protect and restore floodplain habitats along anadromous fish-bearing streams in the agricultural portion of the Yakama Reservation. The 50,308 acre project area (Bich et al. 1991) is located within the agricultural valley of the Yakama Reservation and includes the riparian corridors and associated uplands of the Yakima River, Satus Creek, and Toppenish Creek (Figure 7).

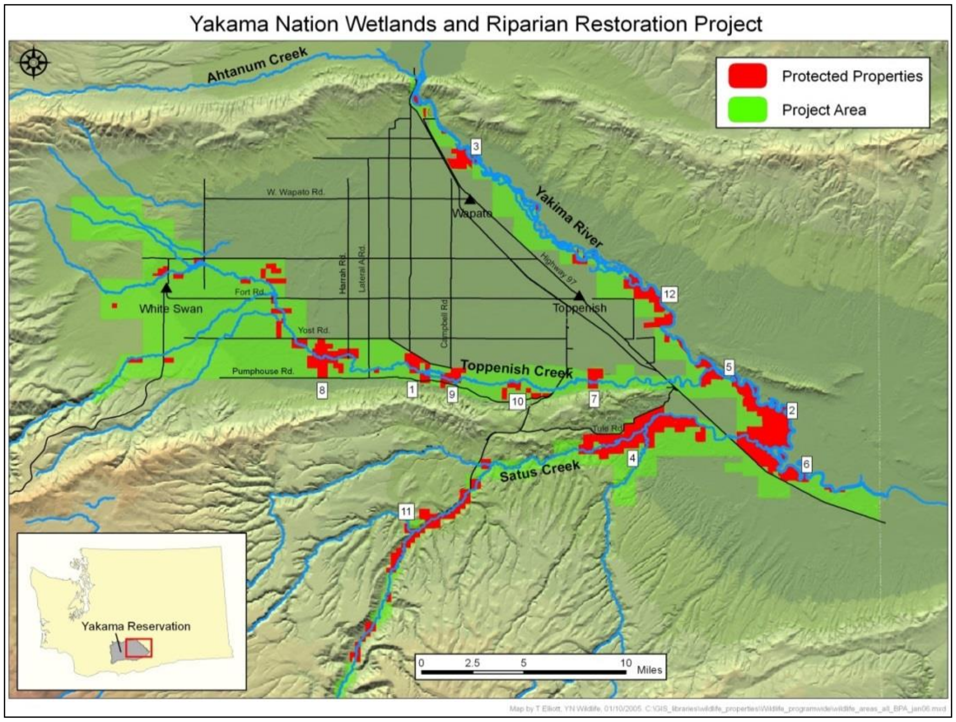

Figure 7 YN wetlands and riparian restoration project map

Along with the land, associated irrigation water rights were acquired and allowed to remain in-stream. Water rights for hundreds of acres, including all of the water rights on Satus Creek, have been secured.

From 1990 through 2010 between 1,000 and 3,000 acres were acquired/protected each year including more than 115 miles of steelhead (*Oncorhynchus mykiss*) bearing stream, river, and side channels at an average cost of less than $400 per acre. To date, more than 39 separate parcels ranging in size from 22 acres to 4,725 acres have been permanently protected for fish and wildlife on the Yakama Reservation.

[13] Protection measures included both land acquisitions and management leases on property located within the Yakima Nation Reservation.

In addition to the WRRP, the YN and BPA partnered to purchase/protect over 1,023 acres on 10 parcels[14] ranging in size from 15 to 306 acres along the upper Yakima River near Cle Elum, Washington (Tier II projects). The parcels, acquired to protect salmonid habitat, also provide significant wildlife benefits. The Cle-Elum Fish Hatchery parcel is the largest parcel. In its September 2011 close out report, the Council's Wildlife Crediting Forum identified all of these properties as "Tier II" meaning that they were eligible for BPA to take for wildlife credit if certain criteria were met. The RHT completed HEP analyses on Tier II projects in 2012 and 2013 and uploaded HU results to PISCES[15].

The WRRP yielded 33,860 HUs while the Tier 2 Fish projects generated 1,459 HUs for a total of 35,319 HUs credited towards BPA's Lower Columbia River wildlife mitigation obligation. Yakama Nation wildlife mitigation projects account for the largest share of habitat unit gains credited against Washington State HU losses incurred at McNary, John Day, The Dalles, and Bonneville Dams as illustrated in Figure 4.

Discussion

The YN considered all wildlife habitat losses resulting from construction and subsequent inundation from McNary, John Day, The Dalles, and Bonneville Dams as a single landscape level habitat loss. Furthermore, the YN has always maintained that the current wildlife mitigation program will not compensate the Tribe for its habitat/wildlife losses due to hydro development on the lower Columbia River (T. Hames, pers. comm.). T. Elliot (YN, pers. comm.) reiterated to the RHT in February 2015 that the Yakama Nation requested BPA fund the protection and maintenance of up to 27,000 acres of wildlife habitat on the Yakama Reservation in perpetuity i.e., the WRRP. To date, approximately 22,000 acres have been protected.

Although the Yakama Nation agreed to allow HEP analyses[16], the YN does not consider the habitat unit concept as a legitimate method for determining when BPA has met its wildlife mitigation obligation. The YN asserts its 1992 project proposal agreement with BPA was acre based, not HEP/ HU based. Because of this perspective, the YN elected not to take a position on or become involved in the disbursement of habitat units generated on compensation sites, leaving BPA COTRs responsible for assigning HU gains towards HU losses to specific dams (T. Hames, pers. comm.).

[14] The YN acquired additional small parcels that were not evaluated by the RHT. Therefore, the acres and associated HUs listed in this report do not reflect the potential total acres or HUs protected.
[15] HUs are tracked in BPA's PISCES data base.
[16] The YN contracted with Raedeke Associates, Inc. Seattle, Washington to conduct the majority of the baseline HEP evaluations. The RHT conducted a number of baseline and follow-up HEP surveys after 2004.

This became problematic for BPA COTRs, Raedeke Associates, Inc., (Raedeke) and later the RHT as HEP model evaluation species selection and stacking is directly linked to individual hydro facility loss assessments. T. Hames (YN, pers. comm.) stated that at the direction of the YN, Raedeke developed and used an alternate cover type/species matrix (Raedeke and Raedeke 2000) that generally combined Lower Four loss assessments evaluation species for like cover types.

For example, the riparian tree cover type was listed in each Lower Four cover type/species matrix (Appendix H). Two HEP models were used to determine HU losses for this cover type at McNary Dam, The Dalles Dam, and Bonneville Dam while only one evaluation species is listed in the John Day Dam cover type/species matrix. This means that a maximum of two evaluation species were needed to fulfill stacking requirements had standard crediting practices and protocols been followed. Raedeke, however, used five evaluation species to assess the riparian tree cover type (Raedeke and Raedeke 2000) when only a maximum of two species was needed, resulting in over-mitigating the cover type. This scenario was repeated for other cover types.

Taken together, the Lower Four loss assessments list four different HEP models that were used to evaluate the riparian tree cover type. In most cases, Raedeke either matched the maximum number of evaluation species listed per cover type in one of the Lower Four loss assessments or exceeded that number as shown in Appendix I.

The net result was that the number of HU gains generated on YN compensation site acquisitions/leases and credited against Lower Four HU losses would have been less if compensation sites had been paired with a specific hydro facility and proper HEP model stacking had been followed on baseline HEP surveys. Theoretically, additional unmitigated HUs would have been available to WDFW and the CTUIR.

Since the YN elected to use an acre-for-acre approach and not to participate in crediting HU gains against specific Lower Four Dams, the task defaulted to BPA COTRs and later the RHT. Without additional guidance and the use of appropriate cover type species matrices to appropriately "match" compensation HU results with a specific hydro facility's loss assessment, McNary Dam became the default parking lot on the crediting ledger for a significant number of HUs. This interim approach resulted in McNary Dam being nearly 200% credited while other Lower Four Dams had significantly fewer HU gains credited. The RHT nevertheless tried to more accurately place the HU credit from the HEP surveys it performed so results were credited to specific hydro facilities as per Washington Coalition guidelines and later Crediting Forum recommendations (NPCC 2011).

In 2007, the RHT redistributed compensation site HUs across Lower Four Dams based on a compensation site's nearness to a hydro facility and proper stacking. HUs were credited against more than one dam. The results showed that although unmitigated HUs remained at some hydro facilities, the Lower Four Dams were collectively over-mitigated by 2,510 HUs (Attachment 1).

In 2010, the RHT again redistributed Lower Four compensation site HUs – this time crediting HUs to a single hydro facility. The RHT reassigned compensation site HEP results to specific hydro facilities using appropriate HU stacking for each dam. The results of this exercise showed that less than 1,000 un-mitigated HUs remained for Lower Four Columbia River Dams[17]. Like the 2007 effort, the 2010 HU redistribution exercise occurred prior to establishment of the Crediting Forum (NPCC 2011); however, the RHT believes differences resulting from applying Crediting Forum guidelines to the 2010 analysis would have been insignificant.

HEP surveys conducted since 2010 have added significantly more HUs towards BPA's Lower Four mitigation obligation. The RHT's opinion is that the Lower Four Columbia River Dams are currently approximately 35,574 HUs over-mitigated—without adding in projected construction and inundation gains or the pre-Act mitigation described in the Giger Report (Giger 1991).

YN Closing Comments

Although Lower Four C&I loss HUs have been more than mitigated at this juncture, one alternative that could be explored to address the concerns expressed by WDFW and the CTUIR and increase the number of unmitigated HUs available would be to remove the YN from the HU crediting process. This would be in line with Tracy Hames' (YN, pers. comm.) argument that the YN negotiated a mitigation agreement with BPA based on acres, not HUs.

Umatilla Tribe

Background

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) purchased project lands pursuant to the Interim Washington Wildlife Mitigation Agreement. C. Scheeler (CTUIR, pers. comm.) stated that the Tribe agreed to mitigate for losses within their ceded territory. In Washington State, that included all of the McNary Pool and approximately half the John Day Pool. As such, CTUIR compensation projects were credited towards BPA's mitigation obligation at McNary and John Day Dams.

Beginning in the early 1990s, the CTUIR in partnership with BPA acquired and protected four wildlife mitigation compensation sites totaling 30,176 acres[18]. Two of the compensation sites are

[17] The 2010 HU redistribution results consist of a series of "draft" spreadsheets and not included in this document. A final report was not completed due to RHT workload priorities.
[18] Project acres are based on cover type maps and may vary slightly from acres listed on sale agreements.

located in Washington State (Rainwater I and Rainwater II[19]) while the Isqúulktpe Watershed Project (Isqúulktpe) and Wanaket[20] compensation sites are located in northeast Oregon.

Both baseline and follow-up HEP surveys were conducted at the Rainwater I, Isqúulktpe, and Wanaket compensation sites while only a baseline HEP analysis was conducted at the Rainwater II project area. CTUIR Wildlife Department Staff completed the Rainwater I, Isqúulktpe, and Wanaket baseline HEP surveys while the RHT conducted the Rainwater II baseline HEP survey and all follow-up HEP surveys.

The RHT modified the CTUIR's baseline HEP cover type/species matrices[21] to correct stacking deficiencies and added or substituted biologically appropriate evaluation species as needed consistent with NPCC Crediting Forum SOPs (NPCC 2011). The CTUIR, however, opposed the RHT's use of modified HEP cover type/species matrices and subsequent stacking for all compensation site HEP surveys conducted by the RHT. The CTUIR did not offer a clear HEP or biological based rationale supporting their position; citing instead differences of opinion over HU stacking and HEP models. They also alluded to the undocumented tacit agreement of BPA staff to support CTUIR's use of cover type/species matrices and stacking that were inconsistent with HEP principles and practices and later Crediting Forum guidelines (NPCC 2011) on baseline HEP surveys (Carl Scheeler, pers. comm.). Current BPA staff and management are unaware of any such agreement, and BPA through the Crediting Forum led the efforts for developing and adopting biologically based HEP SOPs and standardized crediting practices across the region.

The RHT discussed the matrix and stacking issues with CTUIR Wildlife Department staff without resolution. Both parties recognized the situation was at an impasse, at which time the RHT requested assistance from BPA staff, which elected not to engage the issue. Subsequently, both CTUIR staff and the RHT "agreed to disagree," acknowledging that the issues will continue and will likely be resolved only through the settlement process.

BPA asked the RHT to complete CTUIR HEP surveys following HEP principles and Crediting Forum guidelines (NPCC 2011). The RHT finished the HEP surveys without reconciling the issues with the project sponsor. CTUIR staff did not agree with the RHT's HEP results.

The CTUIR further pointed out that YN wildlife mitigation projects should not have been credited against HU losses at McNary Dam and John Day Dam, citing ceded land territorial issues (Carl Scheeler, pers. comm.). Recognition of the CTUIR position would have provided more loss HUs to both the CTUIR and WDFW to mitigate. BPA's position regarding the CTUIR views is the same as with Washington: BPA must mitigate wildlife and wildlife habitat, but it has considerable discretion in determining how to fulfill that responsibility and whom to work with.

[19] Tier 1 Fish project.
[20] This site was formerly the Conforth Ranch.
[21] Exception: The newly formed RHT used the same number of HEP models per cover type for the 2005 Wanaket follow-up HEP analysis as applied to the baseline HEP survey conducted by the CTUIR.

The RHT encountered two main issues while implementing the Council's HEP program:

1. Baseline HEP survey stacking as implemented by the CTUIR was not consistent with that found in either the John Day Dam or McNary Dam loss assessments (Rasmussen and Wright 1989) or consistent with Crediting Forum guidelines (NPCC 2011).
2. The project sponsor's BPA COTR did not assist the RHT in working through the issues with the project sponsor.

Discussion

As with other wildlife mitigation HEP surveys, the RHT was tasked with conducting HEP surveys following HEP protocols and using Crediting Forum guidelines (NPCC 2011) to ensure that HEP was applied fairly and consistently to all project sites and sponsors across the Region. In the case of CTUIR projects, applying these principles and guidelines required the RHT to modify extant CTUIR baseline HEP cover type/species matrices to conform to the same Crediting Forum standards (NPCC 2011) the RHT applied to all wildlife mitigation HEP surveys. CTUIR compensation site cover type/species matrix and stacking issues are presented below for each CTUIR wildlife mitigation compensation site along with the RHT's responses.

Isqúulktpe Compensation Project

Working for the CTUIR, Quaempts (2003) used HEP species from both the McNary and John Day hydro projects to evaluate habitat conditions during the 2003 Isqúulktpe baseline Habitat Evaluation Procedures (HEP) analysis. The Tribe's baseline HEP model stacking, however, was not consistent with that found in either the John Day Dam or McNary Dam loss assessments (Rasmussen and Wright 1989), and was inconsistent with Crediting Forum (NPCC 2011) guidelines and how stacking was applied to other mitigation projects across the Region. As a result, BPA received fewer HU credits to apply towards its Lower Columbia River wildlife mitigation obligation than would have been available had proper stacking been applied.

To address this inconsistency, the RHT developed the 2012 follow-up HEP analysis cover type/species matrix, including HEP model species selection and stacking, based on the McNary Dam loss assessment (Rasmussen and Wright 1989) and Crediting Forum's Crediting Technical Team (CTT) guidelines that recommended HEP technical teams: "*use the same number of species to characterize the out of kind cover types as were used to characterize the loss assessment cover types*" (SOPa) (NPCC 2011).

Crediting the Isqúulktpe project was complicated. The RHT had to take the following actions to determine 2012 follow-up HEP results. Two of the actions (3 and 4) were unique to the Isqúulktpe project:

1. The RHT ensured that BPA received "full" acquisition/protection and habitat improvement HU credit generated on mitigation lands acquired with BPA funds, while HU credit on Tribal Allotment/Trust lands included only habitat "enhancement" HUs that exceeded baseline HEP results.

2. The RHT added or subtracted HEP models from the 2003 baseline HEP matrix (Quaempts 2003) as needed, (which was not supported by the CTUIR), to ensure that HU stacking was consistent with the HU stacking principles and practices applied throughout the Region.
3. The RHT developed a “construct” for determining an “enhancement” HSI value for species added to the 2012 follow-up HEP survey, but not used in the 2003 HEP analysis.
4. The RHT developed a method to determine how HUs generated from “added” HEP models HUs were calculated for “BPA mitigation acquisition lands” versus “Tribal Allotment/Trust” lands.

Issue 1 Discussion

The Isqúulktpe Watershed Project is comprised of four land categories including:

1. Bonneville Power Administration (BPA) Mitigation Acquisition lands (purchased with BPA funding)
2. Tribal Allotment lands
3. Tribal Trust lands within the range unit
4. Tribal Trust lands out of the range unit

Elseroad (2013) reported that BPA and the CTUIR agreed to allow both baseline and enhancement credit for lands purchased with BPA funds and that BPA would take only enhancement HUs generated on extant Tribal Allotment and Tribal Trust lands included as part of the Isqúulktpe Wildlife Mitigation and Watershed Project. Crediting of Isqúulktpe land categories is summarized in Table 2.

Table 2 Isqúulktpe land categories, HU crediting type, cover types, and acres

Project Land Class	Crediting Type	Cover Type	Acres
BPA Mitigation Acquisition	Acquisition, protection, and enhancement credit (“Full” Credit)	conifer forest	1,230.10
		grassland	4,142.17
		riparian forest	62.33
		upland shrub	502.01
		Total	**5,936.61**
Allotment	Enhancement credit above baseline	conifer forest	1,964.70
		grassland	5,980.12
		riparian forest	39.56
		upland shrub	657.31
		Total	**8,641.69**
Tribal Trust- within range unit	Enhancement credit above baseline	conifer forest	352.63
		grassland	781.35
		riparian forest	9.74
		upland shrub	82.80

Project Land Class	Crediting Type	Cover Type	Acres
		Total	**1,226.52**
Tribal Trust- outside range unit	Enhancement credit above baseline	conifer forest	338.37
		grassland	291.15
		riparian forest	11.14
		upland shrub	7.83
		Total	**648.49**
		Grand total	**16,453.31**

BPA funds were used to acquire/manage the grazing leases on Tribal Allotment and Trust lands (Appendix J) for wildlife. As such, BPA funds are, in effect, being used to manage extant Tribal lands similar to what occurred with WDFW wildlife areas.

Crediting BPA with only permanent enhancement HU credit above baseline HEP results on Tribal Allotment and Tribal Trust lands was an anomaly, as BPA generally claimed baseline HU credit elsewhere in the Region. Case in point: WDFW, which used extant wildlife area lands purchased with State funds for much of its wildlife mitigation compensation program, provided BPA partial HU credit generated on those lands based on the WDFW crediting formula (Appendix G). In contrast, the CTUIR did not provide BPA baseline HU credit for including tribal lands as compensation sites, which created an inconsistent crediting standard between the two project sponsors. However, all parties agreed to their respective crediting terms.

Issue 2 Discussion

The RHT paired Isqúulktpe cover types with cover types listed in the McNary Dam loss assessment (Rasmussen and Wright 1989) as shown in Appendix K, and compared baseline and follow-up HEP model stacking to determine the additional number of HEP models needed to evaluate the project site. Follow-up/baseline HEP model stacking and variances are compared in Table 3.

Table 3 Baseline and follow-up HEP stacking comparison

Isqúulktpe Cover Types	Grassland	Conifer Forest	Riparian Forest	Upland Shrub
Number of HEP Species - 2012 Follow-up HEP Survey	4	2	2	3
Number of HEP Species – 2003 Baseline HEP Survey	1	2	4	1
Number of 2012 Follow-up HEP models needed (±)	**+3**	**0**	**-2**	**+2**

The CTUIR used less than the minimum number of HEP models required to evaluate three out of four cover types in the baseline HEP survey; the exception was the riparian forest cover type where four HEP models were applied when only two were needed. Netting the under-and over-use of HEP models per cover type, the CTUIR's HEP survey results understate actual HUs protected and BPA's credit. To address this problem, the RHT modified the Isqúulktpe follow up HEP matrix as shown in Table 4.

Table 4 Modified Isqúulktpe cover type/species matrix

HEP Species Models	Grassland	Upland Shrub	Conifer Forest	Riparian Forest
Downy Woodpecker			x	
Black-capped Chickadee			x	
Blue Grouse	x	x		
Great Blue Heron				x
Mink				x
Western Meadowlark	x			
White-tailed Deer	x	x		
Sharp-tailed Grouse	x	x		
Total	**4**	**3**	**2**	**2**

The RHT retained the HEP models used in the 2003 baseline HEP survey and added models as needed to ensure that 2012 follow-up HEP model stacking was consistent with NPCC Crediting Forum guidelines (NPCC 2011). Follow-up and baseline HEP species are compared to McNary Dam loss assessment HEP models (Rasmussen and Wright 1989) in Appendix L.

Issues 3 and 4 Discussion

These two issues are closely related and therefore will be discussed concurrently. The crediting "construct" suggested by the RHT is described in detail in the Isqúulktpe 2012 follow-up HEP report (Ashley and others 2014) and summarized below.

3. Use standard crediting protocols on mitigation lands acquired with BPA funds.
   A. BPA receives enhancement HUs above baseline HU values for those HEP species used in both the 2003 baseline and 2012 follow-up HEP analyses.
   B. Follow-up HEP (2012) habitat suitability indices and HU results that are less than 2003 baseline HSIs/HUs remain credited at 2003 levels unless otherwise agreed to by all parties.
   C. BPA receives minimal HU "baseline" credit for those species "added" to the 2012 follow-up HEP cover type/species matrix that were not used in the 2003 baseline HEP survey
4. Develop a metric for estimating a minimum "enhancement" HSI value for HEP models "added" to the 2012 follow-up HEP analysis that were not used during the 2003 HEP surveys.
   A. Based on Crediting Forum principles.
   B. Applicable only to Tribal Allotment and Trust lands.
   C. Assumes that if the "added" HEP models had been used in the 2003 baseline HEP survey, habitat suitability indices would have increased by 2012.

Metric Discussion

Although the Crediting Technical Team (NPCC 2011) did not have this specific purpose in mind when they suggested, "If using fewer species to characterize the mitigation site cover type than were used to characterize the losses, *average the HSIs* of the out of kind mitigation cover types and multiply by the number of species used in the losses…", the RHT applied this stacking SOP to develop the metric to determine the HSI value to apply to HEP models that were added to the 2012 follow-up HEP analysis, but not used in the 2003 baseline HEP survey.

Based on this SOP, the RHT *averaged* the "differences" between 2012 HSIs and 2003 HSIs for like species by cover type (Table 5) and then averaged those results, which resulted in a 0.11 HSI that was applied to HEP species added to the 2012 HEP analysis. The 0.11 HSI represents the minimum increase in habitat suitability (enhancement) that *could have* occurred had the models added to the 2012 HEP analysis, for stacking purposes, been used in the 2003 baseline HEP analysis (the RHT *assumed* that habitat quality/HSI would have increased between 2003 and 2012). Note that since the 0.11 HSI was determined by averaging the HSI differences, the resultant HUs are extrapolated from the data, using the Crediting Forum SOPs, but they are not biologically based and should be considered "negotiated HUs".

The RHT applied the 0.11 HSI to HEP models added to Tribal allotment and Trust Lands and calculated HU results. Isqúulktpe compensation site HUs and calculations are shown in Appendix M, which includes column explanations included below the table. As of the writing of this document, the RHT's approach to crediting the Isqúulktpe project has not been accepted by either BPA or CTUIR staff.

Table 5 Metric table for determining the "enhancement" HSI value of add-on HEP models

	Grassland HSIs			Conifer Forest HSIs			Riparian Forest HSIs			Upland Shrub HSIs			
RHT 2012 HEP Species	**2012**	**2003**	**Change**	**2012**	**2003**	**Change**	**2012**	**2003**	**Change**	**2012**	**2003**	**Change**	**Project $\bar{X}$ HSI Change**
Downy Woodpecker	-	-	-	0.58	1.00	-0.42	-	-	-	-	-	-	-
Black-capped Chickadee	-	-	-	0.94	0.98	-0.04	-	-	-	-	-	-	-
Blue Grouse	0.14	n/a[a]	n/a	-	-	-	-	-	-	0.14	0.39	-0.25	-
Great Blue Heron	-	-	-	-	-	-	0.67	0.31	0.36	-	-	-	-
Mink	-	-	-	-	-	-	0.99	0.84	0.15	-	-	-	-
Western Meadowlark	0.80	0.12	0.68	-	-	-	-	-	-	-	-	-	-
White-tailed Deer	0.49	n/a	n/a	-	-	-	-	-	-	0.49	-	-	-
Sharp-tailed Grouse (nesting)	0.22	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a	-
Sharp-tailed Grouse (winter)	-	-	-	-	-	-	-	-	-	0.75	n/a	n/a	-
$\bar{X}$ HSI Change per Cover Type	-	-	**0.68**	**-**	**-**	**-0.23**	**-**	**-**	**0.26**	**-**	**-**	**-0.25**	**0.11**

[a] The abbreviation n/a indicates the HEP model was not used in the 2003 baseline HEP survey.

Rainwater I Compensation Project

The Rainwater 1 Wildlife Mitigation and Watershed Project (Rainwater 1) 2004 baseline HEP analysis (Childs 2004) included HEP species from both the McNary and John Day hydro projects. Baseline HEP model stacking, however, was not consistent with that found in either the John Day Dam or McNary Dam loss assessments (Rasmussen and Wright 1989).

The RHT based the 2013 follow-up HEP analysis, including HEP model species selection and stacking, on the John Day Dam loss assessment (Rasmussen and Wright 1989) and Crediting Forum guidelines and principles (NPCC 2011). The RHT modified the cover type/species matrix and stacking accordingly and conducted the follow-up HEP analysis.

Like at Isqúulktpe, the CTUIR did not accept the modified cover type/species matrix and stacking proposed by the RHT, nor did the Tribe agree with the RHT's HEP results. All parties again recognized the impasse and tabled further discussion.

Rainwater II Compensation Project

The Rainwater II site was acquired with BPA Fish Project funds. Because the project area provided significant benefits to terrestrial wildlife species, the project area was identified as a Tier 1 Fish project area in NPCC's Crediting Forum Report (NPCC 2011), which meant that BPA would take C&I HU credit.

The RHT conducted the baseline Habitat Procedures Evaluation (HEP) evaluation on the 2,435 acre Rainwater Phase II project site in June 2012. The RHT based the Rainwater Phase II cover type/HEP species model matrix on the HEP species model selection and stacking described in the McNary Dam loss assessment (Bich and others 1991). Again, the CTUIR could not state a HEP or science-based reason for doing do, but it still did not agree to the modified cover type/species matrix and stacking recommended by the RHT nor did the Tribe concur with the RHT's HEP results.

Wanaket Compensation Project

Wanaket Wildlife Area (formerly the Conforth Ranch) baseline HEP studies were completed in 1990 (Rasmussen and others 1991) and re-evaluated in 1995 (CTUIR, unpublished data). In the original HEP study conducted by Rasmussen (1991) cover type acres and habitat suitability indices were estimated based on the proposed boundary of the wildlife area, which had not been finalized for mitigation purposes.

When acquisition of the property was completed, the final boundary was different than the proposed 1990 project boundary. In 1995, corrected acreages for each cover type were applied to the 1990 habitat suitability indices to adjust the number of baseline habitat units.

Although baseline HUs were credited towards BPA's mitigation obligation at McNary Dam, fewer species were used to evaluate project cover types than listed in the McNary Dam loss assessment (Rasmussen and Wright 1988) for like cover types as shown in Appendix N. Unlike other CTUIR projects, the newly formed RHT did not modify the baseline HEP matrix, but noted the discrepancy in the Wanaket project follow-up HEP report (Ashley 2006). At that juncture, there was no clear direction from BPA concerning the modification of HEP matrices. Consequently, the Wanaket baseline and follow-up HEP result HUs are under reported.

CTUIR Closing Comments

The RHT believed that in their earlier individual survey efforts the CTUIR had not followed the standard HEP protocols or the crediting practices used by other project sponsors across the Columbia Basin. What were considered principled compromises based on HEP protocols and later, Wildlife Crediting Forum (NPCC 2011) consensuses in other areas (e.g., applying proper HEP model stacking and substituting HEP models), seemed to appear to CTUIR Wildlife Department staff as capitulating to BPA, perhaps due to a perceived adversarial role by some of the parties.

CTUIR Wildlife Department staff appeared to view the Region wide effort to standardize crediting practices as a method for BPA to increase the number of HUs BPA received for each project, rather than an effort to “level the crediting playing field” and bring fairness to the crediting table. CTUIR Wildlife Department staff may have also perceived the RHT as biased towards BPA’s positions on issues such as HU crediting.

It is the RHT’s opinion that the CTUIR’s assertion that BPA COTR staff agreed with the Tribe’s use of inappropriate cover type/species matrices on baseline HEP surveys during the 1990s is accurate, but there is no evidence that BPA management knew of or approved this “agreement.” At that juncture, there appeared to be little Program level guidance or unity within BPA regarding HU crediting. COTRs often developed close relationships with project sponsors and worked autonomously and made decisions independent of what was occurring elsewhere in the Region with other project sponsors—even those working to mitigate the same dams. This allowed both BPA COTRS and project sponsors within a Sub-region to reach agreement on a variety of issues without recognizing or fully understanding the long term or programmatic implications elsewhere.

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Appendix A – Habitat Evaluation Procedures Synopsis

HEP, developed by the U.S. Fish and Wildlife Service (USFWS), is used to quantify the impacts of development, protection, and restoration projects/measures on terrestrial and aquatic habitats by assessing changes, both negative and positive, in habitat quality and quantity (USFWS 1980), (USFWS 1980a).

HEP is a habitat based approach to impact assessment that documents change through use of a habitat suitability index (HSI). The HSI value is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected wildlife and fish species.

The HSI value is an index to habitat carrying capacity for a specific species or guild of species based on a performance measure (e.g. number of deer per square mile) described in HEP species models. The index ranges from 0.0 to 1.0. Each increment of change is identical. For example, a change in HSI from 0.1 to 0.2 represents the same magnitude of change as a change from 0.2 to 0.3, and so forth. A HSI of 0.3 indicates that habitat quality/carrying capacity is marginal while a HSI of 0.7 suggests that habitat quality/carrying capacity is relatively good for a particular species (Table 1).

Table 1 Habitat suitability verbal equivalent rating

Habitat Suitability Index	Verbal Equivalent
0.0 < 0.2	Poor
0.2 < 0.4	Marginal
0.4 < 0.6	Fair
0.6 < 0.9	Good
0.9 ≤ 1.0	Optimum

Habitat units are determined by multiplying the habitat suitability index by the number of acres of habitat (cover type) protected. For example, if the HSI output for a mule deer HEP model is 0.50 and the number of acres of shrubsteppe habitat protected is 100, then the number of HUs are 50 (0.50 HSI x 100 acres = 50 HUs).

Habitat variables, suggested mensuration techniques, and mathematical aggregations of assessment results are included in HEP evaluation species models. In some cases, habitat variable measurement techniques have been modified to take advantage of current global information system (GIS) data/capabilities.

Appendix B – Wildlife Crediting Forum report

Wildlife Crediting Forum Report on Forum Deliberations
January 2010 – May 2011

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Wildlife Crediting Forum
Report on Forum Deliberations
January 2010-2011
Northwest Power and Conservation Council

TABLE OF CONTENTS

Wildlife Crediting
Forum Report on Forum
Deliberations January 2010
– May 2011
Northwest Power and Conservation Council

EXECUTIVE SUMMARY

The Council chartered the Forum to provide advice on the crediting and accounting of wildlife habitat mitigation associated with the construction and inundation impacts of the Federal Columbia River Power System (FCRPS). The Forum consists of wildlife program managers representing tribes (14 in all) and state fish and game departments (Oregon, Washington, Idaho) impacted by the FCRPS, the U.S. Fish and Wildlife Service (USFWS), and representatives from the Bonneville Power Administration (BPA) and BPA Customers. The State of Montana is not a participant as wildlife mitigation issues relating to the FCRPS have been settled by prior agreement between BPA and the state.

The instructions to the Forum were to make recommendations regarding the NPCC Wildlife Crediting Program (Program) with respect to:

- Developing a commonly accepted "ledger" of habitat units acquired by BPA
- Developing a common database for tracking, assigning and recording habitat units
- Resolving issues about accounting for habitat units
- Other issues related to wildlife crediting, including the use of Habitat Evaluation Procedures (HEP) or alternative evaluation procedures

The charter also allowed for the development of strategies that will allow the parties to achieve long-term agreements.

The Forum and several subcommittees have been meeting since January, 2010 to address Program issues. Much of the Forum's early deliberations focused on the difficulty of coming to collective agreement on all issues posed by the Council's Fish and Wildlife Program. Crediting issues were found to differ depending on geographic area, specific hydropower projects, and the entities involved in specific crediting decisions. The methodologies involved in crediting decisions have also changed and evolved over time, been interpreted and applied in differing ways, and in some cases crediting has been resolved through individual project agreements. Reflecting on these factors, the Forum felt that the many technical and recordkeeping issues with the ledger, overlaid with unresolved policy issues, would make full resolution at the Forum level difficult, and decided that "agreements" were more likely to be an effective means of resolution. At the same time, the Forum indicated that the technical analysis of the ledger should continue in order to help resolve or make clear as many outstanding issues as possible. The Forum dedicated considerable effort over several months and while not every issue or dispute was resolved, and while significant anomalies remain, the commonalities developed by the Forum provide a solid basis for bringing this portion of the Program to a successful conclusion. Major areas of accomplishment include:

- Establishment of a ledger depicting the current status of Bonneville-funded wildlife mitigation activities
- Development of Standard Operating Procedures for future applications of HEP
- Development protocols for determining the amount of credit Bonneville should receive for management actions that occur on Federal lands
- Development of protocols for determining the amount of credit that Bonneville should receive for fish mitigation projects that benefit wildlife
- Acceptance of the Fish and Wildlife Program loss assessments as the agreed upon measure of wildlife losses

However, several policy-related issues remain unresolved including:

- Agreement on the application of the crediting ratio established in the Fish and Wildlife Program
- Agreement on how to deal with wildlife species benefiting from open water habitats resulting from reservoirs associated with dam construction
- Agreement on how to account for mitigation that occurred prior to the 1980 Northwest Power Act

While these issues remain unresolved, the report provides important background information on them which can form the basis for negotiations focused on agreements and for future Council policy deliberations associated with future Fish and Wildlife Program amendment processes.

PURPOSE

The purpose of this summary report is to capture the work conducted by the Wildlife Crediting Forum (**Forum**). The Forum was chartered in late 2009 by the Northwest Power and Conservation Council (**NPCC**) to provide input on the Council's Columbia River Basin Fish and Wildlife Program (Program). This summary report provides an overview of the Forum's discussions and direction through December 2, 2010. This summary report and appendices also reflect the additional work conducted in January and February 2011 with Bonneville Power

Administration (BPA) and Columbia Basin Fish and Wildlife Authority (CBFWA) staff to further analyze Program records by sub-basin.

This summary report only reflects the input of individual Forum members and does not necessarily represent the policy position(s) of the tribes, agencies, and stakeholders they represent. Forum members have been made aware that they serve only in an advisory role to NPCC.

BACKGROUND

NPCC chartered the Forum to provide advice on the quantifying and accounting system (informally known as the **Ledger**) for the wildlife habitat mitigation credits associated with the construction and inundation impacts of the Federal Columbia River Power System (**FCRPS**) within the Columbia River Basin (**Basin**). The database that currently houses the Ledger is called **Pisces**. The Program was initiated in 1981, and has been modified from time to time (most recently in 2009) by NPCC in updating the overarching **Northwest Power Plan, which by law includes the Program as a component**.

The Forum consists of wildlife co-managers representing the 14 tribes and 3 state fish and game departments (Oregon, Washington, Idaho) impacted by FCRPS; and representatives of the U.S. Fish and Wildlife Service (USFWS), BPA, and BPA Customers. The State of Montana is not a Forum participant, as wildlife mitigation issues relating to FCRPS have been settled by prior agreement between BPA and that state. CBFWA and NPCC staff acted as advisors to the Forum. A private consulting firm (Parametrix) was engaged to facilitate Forum processes and to provide for augmented technical analysis of the Ledger.

The original Forum charter called for the development of recommendations with respect to:

- Developing and recommending to the Council a commonly accepted ledger of habitat units acquired by the Bonneville Power Administration.
- Recommendations to the Council on ways to resolve issues about accounting for habitat units.
- Developing a common data base for tracking, assigning and recording habitat units.
- Reviewing issues related to wildlife crediting, such as the frequency and use of the Habitat Evaluation Procedure (HEP) following the initial baseline evaluation. The forum could also provide recommendations on acceptable alternative evaluation procedures.

The Forum met eight times in 2010 to address the Program issues. The Forum also convened three sub- committees to discuss specific issues (credits for fish projects, Federal lands, and general Ledger issues). Each of these subcommittees met one or two times, and produced reports which were provided to the full Forum. The Forum conducted wildlife crediting issues orientation and reviews over the course of its first three meetings. Starting in May 2010, the Forum focused on the difficulty of coming to collective agreement on the resolution of even the first issue specified in its NPCC charter (see above). Several factors contributed to this challenge:

- Over the course of nearly 30 years, the NPCC has modified the Program from time to time. In addition, some changes have not been uniformly interpreted by the co-managers or BPA.

- Wildlife mitigation is largely, though not exclusively, out-of-place and out-of-kind, which means the areas and species used for mitigation are not necessarily the same as those lost through the construction and inundation of FCRPS dams. Thus, the habitats and species used in the loss assessments were in many cases not the same as those needing crediting on the mitigation sites.

- Crediting issues were found to differ depending on geographic area, specific hydropower projects, and the tribes or agencies involved.

  The database system housing the Ledger has also changed and evolved, and some ad-hoc “workarounds” have been made to fit data into database formats.

- The methodologies involved in the Program have changed and evolved, and interpretation and application has varied in the field, across different sub-regions, and as entered in the ledger.

- The tool used to evaluate the quality of habitat being acquired or enhanced (the Habitat Evaluation Procedure or HEP) was not designed to provide comparability across a region as large and diverse as the Columbia River Basin.

In some cases, (e.g. Montana, Dworshak, Willamette) crediting has been resolved through individual wildlife mitigation agreements. Generally, these types of agreements have resulted in a comprehensive resolution of wildlife mitigation issues. *NOTE: the use of individual agreements is permitted by the Program.*

Reflecting on these factors, the Forum concluded that the many technical and recordkeeping issues with the Ledger, overlaid with unresolved policy issues, would make full resolution in accordance with the original NPCC charter difficult. The Forum discussed, therefore, the possibility of “settlement agreements” as a more effective means of resolution. At the same time, the Forum indicated that the technical analysis of the Ledger should continue to help resolve or make clear as many outstanding issues as possible. NPCC concurred with this overall “revised” approach and goals at its July 2010 meeting.

NOTE: The possibility of shifting to a "settlement agreement" option is referenced as an acceptable alternative in the original Forum charter: ".... or strategies that will allow parties to achieve long-term settlement agreements." In October 2010, a settlement for the Willamette River Sub-basin of the FCRPS was signed between BPA and the State of Oregon (Oregon participated during the early phases of the Forum, but discontinued participation following completion of the Willamette Wildlife Agreement).

On December 2, 2010, the Forum met and discussed ongoing issues and concerns. NPCC staff and the consultants recommended that additional basin-wide technical analysis was becoming more costly than merited by the resulting understanding or improvements to the ledger. The suggestion was made that the most valuable additional analysis would be that conducted at the sub-region level. A considerable effort with respect to this detailed technical analysis was undertaken **up through May 20, 2011**. The outcomes of these sub-region reviews are attached as Appendix D.

Also at the Forum's December 2 meeting, a matrix prepared by NPCC and Parametrix staff was presented that estimated the level of agreement (high, medium, low) by sub-region for each of the remaining issue topics. A version of this matrix, revised as per sub-region reviews, is included in each of the attached sub- region appendices.

NOTE: Inclusion of the following issue topics in this summary report does not mean that the Forum has reached full consensus on any given item. Each may require additional discussion on the part of the full Forum and/or at the subgroup level. Accordingly, specific recommendations are not included. Some divergent viewpoints remain (an example being over the 2:1 crediting ratio). It is also important to keep in mind that within the context of developing settlement agreement(s) a full resolution of many of the remaining Ledger issues identified herein may be moot, as settlement(s) may simply supplant the issue irrespective of the degree to which it is technically resolved (or not).

VARIABILITY AND EXPECTATIONS OF HEP

NOTE: This issue was referred to an ad-hoc subcommittee of the Forum. The summary below reflects the deliberations of that subcommittee. In addition, this particular subcommittee addressed other Crediting issues. ***The full report of the subcommittee is attached as Appendix A.***

At the May meeting of the FORUM, the Ledger Subcommittee provided a report that identified a number of technical and policy issues that would need to be addressed in order to develop a comprehensive and consistent crediting ledger based on habitat unit accounting. The subcommittee was tasked with working through known issues such as: lack of consistency in the use of the Habitat Evaluation Procedure (HEP), HEP models, data collection, "stacking" and other related issues.

Inherent Variability in HEP

However, the subcommittee acknowledged at the outset that a major cause of the variation in the region is the nature of the HEP tool itself. The HEP tool was designed and is very effective as a comparative tool to address mitigation for specific losses. The habitat units provided through the HEP process provide relative value, but should not be seen as an absolute value. HEP was not intended as a comprehensive accounting tool tracking progress over a broad geographic area and over a long period of time. For that reason, the group recognized and accepted there is great variation, either positive or negative, in the habitat units attributed to any given property.

Other Issues

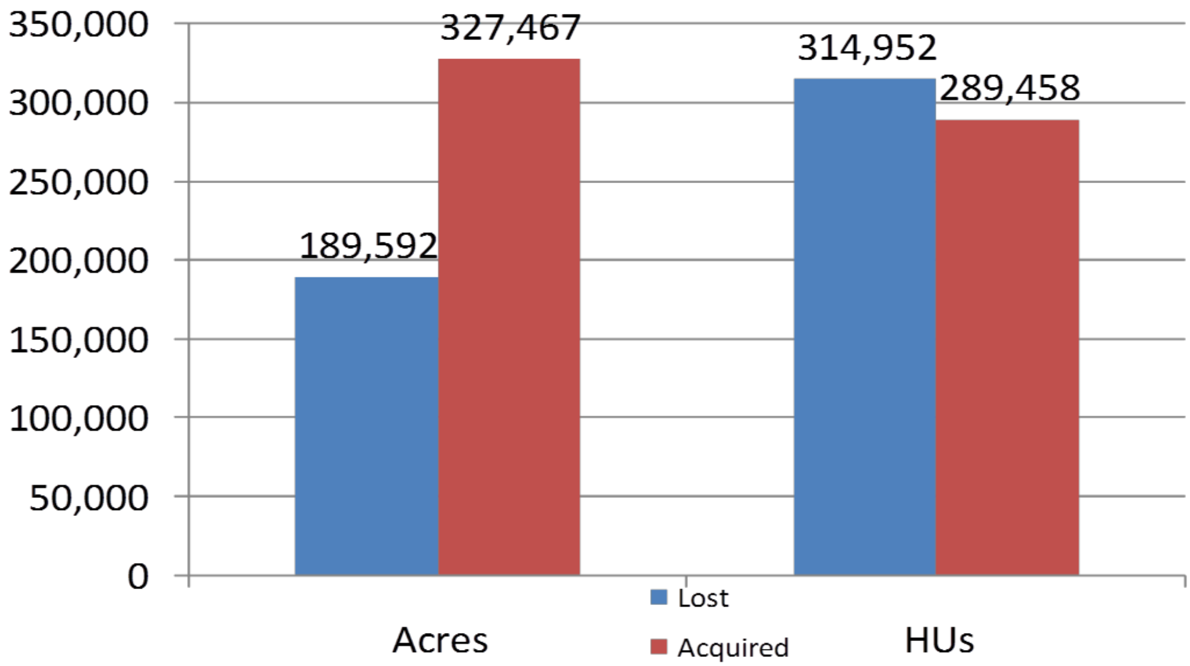
The subcommittee worked through the many issues identified above. Appendix A includes a summary of each of the issues and recommended standard operating procedures for the following:

- HEP Methods
- Stacking
- Crediting

Team Recommendation

In recent years, however, the application of HEP has been relatively consistent among projects. The subcommittee identified that Program crediting issues were found to differ depending on geographic area, specific hydropower projects, and the entities involved in the specific crediting decisions. The methodologies involved in crediting decisions have also changed and evolved over time, been interpreted and applied in differing ways, and in some cases crediting has been resolved through individual project agreements. Reflecting on these factors, the Forum felt that the many technical and recordkeeping issues with the ledger, overlaid with unresolved policy issues, would make full resolution at the Forum level difficult, and discussed the possibility of “agreements” as a more effective means of resolution. At the same time, the Forum indicated that the technical analysis of the ledger should continue to help resolve or make clear as many outstanding issues as possible while recognizing the numerical values from such an exercise are subject to the inherent discrepancies described above.

Figure 1 Acres and Habitat Units Lost and Acquired.



ISSUES RESOLVED

STANDARD OPERATING PROCEDURES FOR HEP

The quality of habitat varies widely between watersheds, sub-basins, and major regions across the basin. Thus the number of HUs per acre will also vary from watershed to watershed, sub-basin to sub-basin, etc. (Figure 1). The type of protection method also varies greatly. These variables were recognized by the Forum as a “fact of life” across such a large region, and such variation cannot be necessarily construed as inequity. The ledger subcommittee’s suggestions focused primarily on resolving such issues in future applications of HEP through the development of standard operating procedures to address the following issues:

- Sources of Variation in Crediting Due to HEP Methods: Methodological choices beginning with how habitat types are delineated for analysis and ending with the species models and inputs used can dramatically alter HEP results and therefore the HUs credited.

- Species Stacking: Using fewer species per cover type in the crediting HEP than were used in the loss assessments results in underreporting of HU credit.

- Crediting for Actions on public and other non-Permanent or Unsecured Mitigation: Either HUs on such sites have not been credited yet, or the credit was agreed to absent clear consistent guidance.

See Appendix A for a complete listing of the standard operating procedures recommended by the ledger subcommittee.

CREDITS ON FEDERAL LANDS

NOTE: This issue was referred to an ad-hoc subcommittee of the Forum. The summary below reflects the deliberations of that subcommittee.

Some management actions included in the Program occur on federal lands. This raises the question of how much credit BPA should receive for these actions. The Forum has concluded that for all future projects involving federal lands, the following considerations need to be addressed.

- Whether Bonneville funded actions on federal lands that are generally creditable, but have happened or would have happened anyway based on a Federal agency's usual and customary responsibilities should be included.
- Whether the federal agency's usual and customary responsibilities are such that the protections for wildlife values are assured over time.

This Forum subcommittee suggested that the following standards be applied to the question of crediting of federal land projects:

- Must meet the current Program criteria for wildlife projects
- Must be "permanently" protected – <u>minimum</u> of an easement with a term of equal to the life of the FCRPS, or an appropriately formulated and adopted federal management plan
- Must primarily benefit <u>priority</u> wildlife habitat, species or populations (as defined by federal, state, or tribal wildlife management plans or sub-basin plans).
- Subject to a completed wildlife management plan
- Subject to an "adequately funded" long-term restoration and/or maintenance agreement
- Located in the same province as the FCRPS hydroelectric dam against which it is being credited

The subcommittee also suggested that BPA receive credit for any enhancement provided by the management actions taken by the Federal agency, subject to:

- The enhancement credit shall be determined through the use of baseline HEP data if available, or from existing Federal agency data sets if HEP data are not available

- The enhancement credit being in "perpetuity" (e.g.: life of the FCRPS), unless there is a change in the management plan employed by the federal agency that results in the reduction of enhancement values. In such cases, the enhancement credits would be adjusted to reflect the reduced value.

CREDITS FOR FISH MITIGATION

NOTE: This issue was referred to an ad-hoc subcommittee of the Forum. The summary below reflects the deliberations of that subcommittee.

This Forum subcommittee clearly recognized that acquisition and restoration projects primarily, or even exclusively, designed for the purposes of mitigating for fish losses resulting from the FCRPS hydroelectric dam system could and does benefit wildlife. The subcommittee identified the need to develop guidelines for future habitat projects; and the need to state upfront what type of benefits were being sought (e.g.: what are the benefits for fish and wildlife?). The subcommittee also felt that projects that have joint benefits to fish and wildlife should be encouraged.

The subcommittee suggested the following should apply for fish projects to receive wildlife credits:

- Specific wildlife management plans for the project area need to be completed, approved and implemented
- Long-term operations and maintenance funding for wildlife species/habitats must be in place and "adequate"
- Appropriate permanent land protections (easements) should be applied, in perpetuity and with adequate protection language
- The protected wildlife species/populations/habitats should be "priority" and so defined by existing Federal, state or tribal management and sub-basin plans
- Located in the same province as the FCRPS hydroelectric dam against which it is being credited

The subcommittee also reviewed a specific list of such projects (Table 1). Projects were classified into four tiers. Tier 1 includes wildlife projects supported by anadromous fish funds that should be credited. The projects shown as Tier 2 were left as subject to "further review." Projects in the Lower Columbia Estuary were flagged as "special case" and included as Tier 3. These Tier 3 projects were identified by the subcommittee as potentially available as operational loss offsets for projects elsewhere in the FCRPS. Tier 4 projects are special existing projects on federal lands that may be considered for credit but in some cases may be difficult to categorize because they are located in areas not directly affected by hydroelectric development. These three projects (Bear Valley, Deer Creek, and Elk Creek) were moved by the Forum from the Federal Lands topic of this summary report and were directed to be included in Table 1. These types of projects potentially could lead to “over-mitigation” in some sub-regions. However these issues could be addressed as part of an agreement, as was the case with the Dworshak Settlement Agreement or as part of operational losses in the future.

Table 1: Candidate Fish Projects for Wildlife Credits

Parcel Name	Proponent	Sub-basin	Acres	Tier
Forrest Conservation Area	CTWSRO	John Day	4,232	1
Oxbow Conservation Area	CTWSRO	John Day	1,022	1
Pine Creek (Wagner Conservation Area)	CTWSRO	John Day	9,000	1
Rainwater Wildlife Area (Part II)	CTUIR	Walla Walla	2,340	1
Yakama Nation Riparian/Wetlands Restoration	Yakama Nation	Yakima	5,000*	1
Yakima Side Channels (Lower Naches)	Yakama Nation	Yakima	376	2
Colville Fish Habitat Projects	Colville Tribes	Okonogan	176	2
Cottonwood Farms / Witte Place	NFWF, Methow Conservancy	Methow	54	2
Hancock Springs	NFWF, Methow Conservancy	Methow	122	2
Heath	NFWF, Methow Conservancy	Methow	140	2
Mid-Methow / Lehman	NFWF, Methow Conservancy	Methow	93	2
Oak Flats (Naches River)	WDFW	Yakima	289	2
Red River Wildlife Area (Little Ponderosa)	IDFG	Clearwater	1,300	2
Sandy River Delta	Forest Service	Sandy	1,400	2
Yakima Side Channels (Upper Yakima)	Yakama Nation	Yakima	544	2
Zumwalt Prairie Preserve (Camp Creek Ranch)	Nature Conservancy	Imnaha	27,000	2
Crims Island	Columbia Land Trust	Columbia Estuary	451	3
Crazy Johnson Creek	Columbia Land Trust	Grays	305	3
Crooked Creek (F&W)	Columbia Land Trust	Columbia Estuary	60	3
Elochoman River	Columbia Land Trust	Columbia Estuary	183	3
Germany Creek	Columbia Land Trust	Columbia Estuary	155	3
Walker Island	Columbia Land Trust	Columbia Estuary	100	3
Willow Grove	Columbia Land Trust	Columbia Estuary	312	3
Bear Valley	IDFG/ShoBan	Salmon	n/a	4

Deer Creek	IDFG/ShoBan	Salmon	n/a	4
Elk Creek	IDFG/ShoBan	Salmon	n/a	4

LOSS ASSESSMENTS

The Forum chose not to reconsider prior loss assessments, and generally accepted *Wildlife Crediting Program Table C-4* (as published in the NPCC-approved 2009 Program) as an agreed to measure of loss assessments (Program Table C-4 is attached as Appendix B to this summary report).

The Forum's determination notwithstanding, in 2009 the Shoshone-Bannock Tribe, Shoshone-Paiute Tribe, Idaho Department of Fish and Game (IDFG) and CBWFA staff re-examined the Anderson Ranch, Palisades, Black Canyon, Minidoka, and Deadwood loss assessments in Southern Idaho for accuracy and consistency relative to other loss assessments across the Basin, and for the number of HUs credited against hydro facilities. HU losses reported in *Program Table C-4* were found by this group to be in error for the number of HUs listed for the Anderson Ranch, Black Canyon, and Palisades projects. In one instance, HUs were listed for sharp-tailed grouse, which was not a target species in any of the SE Idaho loss assessments and yellow-rumped warbler were not listed for Deadwood when they were included in the loss assessment.

NOTE: BPA's position is that it is not responsible for Deadwood Dam mitigation.

Southern Idaho loss assessment calculations subtracted estimated post-project HU gains from the total losses in reporting "net" losses. Because most other loss assessments show just the "total" losses, the "net" HU losses reported in Southern Idaho were 4,835 fewer than if the Southern Idaho loss assessments had listed only the "total" HU losses (as was the case in other parts of the Basin). Wildlife managers now believe that Habitat units gained from Southern Idaho mitigation projects should be examined and subtracted from the losses shown in *Program Table C-4*. .

NOTE: Program Table C-4 as published also included habitat <u>gains.</u>

ISSUES UNRESOLVED

CREDITING RATIO

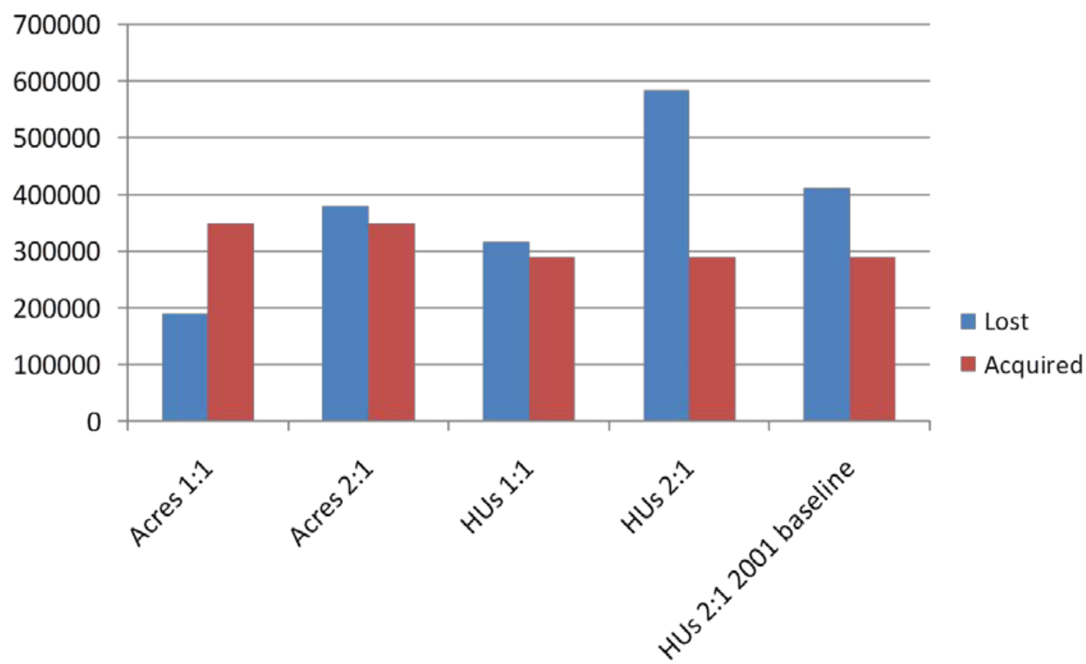
The <u>2000</u> Program applied a 2:1 ratio to all remaining habitat units (HUs) in the Ledger that had not been previously satisfied by habitat acquisitions and projects, and went into effect on April 1, 2001. The balance of HUs that remained on April 1, 2001 were to be doubled as a means of "settling" questions over the actual mitigation work remaining to reach full compensation for dam inundation and construction losses. NPCC specified that all credits from projects prior to April 2001 were to remain at the levels previously agreed to by BPA and project proponents.

Moreover, the findings section of the Program acknowledged that “the Council recognized existing mitigation project agreements, even if such agreements have a crediting ratio of 1:1. The 2009 Program reaffirmed the 2:1 crediting ratio (see Appendix E for 2009 Program language).

At its April 2010 meeting, the NPCC responded to questions put by some Forum members with respect to this policy, and confirmed its earlier policy decision establishing a 2:1 ratio effective April 1, 2001. Notwithstanding the NPCC’s recent confirmation, Forum members indicated that there is either disagreement with or different interpretations of the Council’s position. Further, members indicated that not all entities had made a formal policy decision relative to the Council’s 2:1 position. (See Appendix F for a more complete discussion of this issue).

The application of the 2:1 mitigation ratio and its varying interpretations results in changes in the total habitat units outstanding for mitigation. Figure I-2 shows the increase in habitat units or acreage needed to meet the mitigation obligation with the 2:1 ratio applied.

Figure 2.



HYDROELECTRIC FACILITY CREDIT ASSIGNMENTS

Credits are assigned to specific FCRPS hydroelectric facilities. In some cases, credits have been assigned to hydro facilities in different sub-basins from the actual project, to facilities that are more distant from projects than other hydro sites or to more than one facility. Although to an extent a recordkeeping issue, this practice has resulted in uncertainty over what HUs remain in any given subregion, whether mitigation has been adequately met for a given dam (or even over-mitigated), and concern that other sub-regions may end up being “short changed” when mitigation responsibilities are rolled up to the system-wide total. Figure 3 maps the location of wildlife projects and shows the relationship with facilities mitigated by the projects.

Forum members asked that the assignment of wildlife projects to multiple dams be evaluated. The available data does not specify the specific division of HUs to each dam. The way the data is stored in the ledger prevents double counting of credits when applied to multiple projects, but it does create new groupings of dams in addition to individual dams. Accordingly, a single dam may not easily be reviewed based on mitigation projects. Another concern raised by the Forum was the sets of species used for HEP evaluation when spread across multiple dams. The available data does not indicate the species used, or if the species at the dam site are the same as at the wildlife project site.

It also should be noted that the Loss Assessments for the Lower Snake River Dams included in the Fish and Wildlife Program are aggregated for all four dams. Because of the complex relationship of these projects with the Lower Snake River Compensation Plan and other federal responsibilities no individual loss assessments were performed.

Ideally, the geographic distribution of projects effectively assigns projects to the closest dam. In some cases this can be a considerable distance, such as in the lower Snake. However, these projects are in the watershed nearest to the facilities. The Forum has indicated a preference that projects assigned to a hydro facility should at a minimum be in the same province as that hydro facility.

Additionally, it is also important to note that BPA does not believe that it has a mitigation responsibility for losses caused by the construction and operation of Deadwood Dam.

INUNDATION GAINS

The permanent dam reservoir pools resulting from inundation created a significant expansion of open- water habitat on the Columbia River. Not all wildlife species benefiting (and expanding) from new open water were those that lost suitable habitat due to inundation. Tribes and agencies (WDFW and IDFG) concurred that allowing credit for such species did not appear to be appropriate. The following species appear to have increased as a result of open-water gains created by inundation:

Table 2: Species and Gains from the 2009 Wildlife Program

Species	Habitat Units
Bald Eagle	5,693
Black-capped Chickadee	68
Common Merganser	1,042
Greater Scaup	820
Lesser Scaup	20,577
Mallard	174
Mallard (wintering)	13,744
Marsh Wren	207
Osprey	6,159
Redhead	4,475
Other Waterfowl	423
Western Grebe	273
Yellow Warbler	8
Total	**53,663**

PRE-ACT MITIGATION

Prior to the Northwest Power Act of 1980, official mitigation efforts in response to FCRPS system impacts were undertaken by Federal water resource managers (U.S. Army Corps of Engineers, Bureau of Reclamation) and the U.S. Fish and Wildlife Service. Some mitigation actions go back as far as the 1910s, and in many cases are very difficult or impossible to fully document and assess. Wildlife mitigation prior to 1980 was in part generated through consultation with the U.S. Fish and Wildlife Service under the Fish and Wildlife Coordination Act of 1934, and the subsequently more rigorous requirements from amendments in 1946 and 1958. The majority of the pre-Act mitigation is associated with the McNary and John Day dams. The 1991 Geiger Report and 2004 USFWS Coordination Act Report identified 50,938 acres of Pre-Act mitigation and recommended that 14,032 HUs be credited as mitigation (see Appendix D for Giger Report). Because this issue affects each of the sub-regions differently, the impact of the recommended credits will be addressed among the parties within each of the sub-regions.

AGREEMENTS

Following a lengthy discussion of the issues related to the use of HEP, the Forum agreed that resolution of many of these issues would require reevaluation and assessment of many of the original HEPs and a number of the subsequent project HEPs. The Forum concluded that these efforts likely would be both labor intensive and time-consuming, and that it was likely that a better course of action would be to focus on long-term agreements that address the unique situations represented in the various geographic areas. HEP analysis to date can form the underpinnings of agreements. The intent of this report is to help guide the resolution of these issues.

Agreements can provide benefits to both the wildlife managers and to BPA. For managers, they provide an assured funding stream for project implementation and maintenance and greater management flexibility. For BPA the advantages are greater certainty in budgeting and the ability to complete its mitigation responsibility for wildlife construction and inundation losses.

AGREEMENT SUB-REGIONS

The Forum suggests that several agreements are more feasible than a single basin-wide settlement agreement. Several sets of sub-regions based on groupings of hydroelectric projects were identified. The Forum decided on the following sub-regions on which to base further technical analysis and potentially to define agreement groups:

- Lower Columbia (Bonneville, The Dalles, John Day, McNary)
- Lower Snake (Ice Harbor, Little Goose, Lower Monumental, Granite)
- Upper Snake (Anderson Ranch, Palisades, Black Canyon, Minidoka, and Deadwood)
- Northern Idaho (Albeni Falls)
- Upper Columbia (Chief Joseph, Grand Coulee)

AGREEMENT LENGTH & "CURRENCY"

The term of the mitigation is either in perpetuity or for the life of the hydro project(s) to which losses are credited. However, the term of any agreement(s) conceptually could range from 10 years, as with the Fish Accords to the life of the federal hydroelectric system (FCRPS). The recent Willamette River Basin Memorandum of Agreement Regarding Wildlife Habitat Protection and Enhancement (Willamette MOA)specifies a term of 15 years to complete the purchases associated with the agreement which was deemed to be an adequate period for remaining mitigation obligations to be satisfied in that sub-basin.

An issue to consider is the consequences of any events, natural or human-made, that may change habitat conditions over the term of the agreement(s). This requires predicting those natural events that would increase or change the calculations of the remaining habitat needed for "full" mitigation, or identifying the impacts of other agreements in the basin, such as the Fish Accords.

The value of the agreement could also vary based on the term and the type of losses to be mitigated. For example, the value of the Willamette MOA varies across several increments within its overall term. Settlement agreement(s) could also potentially use a variety of “currencies,” including habitat units, acres, or funding. Agreements based on lump-sum payments are considered most desirable by many Forum members although there are challenges around how this may occur based on appropriate Federal funding levels and regulatory compliance issues for BPA.

PRIOR AGREEMENTS

Prior BPA-to-tribe/agency agreements, Memoranda of Agreements, or contracts may inform and/or affect how agreement(s) are reached. Some of these prior agreements include specific decisions about issue topics discussed in this summary report (for instance the 2:1 ratio), as well as including differing terms and requirements. The Forum recognizes the impact such prior agreements may have on settlement considerations.

OPERATION AND MAINTENANCE (O&M)

The success of mitigation projects often relies on active and ongoing management to maintain the habitat benefits obtained from land acquisition and restoration. Properties are purchased based on a number of criteria and. many properties purchased are not in pristine condition so O&M costs may vary considerably, particularly for the first several years after purchase. However, the 2007 Independent Economic Analysis Board (IEAB) report, “Investigation of Wildlife O&M Costs” concluded that Program costs for O&M are generally comparable to other land management agencies costs Settlement agreements should address this issue.

Other key findings relevant to the charter of the Forum include:

- O&M cost data in Pisces is very coarse and needs to be more detailed to provide support for informed comparisons. Current data on O&M does not allow for parcel to parcel comparisons.
- IEAB recommended data be added to Pisces to capture the other non-BPA cost shares and the expected life of investments.

AGREEMENT PROCESS

For any settlement agreement(s) to be funded, a series of steps must first occur, including NEPA review, budgeting and inclusion in a future rate case for BPA. These steps are identified in Appendix C as requested by the Forum, including estimated time requirements for each step. Appendix C assumed a certain timeframe for <u>initiating</u> negotiations, but as these are not definitive, this information should only be treated as an EXAMPLE of the <u>relative</u> time scale of any settlement process.

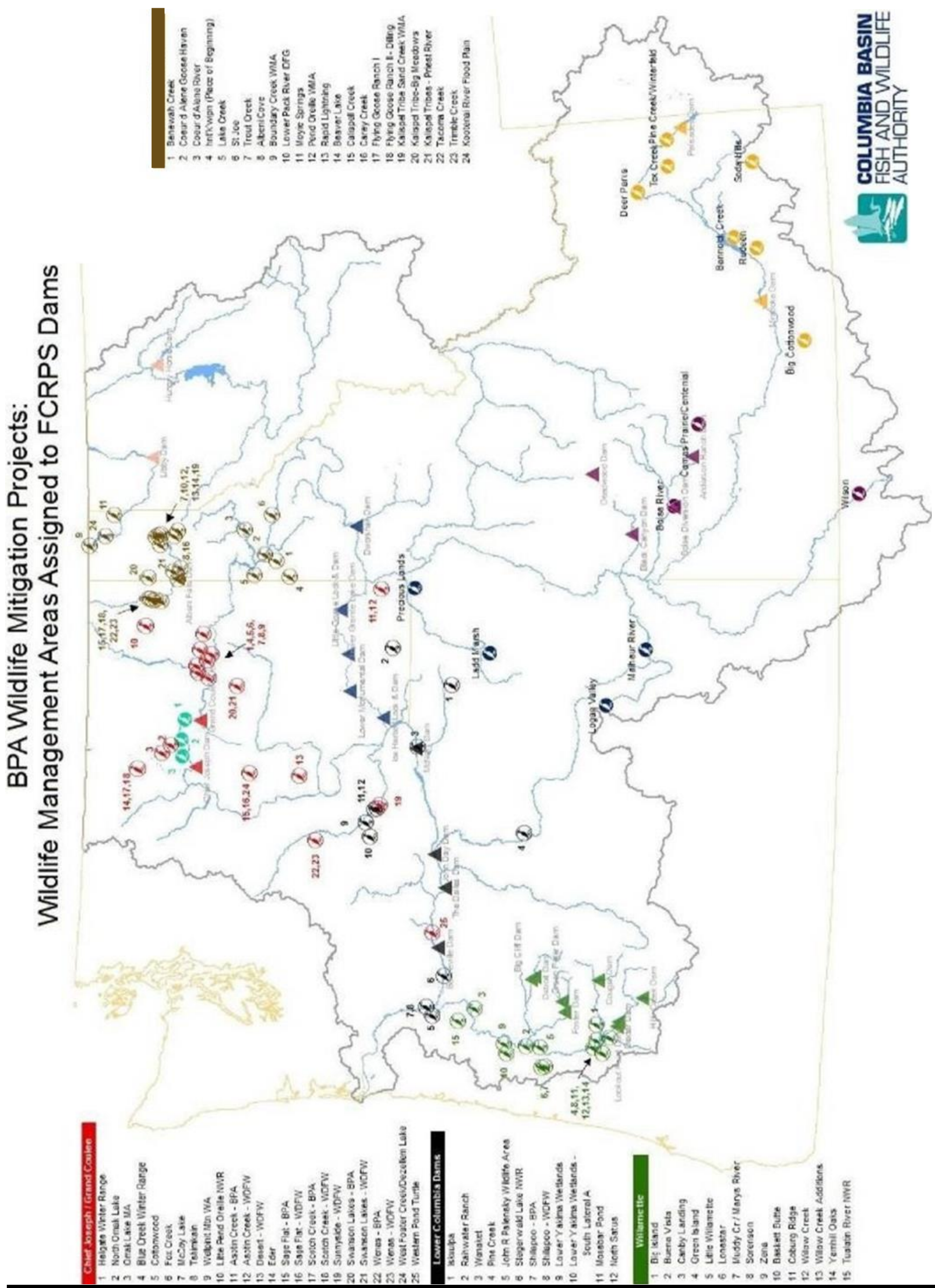


Figure 3: Projects and Facilities Mitigated

April 20-21, 2010 Crediting Forum Technical Team Meeting

The Crediting Technical Team addressed technical HEP issues that make reconciling the crediting ledger difficult and contribute to the different interpretations within the region on crediting. We identified issues in three tiers with the first tier representing technical HEP issues, the second tier focusing more on subregional issues that have policy implications for some but not all managers or areas in the region, and the third tier being primarily overarching, regional policy issues needing resolution. We sought to establish a foundation for greater consistency to the extent possible while recognizing the limitations of existing agreements. The following are working notes from the meeting and have not received regional peer review or input.

Tier 1 Issues: Technical HEP w/ little or no policy implications Sources of Variation in crediting due to HEP methods

1. Cover Typing - Delineation of cover type boundaries
2. Similarity (or lack thereof), between habitats characterized in losses and compensation lands
3. Choice of HEP species- for original losses and compensation lands
    - *Should be a good representation of habitat quality*
4. Lack of peer review or consistency of HEP models chosen for losses or compensation lands.
5. Choice of substitute HEP species when out of kind-
    - Covering same habitat attributes with same number of species
6. Modification or lack of suitable modification of HEP models.
    - Appropriate/inappropriate selection of model
    - Use of updated models for mitigation while losses are static with old models.
    - Appropriate/inappropriate alteration of equations to address site specific realities.
    - Real world differences in application of model from original area

7. Field Data Collection techniques

   - Changes in Techniques and intensity of survey
   - Changes in survey staff
   - Season of survey/phenology
   - Under represented or over represented cover types

Variation SOP

- *Use tools, models, and methods that most accurately reflect the quality and quantity of the habitats being protected and managed.*
- *HEP methods used should reflect the site specific habitat parameters and management goals of the property and may differ from the HEP methods used in determining the losses.*
- *When disagreements arise, the project proponent should seek resolution through consultation with BPA, HEP team, and sub-basin or provincial co-managers to assure consistency and accuracy.*
- *Consider validating new or significantly modified models with appropriate testing and review.*

Species Stacking

Stacking occurs when multiple species are used to characterize the quality of a single cover type. It becomes a crediting issue when the same number of species used to assess losses is not in turn used to characterize the compensation lands. *Stacking is an issue of how you adjust the credits of the mitigation sites to be in balance with the number of species used to characterize the losses. Loss assessments are what they are and should not be revised or replaced to address stacking issues.*

Stacking SOP

- *SOP options to address staking issues include:*

  a. Use the same number of species to characterize the out of kind cover types as were used to characterize the loss assessment cover types.

b. If using fewer species to characterize the mitigation site cover type than were used to characterize the losses, average the HSIs of the out of kind mitigation cover types and multiply by the number of species used in the losses. However, species selection must be peer reviewed and approved by the regional HEP team, BPA and the project proponent.

c. If incidental out of kind cover types (inclusions) are associated with a mitigation acquisition, assume the same HSI as the adjacent cover type.

d. Do not credit the same acres of a given cover type between two or more hydro projects with a combination of species from both.

Tier 2 Issues: Sub-regional issues with policy implications

Crediting public lands actions, trust lands, and non-permanent or unsecured lands mitigations

- How to credit BLM lease for range lands.
- How to credit State DNR Land mitigations.
- How to credit BIA Trust lands leases or easements
- How to credit leases or easements on fee lands
- How to credit areas where BPA contributed to but did not fully provide protection or operations and maintenance funding.
- How to credit BPA where they were not involved in the protection of the habitat but provide all or part of the O&M and enhancements.

Crediting SOP

- *Project proponents must provide minimum irreducible HU letter for each compensation site including statements on each of the following issues:*

  a. Hydro project being mitigated

  b. Cover type(s) and target species used to characterize habitat quality on the compensation site *c. Commitment to follow SOPs to quantify and qualify habitat*

d. Minimum number of habitat units being credited from the site

- *Crediting of Non-permanent protection- The Crediting Technical Team recommends that the region have a Crediting SOP covering sites without permanent protection. The specific operating procedure adopted needs to be further defined and agreed to.*

- *Partial purchase- credit for proportion of protection funding provided.*

- *Partial O&M or enhancements- credit for HU increases proportional to 10 year average investment.*

- *Credit for leases that may not provide permanent protection- credit against operational or secondary losses or normal full credit when the protection and credit from a non- permanent compensation site gets rolled over to another non-permanent site with an equal or greater amount of habitat value*

- *Credit for lands protected with partial lease such as the purchase of an annual grazing lease on Indian trust lands or a federal grazing allotment - receive credit for cover types enhanced by the annual protection and O&M. Assumption of replacement with similar lease if lease terminated.*

Tier 3 Issues: Policy level resolution required

1. Socio-political issues of crediting projects that are out of kind and out of place from impacts.

2. Allocation HUs among resource managers.

   a. Crossing political boundaries with mitigation actions.
   b. Crossing ecological/population boundaries.

3. Crediting of fish projects against construction and inundation wildlife losses.

4. Crediting non-permanent or unsecured lands

5. How to deal with “over mitigation”?

Where do we go from here?

1. Regional Agreements on SOPs after vetting through all Forum members.

2. Direct the HEP team to work with project managers at each compensation site to address technical shortcomings identified above.

    - For new projects, do this with baseline HEPs.
    - For existing projects, do this with follow-up HEPs.
    - Consider adding to HEP team’s contract an express mandate and responsibility to identify inconsistencies in technical HEP applications throughout the region.

3. Incorporate fish credit findings and recommendations as appropriate.

4. Reassign credits within lower four mainstem Columbia River dams.

    - Unlike other areas in the basin, the lower four crediting can be reassigned based on existing HEP reports, so no need to wait or gather additional data.

5. Develop draft ledger for recommendation to Council for review and approval.
    - The ledger will report HUs protected and enhanced through the Council’s Fish and Wildlife Program.

Appendix B - Loss Assessment Summary, Table C-4, 2009 Program

Table C-4 Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
Albeni Falls	
• Mallard Duck	-5,985
• Canada Goose	-4,699
• Redhead Duck	-3,379
• Breeding Bald Eagle	-4,508
• Wintering Bald Eagle	-4,365
• Black-Capped Chickadee	-2,286
• White-tailed Deer	-1,680
• Muskrat	-1,756
• Yellow Warbler	+171
Lower Snake Projects	
• Downy Woodpecker	-364.9
• Song Sparrow	-287.6
• Yellow Warbler	-927.0
• California Quail	-20,508.0
• Ring-necked Pheasant	-2,646.8
• Canada Goose	-2,039.8
Anderson Ranch	
• Mallard	-1,048
• Mink	-1,732
• Yellow Warbler	-361
• Black Capped Chickadee	-890
• Ruffed Grouse	-919
• Blue Grouse	-1,980
• Mule Deer	-2,689
• Peregrine Falcon	-1,222 acres*
* Acres of riparian habitat lost. Does not require purchase of any lands.	
Black Canyon	
• Mallard	-270
• Mink	-652
• Canada Goose	-214
• Ring-necked Pheasant	-260
• Sharp-tailed Grouse	-532
• Mule Deer	-242
• Yellow Warbler	+8
• Black-capped Chickadee	+68
Deadwood	
• Mule Deer	-2080
• Mink	-987
• Spruce Grouse	-1411
• Yellow Warbler	-309

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
Palisades	
• Bald Eagle	-5,941 breeding -18,565 wintering
• Yellow Warbler	-718 scrub-shrub
• Black Capped Chickadee	-1,358 forested
• Elk/Mule Deer	-2,454
• Waterfowl and Aquatic Furbearers	-5,703
• Ruffed Grouse	-2,331
• Peregrine Falcon*	-1,677 acres of forested wetland -832 acres of scrub-shrub wetland +68 acres of emergent wetland
* Acres of riparian habitat lost. Does not require purchase of any lands.	
Willamette Basin Projects	
• Black-tailed Deer	-17,254
• Roosevelt Elk	-15,295
• Black Bear	-4,814
• Cougar	-3,853
• Beaver	-4,477
• River Otter	-2,408
• Mink	-2,418
• Red Fox	-2,590
• Ruffed Grouse	-11,145
• California Quail	-2,986
• Ring-necked Pheasant	-1,986
• Band-tailed Pigeon	-3,487
• Western Gray Squirrel	-1,354
• Harlequin Duck	-551
• Wood Duck	-1,947
• Spotted Owl	-5,711
• Pileated Woodpecker	-8,690
• American Dipper	-954
• Yellow Warbler	-2,355
• Common Merganser	+1,042
• Greater Scaup	+820
• Waterfowl	+423
• Bald Eagle	+5,693
• Osprey	+6,159
Grand Coulee	
• Sage Grouse	-2,746
• Sharp-tailed Grouse	-32,723
• Ruffed Grouse	-16,502
• Mourning Dove	-9,316
• Mule Deer	-27,133
• White-tailed Deer	-21,362
• Riparian Forest	-1,632
• Riparian Shrub	-27
• Canada Goose Nest Sites	-74

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
McNary	
• Mallard (wintering)	+ 13,744
• Mallard (nesting)	-6,959
• Western Meadowlark	-3,469
• Canada Goose	-3,484
• Spotted Sandpiper	-1,363
• Yellow Warbler	-329
• Downy Woodpecker	-377
• Mink	-1,250
• California Quail	-6,314
John Day	
• Lesser Scaup	+14,398
• Great Blue Heron	-3,186
• Canada Goose	-8,010
• Spotted Sandpiper	-3,186
• Yellow Warbler	-1,085
• Black-capped Chickadee	-869
• Western Meadowlark	-5,059
• California Quail	-6,324
• Mallard	-7,399
• Mink	-1,437
The Dalles	
• Lesser Scaup	+2,068
• Great Blue Heron	-427
• Canada Goose	-439
• Spotted Sandpiper	-534
• Yellow Warbler	-170
• Black-capped Chickadee	-183
• Western Meadowlark	-247
• Mink	-330
Bonneville	
• Lesser Scaup	+2,671
• Great Blue Heron	-4,300
• Canada Goose	-2,443
• Spotted Sandpiper	-2,767
• Yellow Warbler	-163
• Black-capped Chickadee	-1,022
• Mink	-1,622
Dworshak	
• Canada Goose-(breeding)	-16
• Black-capped Chickadee	-91
• River Otter	-4,312
• Pileated Woodpecker	-3,524
• Elk	-11,603
• White-tailed Deer	-8,906
• Canada Goose (wintering)	+323
• Bald Eagle	+2,678
• Osprey	+1,674
• Yellow Warbler	+119

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+"

Species	Total Habitat Units
Minidoka	
• Mallard	+174
• Redhead	+4,475
• Western Grebe	+273
• Marsh Wren	+207
• Yellow Warbler	-342
• River Otter	-2,993
• Mule Deer	-3,413
• Sage Grouse	-3,755
Chief Joseph	
• Lesser Scaup	+1,440
• Sharp-tailed Grouse	-2,290
• Mule Deer	-1,992
• Spotted Sandpiper	-1,255
• Sage Grouse	-1,179
• Mink	-920
• Bobcat	-401
• Lewis' Woodpecker	-286
• Ring-necked Pheasant	-239
• Canada Goose	-213
• Yellow Warbler	-58

(Appendices C through G not included due to data download issues)

Appendix C – Cover type pairing background

Cover type "pairing" was a concept developed in the early years of the Columbia River Wildlife Mitigation Program as a method to guide how BPA received credit for acquiring "out of kind/dissimilar" cover types[22]. BPA and the Northwest Power Conservation Council (NPCC) supported Columbia River wildlife mitigation project managers who wanted the ability to acquire high quality functional habitat and important high value "out of kind" cover types. In exchange, wildlife managers agreed to give BPA credit for all lands acquired with BPA wildlife mitigation funds, thus establishing the need to develop the cover type "pairing" concept[23]. Cover type "pairing" addressed the question, "how are out of kind/dissimilar cover types, HEP models, and habitat units credited against a given loss assessment"?

Pairing "in kind" loss assessment and project cover types is simply aligning "like" cover types and, in most cases, evaluating like cover types with the same number of HEP models (stacking) and the same species listed in the credited loss assessment. For example, the project area grassland cover type would correspond to the loss assessment grassland cover type. If four HEP models were used to evaluate the grassland cover type in the loss assessment, then four HEP models would be used to evaluate the project area grassland cover type.

Similarly, "pairing" "out of kind" project cover types with loss assessment cover types involves "pairing" project cover types with loss assessment cover types comprised of "similar" habitat elements or structural conditions such as shrubs, trees, and snags. For example, a compensation site upland deciduous shrub cover type may be "paired" with the riparian shrub cover type listed in a loss assessment matrix because the "similar" habitat element/structural condition shared by both cover types is the shrub component; specifically, deciduous shrubs.

A secondary consideration is the HEP species models associated with the "paired" loss assessment cover type. If habitat elements/structure conditions are similar between a compensation site cover type and more than one loss assessment cover type, the RHT

[22] "Out of kind/dissimilar cover types" are cover types that are not identified as "losses" in a given loss assessment document.

[23] Standard HEP protocols (USFWS 1980) suggest that compensation acquisition and easement cover types should be identical (in-kind) to the cover types identified in the applicable loss assessment document unless another alternative is agreed upon by the involved parties. The mitigation program that BPA funds has become an out-of-kind equal compensation mitigation program by default because wildlife managers chose project lands that, in many cases, include large areas of out-of-kind cover types that are not identical to those identified in the loss assessments.

generally "paired" the compensation site cover type with the loss assessment cover type that included the most HEP models having the best biological fit for compensation site cover type conditions. Note that "pairing" dissimilar cover types does not automatically equate to total HEP model species substitution.

Appendix D – Stacking definition and standard operation procedures

Definition

The Crediting Forum Technical Team (NPCC 2011) stated, “Stacking occurs when multiple species are used to characterize the quality of a single cover type. It becomes a crediting issue when the same number of species used to assess losses is not in turn used to characterize the compensation lands. Stacking is an issue of how you adjust the credits of the mitigation sites to be in balance with the number of species used to characterize the losses. Loss assessments are what they are and should not be revised or replaced to address stacking issues”.

Stacking Standard Operation Procedures (SOP)

- SOP options to address stacking issues include:

  a. Use the same number of species to characterize the out of kind cover types as were used to characterize the loss assessment cover types (see example table at bottom of page).

  b. If using fewer species to characterize the mitigation site cover type than were used to characterize the losses, average the HSIs of the out of kind mitigation cover types and multiply by the number of species used in the losses. However, species selection must be peer reviewed and approved by the regional HEP team, BPA and the project proponent.

  c. If incidental out of kind cover types (inclusions) are associated with a mitigation acquisition, assume the same HSI as the adjacent cover type.

  d. Do not credit the same acres of a given cover type between two or more hydro-projects with a combination of species from both.

“Paired” Grand Coulee Dam Cover Type/HEP Model “Stacking” Matrix Example

Grand Coulee Dam Cover Types	Riparian Forest	Shrubsteppe	Agriculture	Riparian Shrub
Number of Models	3	3	2	3
“Paired” Project Example Cover Types	Deciduous Forest	Shrubsteppe	Agriculture and Pasture	Deciduous Shrub
Number of Models	3	3	2	3

Appendix E – HEP compensation type descriptions

In Kind/Equal/Relative Compensation

Three types of compensation i.e., in kind, equal, and relative, as described in HEP manuals, (USFWS 1980) are listed below along with pertinent comments related to the Columbia Basin Wildlife Mitigation Program's use of HEP.

In-kind (no trade-off)

This compensation goal is to precisely offset the HU loss for each evaluation species. Therefore, the list of target species must be identical to the list of negatively impacted species" (USFWS 1980). Typically, this involves acquiring the same cover types as those impacted. In addition, "in kind" compensation does not suggest that HEP species can be applied to evaluate inappropriate cover types (forcing a "square peg" in a "round hole"), or that HEP models can't be modified if necessary.

Equal replacement (equal trade-off)

This compensation goal is to precisely offset the HU losses through a gain of an equal number of HUs. With this goal, a gain of one HU for any target species can be used to offset the loss of one HU for any evaluation species. The list of target species may or may not be identical to the list of impacted species" (USFWS 1980). In addition, there is no requirement to acquire the same habitat/cover types lost due to dam construction.

Relative replacement (relative trade-off)

"This compensation goal specifies that the gain of one HU can be used to offset the loss of one HU at a differential rate depending on the species involved" (USFWS 1980) e.g., two grassland HUs could be traded for one emergent wetland HU. This procedure has not been used for crediting in the Columbia Basin.

Appendix F – WDFW MOA Agreements synopsis

Excerpt from Ashley (2008)

Memorandum of Agreements

1993 MOA

Under the 1980 Northwest Electric Power and Conservation Act, BPA was directed to protect, mitigate, and enhance fish and wildlife and their habitats affected by the development and operation of the Federal Columbia River Power System. To partially meet this obligation, BPA entered into a Memorandum of Agreement (MOA) in 1993 with nine state, federal, and tribal wildlife management entities with jurisdiction in Washington State (BPA 1993). Under the MOA, BPA agreed to distribute $45.5 million to Washington Wildlife Coalition members over a five-year period (1993 through 1997) for wildlife mitigation projects. In return WDFW and other management entities agreed that by funding mitigation projects, BPA earned credit towards addressing its mitigation obligation in the currency of habitat units.

Biologists estimated that 48% of the impacts on terrestrial habitats from the construction of hydro projects and associated pools on the Columbia River occurred on non-tribal lands in Washington State. WDFW, responsible for management of fish and wildlife resources on non-tribal lands, received 48% of the $45.5 million allocation or $21.8 million "for projects proposed by WDFW and approved by BPA" (BPA 1993). The mitigation funds allocated to WDFW were held and dispersed by Bonneville Power Administration.

BPA funding for terrestrial wildlife projects was limited on an annual basis to 15% of BPA's entire mitigation budget *(the "split" was 15% wildlife, 15% resident fish, and 70% anadromous fish)*. WDFW was to receive the $21.8 million in annual installments over a five-year period. Concurrently, other Washington Coalition members were also to receive BPA mitigation funds. Some Washington Coalition members did not receive enough BPA funds annually to purchase mitigation project lands making it extremely difficult for Coalition members to acquire property and for BPA to meet its' mitigation obligation. As a result, WDFW agreed to forgo payment from BPA for several years in order to free up wildlife mitigation funds for other Washington Coalition members and reduce pressure on BPA. This extended BPA's MOA wildlife mitigation payments to WDFW beyond the original five-year period.

At the time, WDFW was using mitigation funds primarily for operations and maintenance (O&M) on extant wildlife areas and possessed adequate reserves in the MOA account to cover those costs, thus enabling BPA to divert additional funds to other Washington Coalition members. WDFW mitigation projects were to be funded with MOA funds for *five years (including enhancements and O&M) after which WDFW could apply for additional annual O&M funds. MOA funds, however, were used to support WDFW wildlife mitigation projects beyond the original five-year period. Note that temporal terms of the Interim Agreement were five years, or when all MOA funds are expended.*

Habitat Unit Allocations

Unlike the Grand Coulee Dam loss assessment (Howerton, Creveling, and Renfrow 1986) and Chief Joseph Dam loss assessment (Berger and Kuehn 1992) that included specific habitat unit allocations for WDFW, STOI, and CCT, loss assessments for Bonneville, The Dalles, John Day, and McNary Dams (Rasmussen and Wright 1990) did not specify how habitat units should be divided between management entities. As a result, some but not all Washington Coalition members divided unmitigated Lower Columbia River HUs in the same proportions as the 1993 funding allocations[24].

Since WDFW received 48% of the funding, WDFW asserted that it should have the right to provide mitigation for 48% of all available habitat units for Bonneville, The Dalles, and John Day Dams and 60% for McNary Dam. Note that the total number of habitat units resulting from construction of Bonneville, Dalles, and John Day Dams were divided equally between Oregon and Washington. Washington State, however, received 80% of the HUs from McNary Dam, because most of the impacts occurred in Washington.

[24] The Yakama Nation (YN) and BPA only recognized the percentage split of mitigation dollars and did not agree to allocate the HUs from the four lower Columbia River Dams. Therefore, the YN believed all lower Columbia River HUs were equally available to all Coalition members including the YN. This resulted in the YN using the majority of the lower Columbia River HUs as well as over-mitigation on the Washington side of the lower Columbia. WDFW stopped applying HU credits against lower Columbia River hydro-projects after BPA indicated that loss assessment HU goals were met for McNary, John Day, The Dalles, and Bonneville Dams. WDFW mitigated less than 50% of its Lower Columbia HU goal.

Appendix G – WDFW crediting formula explanation

Excerpt from Ashley (2008)

HEP Model Selection and "Stacking"

HSI models were selected from appropriate loss assessments for each mitigation project cover type. In cases where cover types were either dissimilar[25] or not included in loss assessments, substitute HEP models were selected to evaluate habitat quality and determine HUs. Similarly, HEP species model substitutions occurred based on WDFW management priorities for specific areas e. g., the pygmy rabbit (*Brachylagus idahoensis*) HSI model replaced the sharp-tailed grouse (*Tympanuchus phasianellus*) model in areas where pygmy rabbits were the top management priority.

HEP model substitutions also occurred when an extant plant community did not support a target species, or would not support the target species in the future. For example, steppe grasslands devoid of sagebrush (*Artemisia* spp.) or shrublands comprised of bitterbrush (*Purshia tridentata*) do not supply the life requisites needed by sage grouse (*Centrocercus urophasianus*), which feed almost exclusively on sagebrush in winter. Without the presence of sagebrush, the sage grouse HEP model output is zero.

If the management priority for a grassland site was to maintain it as grassland, it follows that the sage grouse model habitat suitability index (HSI) would always be zero. Likewise, if management of a shrubland was to maintain it as a bitterbrush plant community devoid of sagebrush, the HSI again would always be zero for sage grouse. In these situations, the western meadowlark (*Sturnella neglecta*) HEP model was a more appropriate model to evaluate steppe grasslands than the sage grouse model.

The previously described situation was also a "fairness" issue. Both WDFW and BPA were and still are highly committed to applying HEP in a fair, consistent manner.

Habitat unit "stacking" found in the loss assessments was also replicated. For example, if three HSI models were used to determine shrubsteppe habitat unit losses in a given loss assessment, three shrubsteppe HSI models were used to credit BPA.

Habitat Unit Computations

BPA received baseline (protection) and enhancement habitat unit credit for all mitigation project lands. There were, however, differences in how HUs were credited based on whether the project included in whole or in part:

1. New land acquisitions.

[25] Dissimilar refers to cover types that are given the same moniker as that found in a loss assessment, but have different physical/flora characteristics e. g., a "bog" may be comprised of a very different plant community and abiotic characteristics when compared to a "cattail dominated" emergent wetland; however, both may be cover typed as emergent wetland. As a result, HEP models used to evaluate a cattail dominated emergent wetland may be inappropriate for a bog.

2. Washington Department of Natural Resources (DNR) lands.
3. Extant WDFW wildlife management areas.

Consistent with crediting across the Columbia Basin Region, BPA received full baseline (protection) credit for new acquisitions as determined by HEP surveys. Follow-up HEP surveys occurred at five-year intervals to reassess habitat quality and update the number of habitat units credited to BPA. Likewise, BPA received full baseline and follow-up habitat unit credit (protection) on DNR lands where BPA funds were used to pay lease fees.

BPA received both protection and enhancement HUs on WDFW wildlife management areas already owned by WDFW or acquired through funding sources other than BPA[26]. Initial baseline HUs, however, were calculated based on the *potential* decrease in habitat quality that would likely occur *within 10-years* without the infusion of BPA funds[27]. Modified baseline HUs for lands owned by WDFW were calculated based on the following five steps:

1. HEP surveys were conducted to determine the baseline HSI for each HEP species model.
2. HEP model baseline habitat variable suitability results were reviewed relative to the following questions, "Would individual model variables change in ten years without the infusion of BPA funds?" If so, how?
3. Individual habitat variable suitability indices (SIs) were then modified as needed to reflect probable changes in habitat variable suitability. Occasionally, habitat condition projections did not differ from baseline conditions and were not modified.
4. Species model HSIs were recalculated based on projected changes to individual variable suitability indices.
5. Differences between baseline HSIs and projected HSIs were used to calculate permanent HU credit.

The following example illustrates this process. A baseline HEP survey (step 1) determined that the habitat suitability index is 0.5 as shown in Figure 1 (line B).

[26] There is one exception to this policy. BPA received full baseline credit on new acquisitions at West Foster Creek that were acquired with State funds in order to make BPA whole for funds and HUs associated with removing the Cleman Mountain Unit from the Wenas WMA mitigation project.

[27] It was assumed that habitat quality on WMAs would decrease without additional O&M funds. WDFW was unable to adequately fund basic O&M operations such as weed control, fence maintenance, reseedings etc., on WMAs due to limited state funding. Without adequate weed control and associated reseedings and fence maintenance (protection from livestock encroachment), etc., wildlife habitat quality would likely decrease over time. As a result BPA dollars were used to fund operations and maintenance measures on WMAs to maintain and/or improve habitat quality.

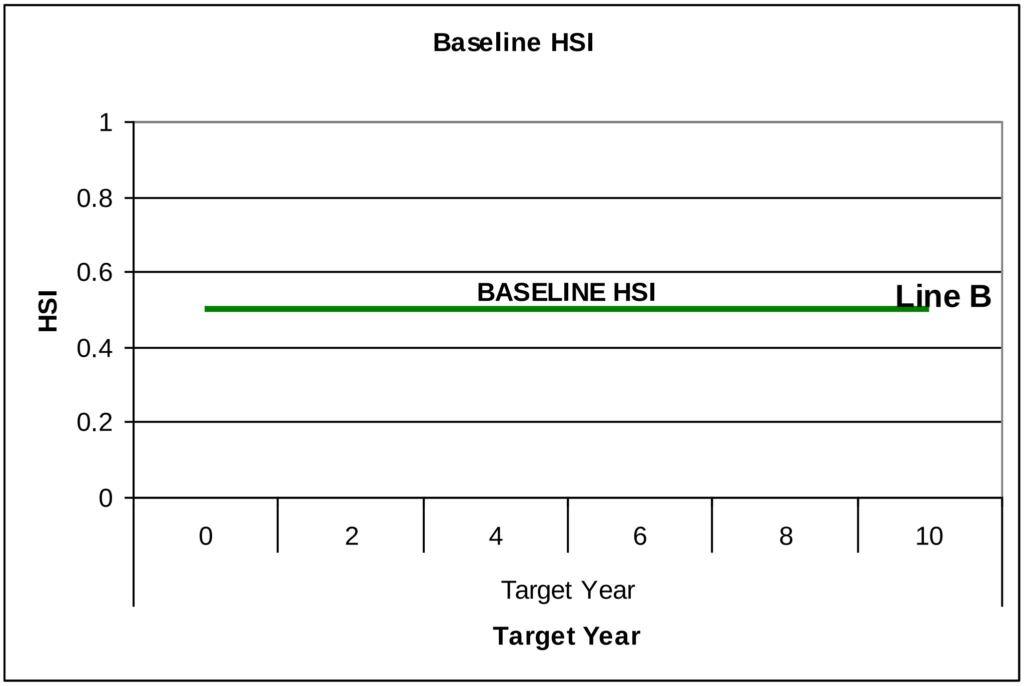


Figure 1 Baseline habitat suitability index example

Individual HEP model variable suitability indices were then modified to reflect projected changes in habitat variables over a ten-year period (steps 2 and 3). The HEP model HSI was recalculated (step 4) and was reduced to 0.40 as illustrated in Figure 2 (line C).

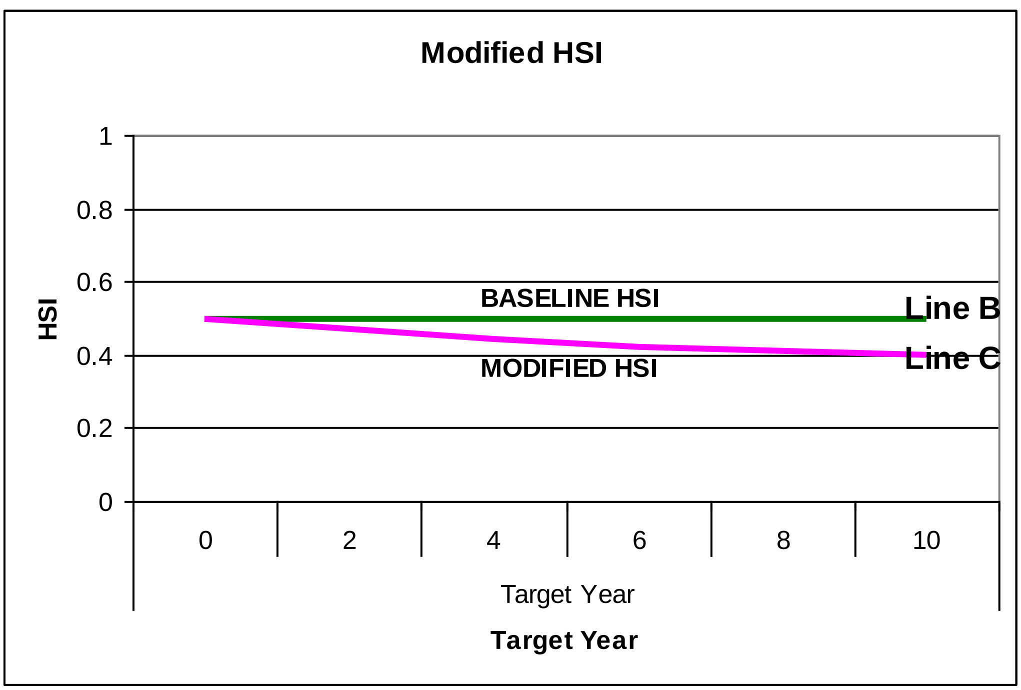


Figure 2 Modified habitat suitability index example

The difference between the baseline HSI of 0.50 (line B) and the modified HSI of 0.40 (line C) was 0.10 HSI (step 5). HUs were then recalculated based on the 0.10 change in HSI.

If habitat quality/HSI projections increased beyond the baseline HSI (line B) through enhancement measures (line A, Figure 3), total credited habitat units were calculated based on the difference between line A (0.65 HSI) and line C (0.40 HSI), or 0.25 HSI as depicted in Figure 4.

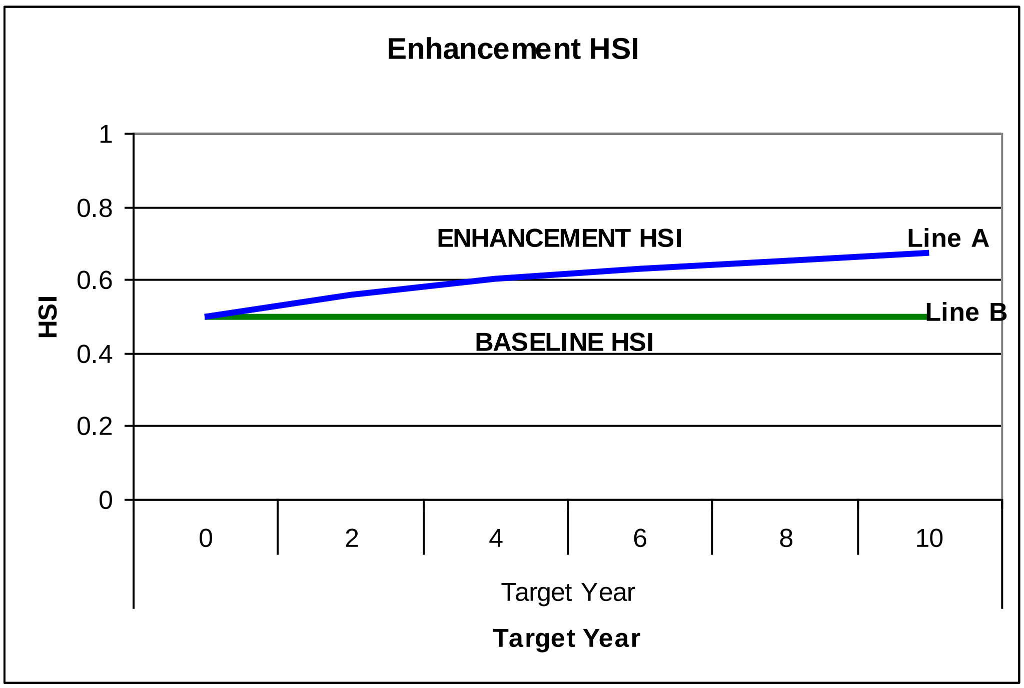


Figure 3 Enhancement habitat suitability index example

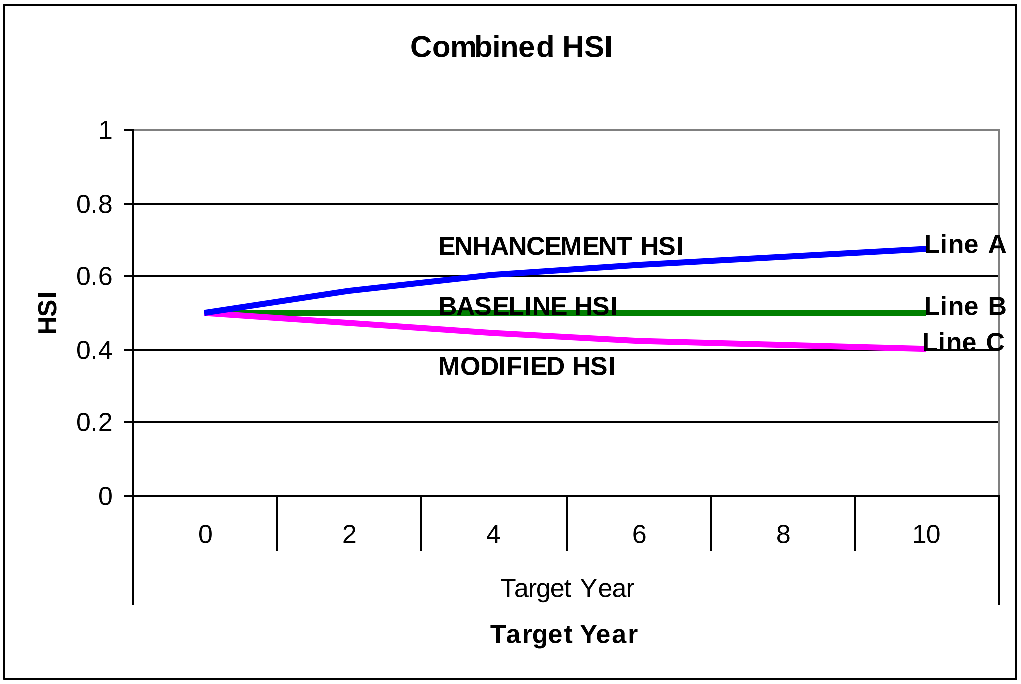


Figure 4 Combined baseline and enhancement suitability index example

Continuing the previous example, in Table 3 the BPA acquisition baseline HSI is 0.50 (Figure 1) generating 500 HUs while the enhancement credit HSI is 0.15 (Figure 3) generating 150 HUs[28]. BPA receives a combined total of 650 habitat units for acquiring and enhancing 1,000 acres of wildlife habitat.

Table 3 Habitat unit comparison example for a new acquisition and land owned by WDFW

Project Type	Credit Type	HSI	Acres	HUs
BPA Acquisition	Baseline	0.50	1,000	500
	Enhancement	0.15	N/A	150
BPA Totals			**1,000**	**650**
WDFW Lands	Baseline	0.10	1,000	100
	Enhancement	0.15	N/A	150
WDFW Totals			**1,000**	**250**

In contrast, the baseline HSI for a 1,000 acre project area owned by WDFW is 0.10 (i.e., 0.50 - 0.40 = 0.1) (Figure 2) generating 100 habitat units while the enhancement HSI is 0.15 (i.e., 0.65 – 0.50 = 0.15) (Figure 4) equaling 150 HUs. BPA is credited with only 250 habitat units on lands owned by WDFW. Note that BPA received the same number of HUs for enhancements regardless of ownership or acquisition funding source. In summary, BPA was credited with only a portion of all baseline HUs generated on lands

[28] Habitat units are determined by multiplying the HSI by the number of acres.

owned or acquired with State funds and received full credit for enhancements and/or lands acquired with BPA mitigation funds.

Swanson Lakes WA Spreadsheet Example

Actual baseline, projected (10-year), and follow-up habitat suitability indices and associated habitat units for the Swanson Lakes Wildlife Area are illustrated in Table 4. HSI and HU computations are shown for both lands owned by WDFW and properties purchased by BPA. Spreadsheet computations in Table 4 are explained briefly in the following paragraphs.

Baseline (measured) HSIs and HUs are listed for both WDFW and BPA ownership (TY[29] 0 HSI and TY O HUs). Further HU computations stopped for lands purchased with BPA mitigation funds until a follow-up HEP analysis was completed in TY 16. Habitat units derived from TY 16 follow-up HEP analysis supplanted baseline HUs. Net HU gains can be determined by subtracting baseline HUs from TY 16 HUs.

On parcels owned by WDFW, the columns titled “W/O[30] Project HSI” and “W/O Project HUs” reflect the projected decrease in habitat quality and habitat units without the infusion of BPA funds for O&M and enhancement activities (notice that the “W/O Project HSI” dropped below the baseline HSI at this project site). The projected “TY 10 HSI” column is the predicted HSI resulting from BPA funding O&M and enhancement activities over a 10-year period. The “Net HSI Gain” is the difference obtained by subtracting the “W/O project HSI” from the “TY 10 HSI.” Credited HUs were derived by multiplying cover type acres by “Net HSI Gain.”

[29] TY is an acronym for “target year.”
[30] W/O is “without project”. The term “project” refers to BPA mitigation funding in this instance.

Table 4 Habitat unit crediting spreadsheet example for Swanson Lakes Wildlife Area

PROJECT	PARCEL	ACRES	PURCHASE ENTITY/OWNER	COVER TYPE(S)	ACRES	HEP MODEL	TY 0 HSI (Baseline)	TY 0 HUs (Baseline)	W/O PROJECT HSI	W/O PROJECT HUs	TY 10 HSI (Projected)	NET HSI GAIN	CREDITED HUS
						Sharp-tailed Grouse	0.20	749.80	0.10	374.90	0.30	0.20	749.80
				Shrubsteppe	3,749	Mule Deer	0.40	1,499.60	0.30	1,124.70	0.40	0.10	374.90
						Sage Grouse	0.20	749.80	0.10	374.90	0.30	0.20	749.80
	Hatton/Tracy/Finch	4,905				Sharp-tailed Grouse	0.20	71.80	0.10	35.90	0.40	0.30	107.70
	Nelson	320	WDFW	Grassland	359	Mule Deer	0.00	0.00	0.00	0.00	0.10	0.10	35.90
						Sage Grouse	0.10	35.90	0.00	0.00	0.20	0.20	71.80
						Sharp-tailed Grouse	0.00	0.00	0.00	0.00	0.40	0.40	446.80
				Agriculture	1,117	Mule Deer	0.00	0.00	0.00	0.00	0.10	0.10	111.70
						Sage Grouse	0.00	0.00	0.00	0.00	0.30	0.30	335.10
	WDFW Sub-total	5,225			5,225			3,106.90		1,910.40			2,983.50
SWANSON LAKES	PARCEL	ACRES	PURCHASE ENTITY/OWNER	COVER TYPE(S)	ACRES	HEP MODEL	TY 0 HSI (Baseline)	TY 0 HUs (Baseline)	W/O PROJECT HSI	W/O PROJECT HUs	TY 16 HSI (Actual)	NET HSI GAIN/ LOSS	TY 16 CREDITED HUS
						Sharp-tailed Grouse	0.20	2,809.40	N/A	N/A	0.29	0.09	4,073.63
	Roloff/Welch	13,280		Shrubsteppe	14,047	Mule Deer	0.40	5,618.80	N/A	N/A	0.46	0.06	6,461.62
	L&C Dynasty	40	BPA			Sage Grouse	0.20	2,809.40	N/A	N/A	0.45	0.25	6,321.15
	Baker	160				Sharp-tailed Grouse	0.60	475.80	N/A	N/A	0.32	-0.28	253.76
	Koch	80		Grassland	793	Mule Deer	0.00	0.00	N/A	N/A	0.38	0.38	301.34
	DNR Lease	1,280				Sage Grouse	0.40	317.20	N/A	N/A	0.20	-0.20	158.60
	BPA Sub-total	14,840			14,840			12,030.60					17,570.10

PROJECT TOTALS		**20,065**			**20,065**			**15,137.50**		**1,910.40**			**20,553.60**

HSI – HU Computation Epilogue

The HSI/HU projection concept was a mechanism by which BPA could receive partial credit for funding O&M and enhancement measures on existing WDFW wildlife management areas without incurring acquisition costs (a "win-win" situation for both WDFW and BPA). Habitat unit/HSI projections also ensured that WDFW did not over mitigate relative to the Agency's "share" of available HUs and also removed the need to conduct follow-up HEP surveys on lands purchased with state funds (HSI projections served the same purpose as follow-up HEP surveys; albeit, projections are less robust).

WDFW further agreed to follow-up the original 10 year HSI projections on lands owned by WDFW with 20 year HSI projections, which were accomplished in 2008. Twenty year HSI projections were determined in the same manner as the 10 year HSI projections and are included in the Results Section of this report. *Based on the results of recent follow-up HEP surveys conducted on parcels acquired with BPA mitigation funds, it appears that HSI projections were fairly accurate on similar cover types such as shrubsteppe. It is recommended, however, that follow-up HEP surveys be conducted on mitigation wildlife areas to ensure that HSI projections truly reflect estimated habitat conditions. This could be accomplished efficiently by assessing a small representative sample on target/priority cover types.*

References

Ashley, P. R. 2008. A comprehensive Review of Columbia River Wildlife Mitigation Crediting. WDFW. Olympia, WA.

Appendix H – Lower Four loss assessment cover type/species matrices

McNARY DAM COVER TYPE/SPECIES MATRIX

HEP MODEL	Rip. Tree	Rip. Shrub	Rip. Herb	Sa/Gr/ Co/Mud[a]	Emergent Wetland	Shrub-steppe/ Grassland	Agricultural	Islands	Open Water - Riverine
California Quail		X	X			X	X		
Canada Goose			X	X		X	X	X	
Mallard			X		X	X	X	X	X
Spotted Sandpiper				X					
Mink	X	X	X	X	X				
Western Meadowlark						X			
Yellow Warbler		X							
Downy Woodpecker	X								
TOTAL	**2**	**3**	**4**	**3**	**2**	**4**	**3**	**2**	**1**

[a] Sand, gravel, cobble, and mud cover type.

JOHN DAY DAM COVER TYPE/SPECIES MATRIX

HEP MODEL	Rip. Tree	Rip. Shrub	Rip. Herb	Sa/Gr/ Co/Mud[a]	Emergent Wetland	Shrub-steppe/ Grassland	Agricultural	Islands	Open Water
California Quail						X			
Canada Goose			X				X	X	
Mallard			X		X			X	
Spotted Sandpiper				X					
Mink		X			X				
Western Meadowlark						X			
Black-capped Chickadee	X								
Yellow Warbler		X							
Great Blue Heron				X					
TOTAL	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**0**

[a] Sand, gravel, cobble, and mud cover type.

The DALLES DAM COVER TYPE/SPECIES MATRIX						
HEP MODEL	**Rip. Tree**	**Rip. Shrub**	**Sa/Gr/ Co/Mud[a]**	**Shrub-steppe/ Grassland**	**Islands**	**Open Water**
Canada Goose					X	
Spotted Sandpiper			X			
Mink	X	X				
Western Meadowlark				X		
Black-capped Chickadee	X					
Yellow Warbler		X				
Great Blue Heron			X			
TOTAL	**2**	**2**	**2**	**1**	**1**	**0**

[a] Sand, gravel, cobble, and mud cover type.

BONNEVILLE DAM COVER TYPE/SPECIES MATRIX								
HEP MODEL	**Rip. Tree**	**Rip. Shrub**	**Wetlands, Lakes, and Ponds**	**Sa/Gr/ Co/Mud[a]**	**Open Water, Reservoir, River**	**Islands**	**Conifer-Hardwood Forest**	**Shrub-steppe/ Grassland**
Canada Goose			X	X		X		X
Spotted Sandpiper			X	X				
Mink			X	X	X			
Black-capped Chickadee	X						X	
Yellow Warbler		X						
Great Blue Heron	X		X	X	X			X
TOTAL	**2**	**1**	**4**	**4**	**2**	**1**	**1**	**2**

[a] Sand, gravel, cobble, and mud cover type

Appendix I – YN/Raedeke HEP loss assessment species per cover type comparison

YN/RAEDEKE HEP STUDY AND LOSS ASSESSMENT SPECIES PER COVER TYPE COMPARISON											
Entity/Hydro Project	**Rip.[a] Tree # Species**	**Rip.[a] Shrub # Species**	**Rip.[a] Herb # Species**	**Riverine # Species**	**Lacustrine Palustrine # Species**	**Sa/Gr/[b] Co/Mud # Species**	**Emergent Wetland # Species**	**Shrub-steppe/ Grassland # Species**	**Agricultural # Species**	**Islands # Species[c]**	**Conifer-Hardwood Forest # Species[c]**
YN/Raedeke	**5**	**3**	**3**	**3**	**3**	**4**	**2**	**5**	**2**	**0**	**0**
McNary Dam	2	3	4	1	0	3	2	4	3	2	0
John Day Dam	1	2	2	0	0	2	2	2	1	2	0
The Dalles Dam	2	2	0	0	0	2	0	1	0	1	0
Bonneville Dam	2	1	0	2	4	4	0	2	0	1	1

[a] Riparian communities

[b] Sand/Gravel/Cobble/Mud

[c] These cover types were not present on compensation sites. Therefore, the number of species in the YN/Raedeke HEP assessment was zero.

Appendix J - Asqúulktpe Watershed Project summary sheet

(Source: André L' Heureux – BPA)

SUMMARY: ISQÚULKTPE WATERSHED PROJECT [1995-060-01]

The Isqúulktpe Creek watershed is a fifth-order sub-basin located in the Umatilla River Basin, encompassing approximately 24,200 acres. Located on the western slopes of the Blue Mountains in Oregon, Isqúulktpe (formerly known as Squaw) Creek drains into the Umatilla River upstream of Pendleton, Oregon. Topography of the Isqúulktpe Watershed is typical of the Blue Mountain foothills, with broad flat ridges dissected by steep canyons with a variety of aspects.

The Isqúulktpe Watershed Project was developed by the CTUIR to offset habitat losses related to the John Day and McNary hydroelectric projects. The purpose of the project is to protect, enhance, and mitigate target wildlife species, promote watershed health and ecosystem function, and nurture self-sustaining habitats for fish and wildlife. The project area contains approximately 958 acres of floodplain riparian habitat, 8,042 acres of grasslands, 4,898 acres of forest environments and 1,409 acres of upland shrub. The project area also contains 7 miles of anadromous and resident fish habitat.

The Project emphasizes two principle strategies for acquiring, protecting, and enhancing these habitats to meet management purposes: (1) fee acquisitions; and, (2) the leasing of Bureau of Indian Affairs (BIA) administered grazing allotments, and resting them from livestock use:

<u>Habitat Acquisition (1997, 1998, and 1999)</u>

Approximately 6,000 acres have been purchased for fish and wildlife mitigation and placed into permanent protection. (Other federal, non-governmental, and tribal funding has been used to secure fee title to properties within the watershed, in addition to BPA-funded acquisitions). These land holdings are all managed to protect and support grassland, forest, and riparian wetland habitats.

1997	Approximately 5,536 acres of land in the Isqúulktpe Creek sub-basin purchased to form the nucleus of the Squaw Creek Watershed Project. Additionally, 1,005 acres of BIA-administered Trust land was incorporated into the project.
1998	Acquired an additional 320 acres of fee lands. Initiated passive restoration of riparian and grassland habitats through lease/rest of two BIA-administered grazing units - lease totals approximately 20,000 acres and 1,056 AUMs.

1999	Acquired an additional 80 acres of land. Administratively closed 16.3 miles of road to protect fish and wildlife habitats.

Grazing leases purchase (initiated in 1998)

2 BIA-administered grazing allotments, containing approximately 11,500 acres and providing approximately 1,056 animal unit months (AUMs), are leased annually. The acres rested from livestock grazing include important grassland, riparian wetland, and in-stream habitats. The leasehold of grazing rights protects these habitats from further degradation, and supports ongoing enhancement activities.

Three classes of land ownership exist within the Isqúulktpe Creek watershed project area: 1) fee lands; 2) CTUIR Tribal Trust lands; and, 3) CTUIR-member allotments. The 1997 Memorandum of Agreement between BPA and the CTUIR differentiates how BPA receives credit from among these ownership-types for the lands acquired in fee, or leased, as mitigation. For fee lands acquired through the Fish and Wildlife Program, BPA receives full credit for acquisition, protection and enhancement. For leased lands (e.g. grazing leases), BPA receives full credit for protecting habitat units (HUs) of rangeland species affected by grazing, and full credit for habitat improvements to all habitats in the leased area.

Land acquisitions have protected an estimated 4,567 baseline HUs for target wildlife species. An additional estimated 393 HUs could be achieved through habitat enhancements developed over the 10-year period of the Isqúulktpe Management Plan. Estimated total benefit of the project expressed through HUs is 4,960 units.

Figure 1 Project Area – Cover Types

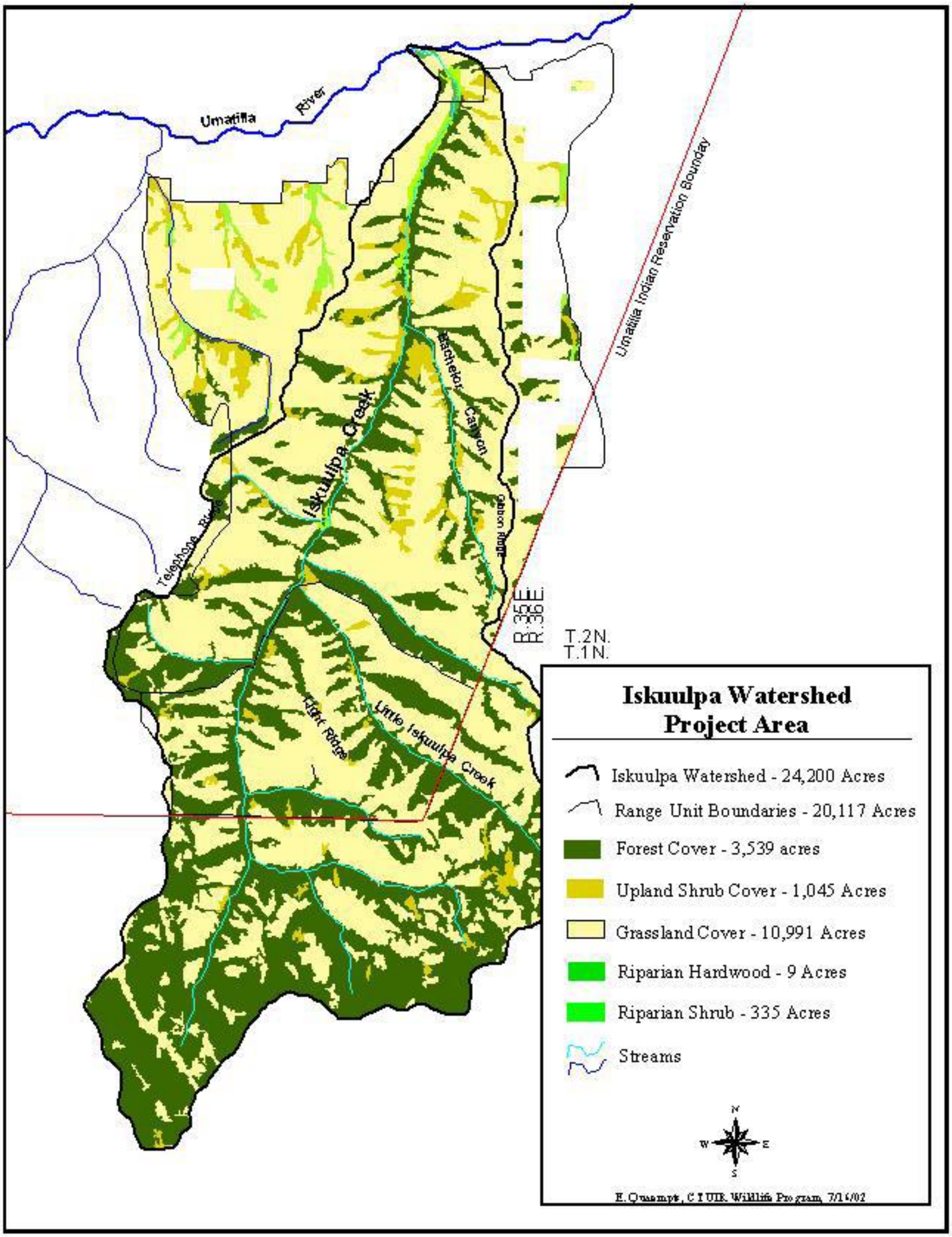
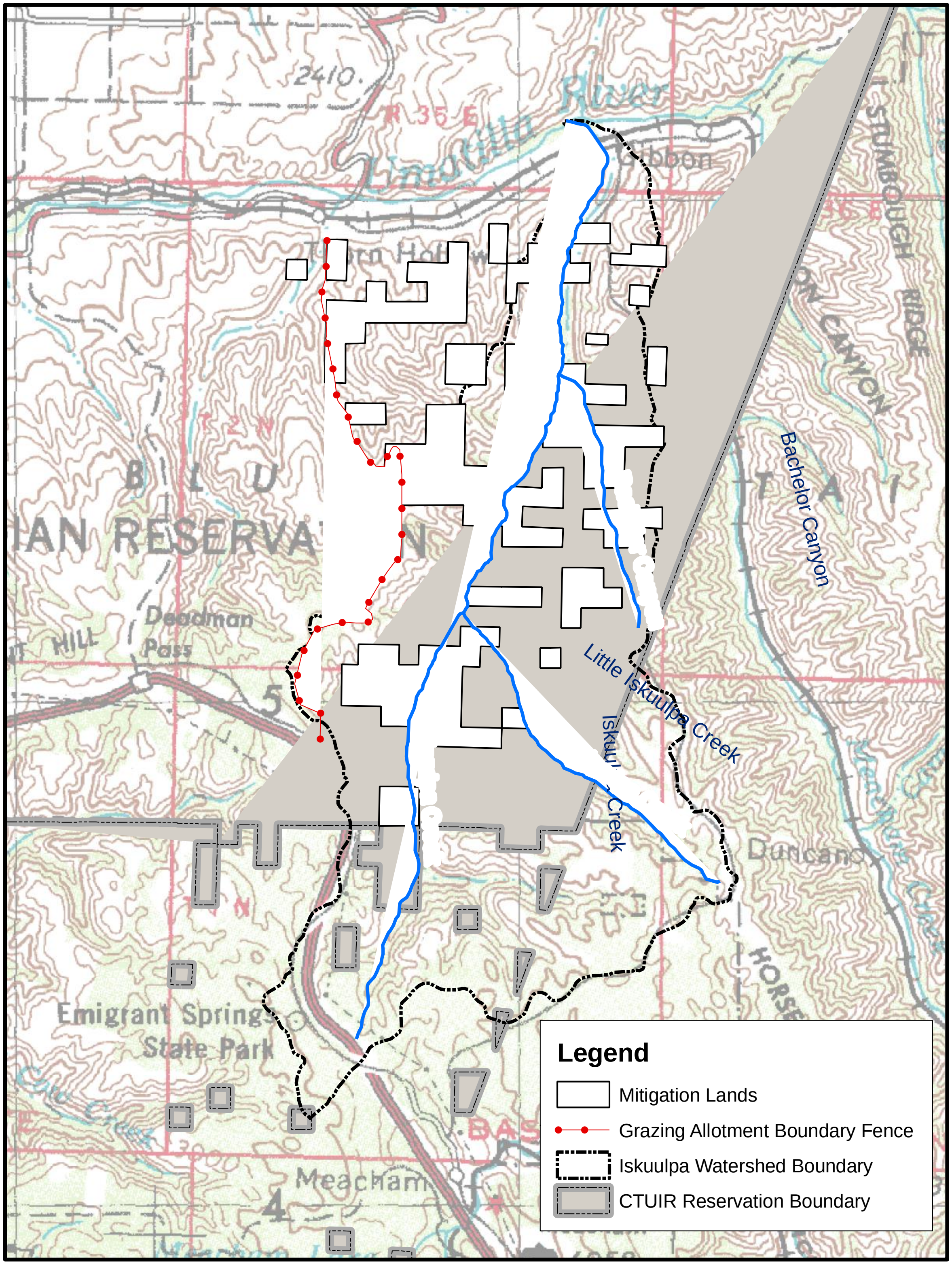


Figure 2 Isqúulktpe Watershed Project – Land Types



Appendix K – McNary Dam loss assessment matrix and paired Isqúulktpe matrix

McNary Dam loss assessment Matrix

HEP MODEL	Shrubsteppe/ Grassland	Islands	Agricultural	Sand, Gravel, Cobble and Mud	Riparian Tree	Riparian Shrub	Emergent Wetlands	Riparian Herb	Open Water River	Open Water-Reservoir
California Quail	x		x			x		x		
Canada Goose	x	x	x	x				x		
Mallard	x	x	x				x	x	x	x
Spotted Sandpiper				x						
Mink				x	x	x	x	x		
Western Meadowlark	x									
Downy Woodpecker					x					
Yellow Warbler						x				
TOTAL	**4**	**2**	**3**	**3**	**2**	**3**	**2**	**4**	**1**	**1**

Paired Isqúulktpe cover type/species matrix

McNary Dam Cover Types	Shrubsteppe Grassland	Riparian Shrub	Riparian Tree	Riparian Tree
Number of HEP Models	**4**	**3**	**2**	**2**

"Paired" Isqúulktpe follow-up HEP Cover Types	Grassland	Upland Shrub	Conifer Forest	Riparian Forest
Number of HEP Models	**4**	**3**	**2**	**2**

Appendix L– Isqúulktpe follow-up and baseline HEP/McNary Dam species comparison

McNary Dam Cover Types	Shrubsteppe/Grassland			Riparian Tree			Riparian Tree			Riparian Shrub		
Paired Isqúulktpe Cover Types	Grassland			Conifer Forest			Riparian Forest			Upland Shrub		
HEP Survey Date/Model Source	2012	2003	McNary Dam[a]	2012	2003	McNary Dam[a]	2012	2003	McNary Dam[a]	2012	2003	McNary Dam[a]
Downy Woodpecker				x	x	x		x	x			
Black-capped Chickadee				x	x			x				
Blue Grouse	x									x	x	
Great Blue Heron							x	x				
Mink						x	x	x	x			x
Western Meadowlark	x	x	x									
White-tailed Deer	x									x		
Sharp-tailed Grouse (nesting)	x											
Sharp-tailed Grouse (winter)										x		
California Quail			x									x
Canada Goose			x									
Mallard			x									
Yellow Warbler												x
HEP Models per Cover Type	4	1	4	2	2	2	2	4	2	3	1	3
Difference between 2012 - 2003		-3			0			2			-2	

[a] Model source is the McNary Dam loss assessment cover type/species matrix.

Appendix M – Isqúulktpe crediting metric calculations and summary

	Land Type/Acres/HUs								
Project Land Class	**(A) 2012 Mitigation Land HUs**	**(B) 2003 Mitigation Land HUs**	**(C) Difference in Mitigation Land HUs (A - B)**	**(D) 2012 Allotment Land HUs**	**(E) 2012 Tribal Trust Land (in RU)[a] HUs**	**(F) 2012 Tribal Trust Land (out of RU)[a] HUs**	**(G) Net HU Change (C+D+E+F)**	**(H) 2012 HUs Reported in Pisces (A+D+E+F)**	**(I) Estimated 2012 Total HUs**
Number of Acres	**5,936.61**	**5,936.61**	**-**	**8,641.69**	**1,226.52**	**648.49**	**16,453.31**	**16,453.31**	**16,453.31**
Downy Woodpecker	707.31	1,223.00	-515.69	0	0	0	-515.69	707.31	**1,223.00**
Black-capped Chickadee	1,161.76	1,204.00	-42.24	0	0	0	-42.24	1,161.76	**1,204.00**
Blue Grouse	650.19	408.00	242.19	657.81	85.95	32.03	1,017.98	1,425.98	**1,017.98**
Great Blue Heron	41.81	31.00	10.81	14.24	3.51	4.01	32.57	63.57	**32.57**
Mink	61.81	104.00	-42.19	5.93	1.46	1.67	-33.13	70.87	**104.00**
Western Meadowlark	3,333.23	1,319.00	2,014.23	4,066.48	531.32	197.98	6,810.01	8,129.01	**6,810.01**
White-tailed Deer	2,257.57	0.00	2,257.57	657.81	85.95	32.03	3,033.36	3,033.36	**3,033.36**
Sharp-tailed Grouse	1,285.24	0.00	1,285.24	802.42	104.17	33.75	2,225.58	2,225.58	**2,225.58**
Total HUs	**9,498.92**	**4,289.00**	**5,209.92**	**6,204.71**	**812.36**	**301.47**	**12,528.44**	**16,817.44**	**15,650.50**
HU to Acre Ratio	**1.60:1.00**	**0.72:1.00**	**-**	**0.72:1.00**	**0.66:1.00**	**0.46:1.00**	**0.76:1.00**	**1.02:1.00**	**0.95:1.00**

[a] RU = range unit

Table Column Explanations

A. The number of HUs resulting from the 2012 follow-up HEP survey on mitigation lands purchased with BPA funds.
B. The number of HUs resulting from the 2003 baseline HEP survey on mitigation lands purchased with BPA funds.
C. The difference resulting from subtracting 2003 HEP results from 2012 HEP results (mitigation lands acquired with BPA funds).
D. E. F. The number of HUs generated on Tribal Allotment and Trust Lands as a result of the 2012 follow-up HEP survey. Follow-up HEP (2012) HSI's generated on Allotment/Trust Lands that were less than the results of the 2003 baseline HEP survey did not generate additional HUs since, by agreement, only "enhancement" HUs would be credited to BPA.
G. The net change in HUs on all land classes relative to 2003 baseline and 2012 follow-up HEP surveys.
H. The number of follow-up HUs to be entered into Pisces
I. The current estimated total number of credited HUs for each HEP model. The estimated total takes into account the subtraction of baseline HUs within Pisces. Furthermore, the total includes the 2003 baseline HEP downy woodpecker, black-capped chickadee, and mink HUs carried forward from column B; because 2012 follow-up HEP habitat suitability indices were less than those reported in 2003 resulting in fewer HUs than baseline totals (negative HU numbers in column C and column G). It is unclear whether or not the "carry forward" function is currently available on Pisces.

Appendix N – Wanaket Project cover type/species matrices comparison

McNARY LOSS ASSESSMENT MATRIX

HEP MODEL	COVER TYPES							
	Shrubsteppe/grass	Islands	Agriculture	Sand/Gravel	Rip. Tree	Rip. Shrub	Emerg. Wetland	Rip. Herb
Canada Goose	X	X	X	X				X
Western Meadowlard	X							
California Quail	X		X			X		X
Mallard	X	X	X				X	X
Sandpiper				X				
Mink				X	X	X	X	X
Woodpecker					X			
Yellow Warbler						X		
TOTAL	4	2	3	3	2	3	2	4

Wanaket (1990/1995 and 2005) matrix

HEP MODEL	COVER TYPES							
	Shrub/steppe/grass	Islands	Agriculture	Sand/Gravel	Rip. Tree	Rip. Shrub	Emerg. Wetland	Rip. Herb
Canada Goose								
Western Meadowlard	X							
California Quail	X					X		X
Mallard							X	X
Sandpiper				X				
Mink				X	X	X	X	X
Woodpecker					X			
Yellow Warbler						X		
TOTAL	2	N/A	N/A	2	2	3	2	3

McNary Dam and Wanaket Project evaluation species number comparison

Matrices	COVER TYPES							
	Shrub/steppe/grass	Islands	Agriculture	Sand/Gravel	Rip. Tree	Rip. Shrub	Emerg. Wetland	Rip. Herb
McNary Dam	4	2	3	3	2	3	2	4
Wanaket	2	N/A	N/A	2	2	3	2	3
Difference	-2	N/A	N/A	-1	0	0	0	-1

Attachment 1 – YN Wetlands and Ripairian Restoration 2007 Report

Compiled By

Paul R Ashley and Sara Wagoner

CBFWA Regional HEP Team

For

Tracy Hames – Yakama Nation

and

Joe DeHerrera – Bonneville Power Administration

February 2007

TABLE OF CONTENTS

List of Tables

List of Figures

Abstract

This Habitat Evaluation Procedures (HEP) report is a compilation of all data collected from 1990 through 2006 on land acquisitions and habitat protection leases associated with the Yakama Nation's (YN) Wetlands and Riparian Restoration Project (WRRP). Since 1990, over 21,600 acres have been protected on 39 separate parcels ranging in size from 22 acres to 4,725 acres. Between 1,000 and 3,000 acres were acquired each year including more than 115 miles of steelhead (*Oncorhynchus mykiss*) bearing stream, river and side channels at an average cost of less than $400 per acre.

Habitat Evaluation Procedures (USFWS 1980) were utilized to document baseline habitat conditions and to determine how many protection habitat units (HUs) to credit Bonneville Power Administration (BPA) for providing funds to acquire/protect project lands as partial mitigation for habitat losses associated with construction of dams on the lower Columbia River. Since 1990, three HEP "methods" including the Yakama HEP study method, the Delphi method, and the Transect method have been employed to document habitat unit gains generated from Yakama Nation mitigation projects. The Delphi method proved unreliable and lacked repeatability and was subsequently rejected after 1999.

The acquisition/protection of 21,631.10 acres of wildlife habitat on the Yakama Reservation yielded 33,860.18 habitat units (HUs) for a habitat unit to acre ratio of 1.57:1. Yakama Nation wildlife mitigation projects account for the largest share (72%) of habitat unit gains associated with McNary, John Day, The Dalles, and Bonneville Dams (Washington State HU losses).

While several HEP species identified in lower Columbia River hydro project loss assessments have not been fully mitigated, the total number of habitat units gained through BPA funded mitigation projects exceed the number lost by more than 2,500 habitat units. As a result, BPA proposes that lower Columbia River wildlife mitigation (Washington State) is complete; due largely to the success of the Yakama Nation's wildlife mitigation program.

Introduction

This Habitat Evaluation Procedures report is a compilation of all data collected from 1990 through 2006 on land acquisitions and habitat protection leases associated with the Yakama Nation's Wetlands and Riparian Restoration Project. This project is a comprehensive effort, funded in part by Bonneville Power Administration, to protect and restore floodplain habitats along anadromous fish-bearing streams in the agricultural portion of the Yakama Reservation. The loss of floodplain function in lower Yakima River watersheds is the primary factor limiting the production and survival of salmonids and associated wildlife populations (YSPB 2004). As a result, protection and restoration of these floodplain habitats are a high priority throughout the Yakima River Basin.

WRRP project objectives include the protection, restoration, and management of 27,000 acres of floodplain habitat along the Yakima River, Satus Creek, and Toppenish Creek (Figure 1). Methods include protection of large contiguous floodplain tracts and associated water rights through acquisitions and leases while restoration emphasizes the return of normative hydrologic processes and ecological functions. Monitoring and subsequent adaptive management actions will ensure that the restored conditions persist into the future (T. Hames, pers. comm.).

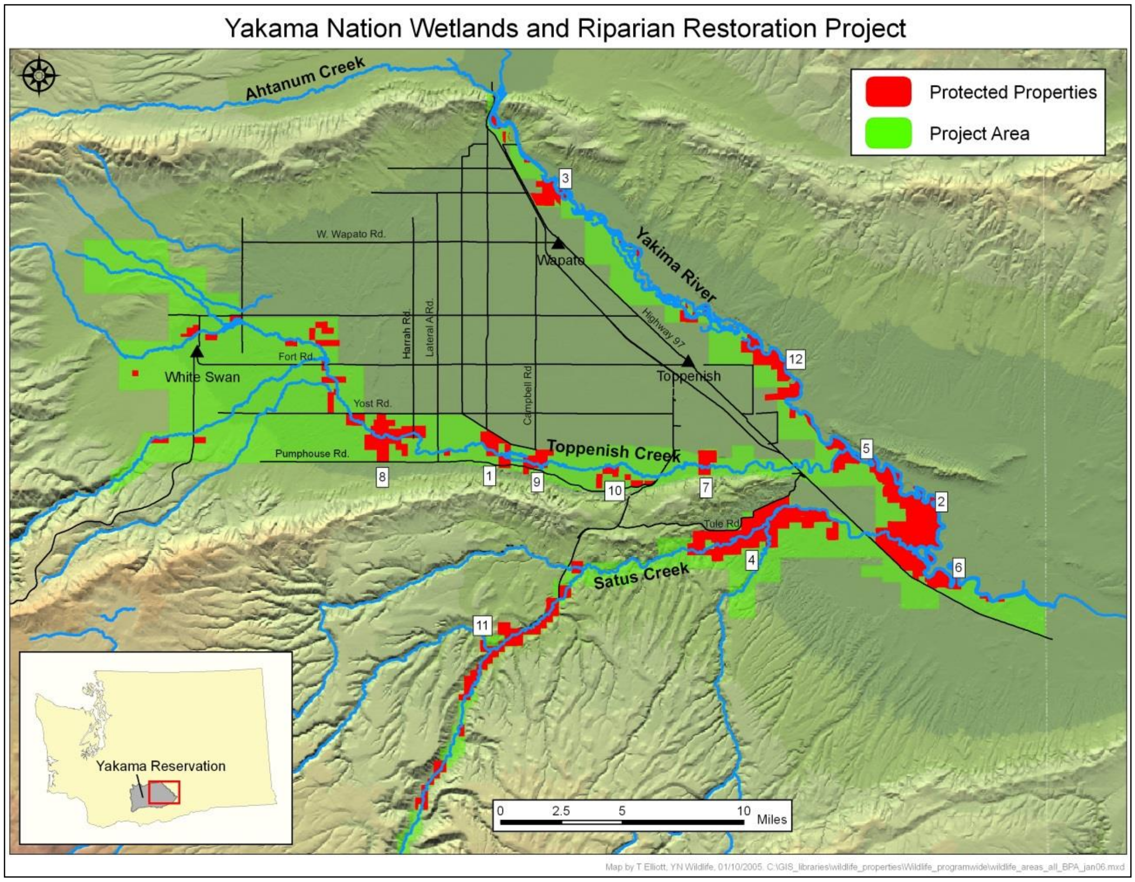


Figure 8. Yakama Nation wetland and riparian habitat mitigation project lands (2006).

Since 1990, over 21,000 acres have been protected under the project. Between 1,000 to 3,000 acres were acquired in most years, including more than 115 miles of steelhead-bearing stream, river and side channels at an average cost of less than $400/acre. In addition to the land, associated irrigation water rights were acquired and allowed to remain in-stream. Water rights for hundreds of acres, including all of the water rights on Satus Creek, have been secured. At the current rate of implementation, 27,000 acres of floodplain habitats should be protected and/or restored by the end of 2012.

No attempt has been made to distinguish the Habitat Units (HU's) protected and restored by BPA-provided funds from those HU's resulting from other funding sources. The Bonneville Power Administration-funded portion of this project includes securing the land, restoration planning, and management/monitoring aspects of this comprehensive effort. Large-scale restoration activities on the secured properties are funded through extensive partnerships.

Project Area

Location

The 50,308 acre project area (Bich et al. 1991) is located along the east slope of the Cascade Mountains within the agricultural valley of the Yakama Reservation and includes the riparian corridors and associated uplands of the Yakima River, Satus Creek, and Toppenish Creek (Figure 1). As a general location reference point, the confluence of Toppenish Creek and the Yakima River is located at UTM[31] coordinates 10 0718055E, 5133759N (NAD 27).

Cover Types

The cover type section consists of two components. The first component describes general structural conditions and/or floristic characteristics associated with each cover type while the second component identifies specific project sites, cover types, and the number of acres protected each year in a series of tables.

Cover type maps were produced by Yakama Nation Wildlife Department staff using Arcinfo ® GIS software. Cover types were delineated on aerial photographs generally following those described by Bich et al. (1991). Cover type maps located in Attachment 1 are either the original cover type maps generated prior to the HEP surveys, or new cover type maps developed as replacements for "irretrievable" original maps. Although "new" cover type maps may not exactly replicate the original maps, they are included because they are the best alternative to missing and/or inaccurate information. Cover type map source information is also located in Attachment 1.

Map scale varied predicated on project area size and level of detail needed to conduct HEP surveys and the year the maps were produced. Map detail and sophistication generally increased in later years as GIS staff became more familiar with using GIS software and as software programs improved. The Regional HEP Team modified cover type maps based on field observations while Yakama Nation GIS staff corrected field maps as needed.

The project area is comprised of nine macro cover types including riparian shrub, agriculture, riparian forest, riparian herb, sand/gravel/cobble/mud, lacustrine, riverine, emergent wetland, and shrubsteppe/grassland (Bich et al. 1991). Cover type acreage for the project area is compared to the number of acres currently protected in Table 1. Cover types are also described briefly in the following section.

[31] Universal Transverse Mercator coordinates

Table 6. Comparisons of extant project area cover type acres and protected acres.

Cover Type	Potential Acres[32]	Protected Acres[33]
Riparian shrub	3,096.00	2,184.80
Agriculture	14,963.00	2,296.90
Riparian forest	2,064.00	2,253.60
Riparian herb	3,096.00	1,666.24
Sand/gravel/cobble/mud	258.00	259.50
Lacustrine[34]	516.00	337.30
Riverine	1,032.00	299.80
Emergent wetland	1,548.00	756.50
Shrubsteppe/grassland	23,735.00	11,558.06
TOTAL	**50,308.00**	**21,612.70**

Riparian Shrub

The riparian shrub cover type occurs on relatively moist sites characterized by deciduous shrubs such as wild rose (*Rosa woodsii*), willow (*Salix* spp.), chokecherry (*Prunus virginiana*), sumac (*Rhus glabra*), blue elderberry (*Sambucus cerulea*), Douglas hawthorne (*Crataegus douglasii*), poison ivy (*Rhus radicans*), and Russian olive (*Elaeagnus angustifolia*) (Bich et al. 1991, P. Ashley, unpublished data). As illustrated in Figure 2, this cover type often serves as a narrow ecotone and is extremely valuable to wildlife providing cover and forage such as fruits and berries.

The riparian shrub cover type occurs along both the Toppenish Creek and Yakima River corridors and may be complex (multi canopy) or simple (P. Ashley, unpublished data). Complex shrub communities generally occur on sites not dominated by Russian olive or disturbed by livestock grazing/fire.

[32] The total number of acres within the 50,308-acre project area depicted in Figure 1.
[33] The number of acres acquired/protected as of November 2006.
[34] Includes "open water".

Figure 9. Riparian shrub cover type ecotone example.

Agriculture

The agriculture cover type occurs throughout the proposed mitigation study area and is characterized by crops such as corn (*Zea mays*), wheat (*Triticum aestivum*), alfalfa (*Medicago sativa*), mint (*Mentha* spp.), hops (*Humulus lupinus*), grapes (*Vitis* spp.), asparagus (*Asparagus officinalis*), and pasture (YSPB 2004). Croplands undergo extensive seasonal modification through intensive agricultural practices such as cultivation and irrigation, and thus experience large seasonal variation in vegetation structure and habitat quality (Bich et al. 1991).

Over a period of 6 months or less, vegetative cover may vary from 0% to >90% with a canopy height varying from less than an inch to over six feet. Likewise, the value of these sites to wildlife may vary over a similarly short period from virtually no value to extremely high value as critical forage and/or cover areas (Bich et al. 1991). Pasturelands range from sites infested with noxious weeds (Figure 3) to managed irrigated pasture comprised of introduced grass species (P. Ashley and T. Hames pers. comm.).

Figure 10. Pastureland infested with introduced knapweed.

Riparian Forest

The riparian forest cover type occurs near ponds, lakes, or streams, and is characterized by black cottonwood (*Populus trichocarpa*), and willow trees. Introduced tree species that may also occur in riparian corridors include various fruit trees, maple (*Acer* spp.), elm (*Ulmus* spp.), locust (*Robinia* spp.), and Russian olive (P. Ashley, unpublished data). This cover type often grades into riparian shrub communities and like riparian shrub communities, often provides a boundary between upland and aquatic ecosystems (Bich et al. 1991).

The riparian forest cover type provides extremely valuable cover and foraging habitat for a variety of wildlife species from passerine birds to large mammals such as deer (*Odocoileus* spp.) and black bears (*Ursus americanus*). It contains high quality nesting habitat for wood ducks (*Aix sponsa*), Canada geese (*Branta canadensis*), great blue herons (*Ardea herodias*), and black-crowned night herons (*Nycticiorax nycticorax*). Due to the multi-layered canopy, this cover type may provide the most diverse vegetative structure of all cover types evaluated (Bich et al. 1991). The riparian forest cover type occurs primarily along the Yakima River corridor (Figure 4).

Figure 11. Riparian forest cover type adjacent to the Yakima River.

Riparian forest corridors provide recreational opportunities, improve water quality for fish and associated wildlife populations (YSPB 2004), and are culturally significant to the Yakama Nation (T. Hames, pers. comm.).

Riparian Herb

The riparian herb cover type occurs on relatively moist sites, often in close proximity to standing water. This cover type is typically dominated by a variety of mesic forbs and/or graminoids such as native sedge *(Carex spp.)*, rush *(Juncus spp.), and* saltgrass *(Distichlis stricta)*. Numerous noxious weeds and non-native plant species including reed canarygrass (*Phalaris arundinacea*) and Russian olive dominate and/or persist on a number of wet meadow sites as illustrated in Figure 5 (P. Ashley, unpublished data).

Though often having the appearance of an upland cover type, plants associated with these mesic sites are often hydrophytic and typically do not desiccate as rapidly as plants in upland areas. This extended period of active growth and plant succulence makes the riparian herb cover type valuable wildlife habitat. These sites typically are important foraging areas for wildlife species such as waterfowl, shorebirds, and aquatic mammals (Bich et al. 1991) and are culturally significant to the Yakama Nation (T. Hames, pers. comm.).

Figure 12. Riparian herb wetland dominated by reed canarygrass.

Sand/Gravel/Cobble/Mud

The sand/gravel/cobble/mud cover type occurs adjacent to riverine and lacustrine cover types primarily along the Yakima River and to a limited extent along Toppenish Creek. This cover type is characterized by fine to coarse substrates that are typically sparsely vegetated as illustrated in Figure 6. Shorebirds forage and nest on these sites while waterfowl loaf in this cover type (Bich et al. 1991).

Lacustrine and Riverine

The lacustrine and riverine cover types are recognized by water flow characteristics. If water flow is not evident as in lakes and ponds, the system is lacustrine (Figure 7). Conversely, if water is flowing like in streams, rivers, irrigation canals, and drains, the system is classified riverine (Figure 6). Although these cover types are differentiated only by water flow characteristics, several HEP species' models used to evaluate these cover types include evaluation of adjacent plant community features (Bich et al. 1991).

Figure 13. An example of sand/gravel/cobble/mud and riverine cover types on the Yakima River.

Figure 14. Lacustrine cover type example.

Emergent Wetland

The emergent wetland cover type occurs on hydric soils characterized by native emergent and aquatic plant species such as cattail (*Typha latifolia)*, bulrush (*Scirpus spp.)*, wapato (*Sagittaria latifolia*), bur-reed (*Sparganium emersum*), and pondweed (*Potamogeton* spp.). Non-native plant species introduced by former waterfowl gun club members may also be present (T. Hames, pers. comm.). Emergent wetlands may be open as shown in Figure 8, or closed exhibiting little to no open water (Figure 9).

Emergent wetlands provide extremely valuable wildlife habitat such as waterfowl pairing and brood-rearing cover (Bich et al. 1991) and are utilized for cultural activities by the Yakama Nation (T. Hames, pers. comm.). In addition, wetlands provide recreational opportunities for hunters and wildlife enthusiasts alike (YSPB 2004).

Figure 15. An example of an "open" emergent wetland.

Figure 16. A "closed" emergent wetland.

Shrubsteppe/Grassland

This cover type is the most widespread habitat in the mitigation study area. The shrub-steppe/grassland cover type is an aggregate complex that includes the majority of native uplands and idle field plant communities. Historically, flood plain grasslands were dominated by Great Basin wildrye (*Elymus cinereus*), salt grass, and greasewood (*Sarcobatus vermiculatus*). Uplands range from remnant shrubsteppe sites that still support native plant communities to areas comprised almost entirely of introduced vegetation (P. Ashley, unpublished data). Big sagebrush (*Artemisia tridentata*) /bluebunch wheatgrass (*Pseudoroegneria spicatum*) plant communities (Figure 10), idle croplands, pastures, and grasslands (Figure 11) characterize these relatively xeric sites (Bich et al. 1991).

In addition to big sagebrush, native shrub species include green rabbitbrush *(Chrysothamnus viscidiflorus*, stiff sagebrush (*Artemisia rigida*), gray rabbitbrush (*Chrysothamnus nauseosus*), hop sage (*Atriplex spinosa*), greasewood and occasionally currant (*Ribes* sp.). Introduced Russian olive shrubs/trees also occur and may dominate some sites (P. Ashley, unpublished data).

As with most non-farmed areas, upland sites support various amounts of introduced vegetation including knapweed (*Centaurea* spp.), mullein (*Verbascum thapsus*), Russian thistle (*Salsola iberica*), pepperweed (*Lepidium* spp.), and cheatgrass (*Bromus tectorum*) to name a few (P. Ashley, unpublished data). Upland sites were generally used for livestock grazing, wildlife habitat, and tribal cultural activities (YSPB 2004).

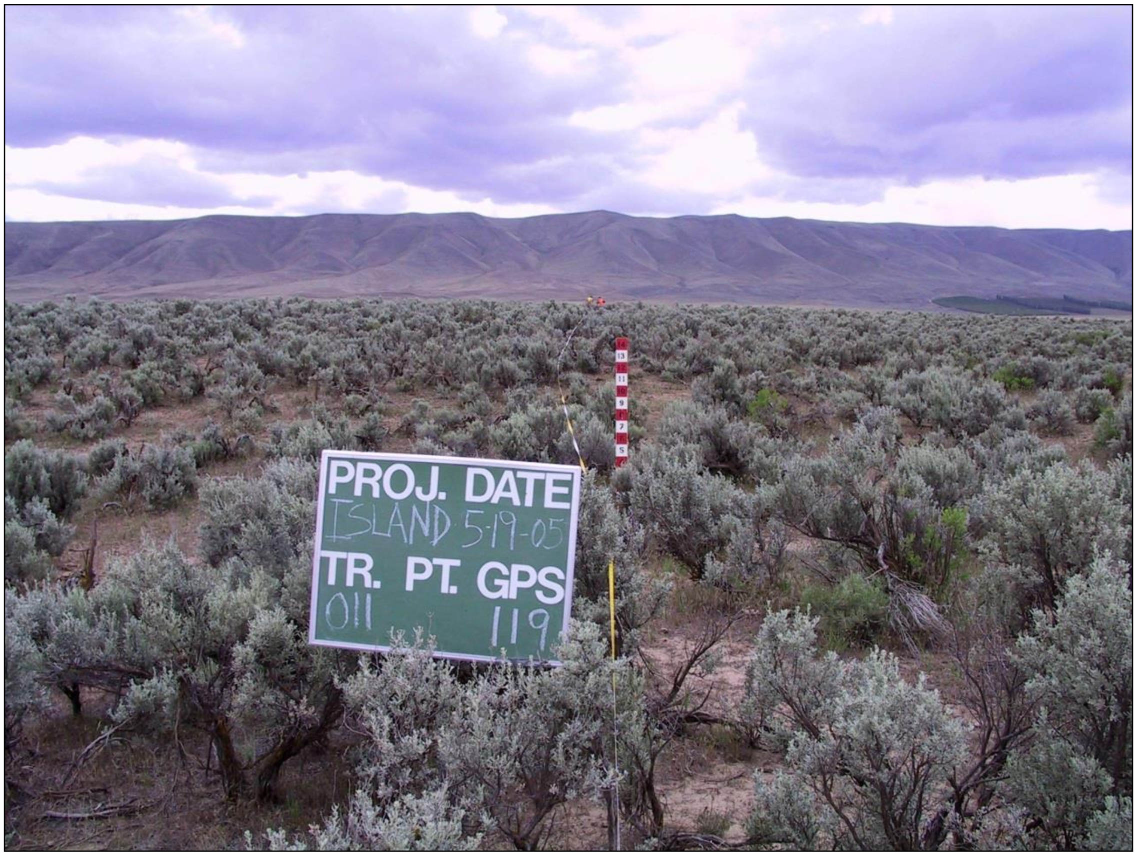


Figure 17. Shrubsteppe cover type dominated by big sagebrush.

Figure 18. Upland grassland site located on the South Lateral A parcel.

Site Specific Cover Types/Acres

Cover types and acres for protected sites are listed in Table 2 through Table 7 for each project year. Cover type acre numbers were obtained from HEP survey files, or from YN Wildlife Department GIS staff. HEP surveys were not conducted in 2000 and 2001. Therefore, tables were not developed for those years.

Table 7. Project site cover types and acres evaluated with HEP in 1999.

PROJECT SITE	Cover Type/Acres										Total Acres
	Riparian Forest	Riparian Shrub	Riparian Herb	Shrubsteppe Grassland	Agricultural	Lacustrine -Lake	Riverine	Open Water	Emergent Wetland	Sand/Gravel/ Cobble/Mud	
Lower Satus Creek	168.00	203.00	31.00	2,252.00	954.00		59.00		6.00	21.00	**3,694.00**
Mosebar Pond	41.00	53.00	109.00	121.00	63.00	21.00			24.00		**432.00**
Satus Creek	493.00	864.00	463.00	1,682.00	216.00		83.00	285.00	214.00	174.00	**4,474.00**
Toppenish Creek	10.00	190.00	66.00	329.00	503.00	1.00	14.00		123.00		**1,236.00**
Wanity Slough		34.00	38.00	270.00	8.00		11.00				**361.00**
Wapato	207.00	51.00	31.00	194.00	223.00	1.00	30.00		3.00	30.00	**770.00**
South Lateral A	4.00	1.00	4.00	257.00	1.00		8.00		139.00		**414.00**
North Satus Creek	106.60	115.70	129.70	256.40	3.70	29.30	43.60		20.60	16.70	**722.30**
TOTAL	**1,029.60**	**1,511.70**	**871.70**	**5,361.40**	**1,971.70**	**52.30**	**248.60**	**285.00**	**529.60**	**241.70**	**12,103.30**

Table 8. Project site cover types and acres evaluated with HEP in 2002.

PROJECT SITE	Cover Type/Acres								Total Acres
	Riparian Forest	Riparian Shrub	Riparian Herb	Shrub/Steppe-Grassland	Agricultural	Emergent Wetland	Riverine	Sand/Gravel/Cobble/Mud	
Satus Corridor	**457.70**	**224.70**	**85.10**	**1,938.80**		**0.90**		**10.80**	**2,718.00**
Lawrence II (Gary Lawrence)	**9.10**		**4.50**	**26.40**					**40.00**
Sunnyside Dam	**5.00**			**13.00**			**2.00**	**2.00**	**22.00**
Plank Road		**35.00**	**2.00**	**67.00**	**36.00**	**28.00**			**168.00**
Parker		**12.00**	**11.00**	**13.00**					**36.00**
Tillman		**7.80**		**71.60**					**79.00**
Dry Creek		**10.00**	**20.00**	**119.00**			**6.00**	**5.00**	**160.00**
Campbell		**55.00**	**21.00**	**141.00**	**124.00**	**4.00**	**15.00**		**360.00**
Old Goldendale			**19.00**	**116.00**		**30.00**	**19.00**		**184.00**
South Barker	**1.00**		**34.00**	**38.00**		**2.00**			**75.00**

Lawrence I (Jim Lawrence)	**8.00**			**21.70**	**30.50**		**0.60**		**61.00**
TOTAL	**480.80**	**344.50**	**196.60**	**2,565.50**	**190.50**	**64.90**	**42.60**	**17.80**	**3,903.00**

Table 9. Project site cover types and acres evaluated with HEP in 2003.

PROJECT SITE	Cover Type/Acres						Total Acres
	Riparian Forest	Riparian Shrub	Riparian Herb	Emergent Wetland	Shrubsteppe-Grassland	Agricultural	
Meninick North	433.00	50.00	40.00	3.00	526.00		**1,052.00**
Shuster Road	113.00	146.00	180.00	8.00	150.00	70.00	**667.00**
TOTAL	546.00	196.00	220.00	11.00	676.00	70.00	**1,719.00**

Table 10. Project site cover types evaluated with HEP in 2004.

PROJECT SITE	Cover Type/Acres				Total Acres
	Riparian Forest	Rip Shrub/Riverine/Cobble	Riparian Herb/Wetland	Shrubsteppe-Grassland	
Buena	24.00	39.00		94.00	**157.00**
Garcia		1.00		81.00	**82.00**
Lawrence (Lawrence 1 west)	10.20	0.40		70.40	**81.00**
Plank		6.00		679.00	**685.00**
T2126			39.94	54.56	**94.50**
T3669				116.00	**116.00**
T4433			17.90	26.40	**44.30**
T565		8.00	18.00	54.00	**80.00**
T570		3.00	28.00	42.00	**73.00**
TOTAL	**34.20**	**57.40**	**103.84**	**1,217.36**	**1,412.80**

Table 11. Project site cover types and acres evaluated with HEP in 2005.

PROJECT SITE	Cover Type/Acres						Total Acres
	Riparian Forest	Riparian Shrub	Riparian Herb	Emergent Wetland	Shrubsteppe-Grassland	Agricultural	
Meninick	86.00	1.00	1.00	1.00	279.00	61.00	**429.00**
Meninick South	38.00	2.00	2.00	4.00	22.00		**68.00**
South Lateral A[35]		0		0	0		**0**
Island Road		8.00	62.00	2.00	171.00		**243.00**
E 80 Pumphouse	17.00	2.00	48.00	11.00			**78.00**
Lower Satus Creek	22.00	27.00			360.00		**409.00**
TOTAL	**163.00**	**40.00**	**113.00**	**18.00**	**832.00**	**61.00**	**1227.00**

[35] South Lateral A acreage was accounted for in Table 2. This was a repeat HEP analysis.

Table 12. Project site cover types and acres evaluated with HEP in 2006.

PROJECT SITE	Cover Type/Acres							Total Acres
	Riparian Forest	Riparian Shrub	Riparian Herb	Riverine	Emergent Wetland	Shrubsteppe-Grassland	Agriculture	
Bailey			1.10			38.80		**39.90**
Mill Creek North		3.50	59.90	2.00		92.40	0.80	**158.60**
Mill Creek South			100.10			65.40		**165.50**
Olney Drain		9.70		6.60		432.20	2.90	**451.40**
TOTAL	**0.00**	**13.20**	**161.10**	**8.60**	**0.00**	**628.80**	**3.70**	**815.40**

Methods

Habitat Evaluation Procedures

From 1990 through 2006, Habitat Evaluation Procedures (HEP) analyses were conducted on 39 individual parcels located on the Yakama Reservation (P. Ashley and T. Hames, pers. comm.). HEP was utilized to document baseline habitat conditions and to determine how many protection habitat units (HUs) to credit BPA for providing funds to acquire/protect project lands as partial mitigation for habitat losses associated with construction of dams on the lower Columbia River

Prior to 1999, Yakama Nation Wildlife Department biologists estimated the number of habitat units derived from the protection of project sites based on professional judgment and/or ocular HEP evaluations (T. Hames, and P. Ashley pers. comm.). In 1999, the Yakama Nation contracted with Raedeke Associates, Inc. (RAI) to conduct formal HEP evaluations on all project sites acquired from 1990 through 1999. RAI, in conjunction with YN wildlife biologists and others, conducted detailed ocular HEP evaluations on all mitigation sites and documented the results in *Habitat Evaluation Procedures Wildlife Management Areas Yakama Nation, Washington* (K. Raedeke and D. Raedeke 2000).

Similarly, the Regional HEP Team (RHT) and staff from the Yakama Nation Wildlife Department completed HEP evaluations from 2000 through 2006 using robust field transects and a minimum number of ocular surveys. Habitat Evaluation Procedures concepts are summarized in the following paragraphs.

Habitat Evaluation Procedures Summary

HEP, developed by the U.S. Fish and Wildlife Service (USFWS), is used to quantify the impacts of development, protection, and restoration projects/measures on terrestrial and aquatic habitats by assessing changes, both negative and positive, in habitat quality and quantity (USFWS 1980), (USFWS 1980a). HEP is a habitat based approach to impact assessment that documents change through use of a Habitat Suitability Index (HSI). The

HSI value is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected wildlife and fish species.

The HSI value is an index to habitat carrying capacity for a specific species or guild of species based on a performance measure (e.g. number of deer per square mile) described in HEP species models. The index ranges from 0.0 to 1.0. A HSI of 0.3 indicates that habitat quality/carrying capacity is marginal while a HSI of 0.7 suggests that habitat quality/carrying capacity is relatively good (Table 8).

Table 13. Habitat suitability index verbal equivalency table.

Habitat Suitability Index	Verbal Equivalent
0.0 < 0.2	Poor
0.2 < 0.4	Marginal
0.4 < 0.6	Fair
0.6 < 0.9	Good
0.9 < 1.0	Optimum

Each increment of change is identical. For example, a change in HSI from 0.1 to 0.2 represents the same magnitude of change as a change from 0.2 to 0.3, and so forth. Habitat variables, suggested mensuration techniques, and mathematical aggregations of assessment results are included in HEP evaluation species models.

Habitat units are determined by multiplying the habitat suitability index by the number of acres of habitat (cover type) protected. For example, if the HSI output for a mule deer HEP model is 0.5 and the amount of acres of shrubsteppe habitat protected is 100, BPA is credited with 50 habitat units (0.5 HSI x 100 acres = 50 HUs).

HEP Model Selection

Yakama Nation HEP model selection was based on the cover type/species matrices found in loss assessments for the lower four Columbia River Dams as shown in Table 9 through Table 12 (Rasmussen and Wright 1990). Unlike state, federal, and other tribal entities, the Yakama Nation did not link specific mitigation acquisitions and leases to individual lower Columbia River Dams. Instead, the YN considered all wildlife habitat losses resulting from construction and subsequent inundation from McNary, John Day, The Dalles, and Bonneville Dams as a single landscape level HU aggregation (T. Hames, pers. comm.).

Table 14. McNary Dam cover type/species matrix.

HEP MODEL	MCNARY DAM COVER TYPE/SPECIES MATRIX								
	Rip. Tree	Rip. Shrub	Rip. Herb	Sa/Gr/ Co/Mud[1]	Emergent Wetland	Shrub-steppe/ Grassland	Agricultural	Islands	Open Water - Riverine[2]
California Quail		X	X			X	X		
Canada Goose			X	X		X	X	X	
Mallard			X		X	X	X	X	X
Spotted Sandpiper				X					
Mink	X	X	X	X	X				
Western Meadowlark						X			
Yellow Warbler		X							
Downy Woodpecker	X								
TOTAL	2	3	4	3	2	4	3	2	1

[1] Sand, gravel, cobble, and mud cover type.
[2] The open water cover type (reservoir) also includes 10,955 mallard HU gains (80% of 13,744 HUs). This matrix, however, includes only loss assessment species.

Table 15. John Day Dam cover type species matrix.

HEP MODEL	JOHN DAY DAM COVER TYPE/SPECIES MATRIX								
	Rip. Tree	Rip. Shrub	Rip. Herb	Sa/Gr/ Co/Mud[1]	Emergent Wetland	Shrub-steppe/ Grassland	Agricultural	Islands	Open Water[2]
California Quail						X			
Canada Goose			X				X	X	
Mallard			X		X			X	
Spotted Sandpiper				X					
Mink		X			X				
Western Meadowlark						X			
Black-capped Chickadee	X								
Yellow Warbler		X							
Great Blue Heron				X					
TOTAL	1	2	2	2	2	2	1	2	0

[1] Sand, gravel, cobble, and mud cover type.

[2] The open water cover type includes 7,199 scaup HU gains (50% of 14,398 HUs). HU gains are not included in this matrix.

Table 16. The Dalles Dam cover type/species matrix.

HEP MODEL	THE DALLES DAM COVER TYPE/SPECIES MATRIX					
	Rip. Tree	Rip. Shrub	Sa/Gr/ Co/Mud[1]	Shrub-steppe/ Grassland	Islands	Open Water[2]
Canada Goose					X	
Spotted Sandpiper			X			
Mink	X	X				
Western Meadowlark				X		
Black-capped Chickadee	X					
Yellow Warbler		X				
Great Blue Heron			X			
TOTAL	2	2	2	1	1	0

[1] Sand, gravel, cobble, and mud cover type.

[2] The open water cover type includes 289 scaup HU gains (50% of 578 HUs). HU gains are not included in this matrix.

Table 17. Bonneville Dam cover type species matrix.

HEP MODEL	BONNEVILLE DAM COVER TYPE/SPECIES MATRIX							
	Rip. Tree	Rip. Shrub	Wetlands, Lakes, and Ponds	Sa/Gr/ Co/Mud[1]	Open Water, Reservoir, River[2]	Islands	Conifer-Hardwood Forest	Shrub-steppe/ Grassland[3]
Canada Goose			X	X		X		X
Spotted Sandpiper			X	X				
Mink			X	X	X			
Black-capped Chickadee	X						X	
Yellow Warbler		X						
Great Blue Heron	X		X	X	X			X
TOTAL	2	1	4	4	2	1	1	2

[1] Sand, gravel, cobble, and mud cover type

[2] The open water cover type includes 1,336 scaup HU gains (50% of 2,671 (HUs). HU gains are not included in this matrix.

[3] Includes pasture

The ten HEP models used to evaluate YN wildlife mitigation sites are identified in Table 13 and are the same models found in *The Yakima Indian Nation Wildlife Mitigation Plan for Bonneville, The Dalles, John Day, and McNary Dams* (Bich et al. 1991). Scanned copies of the models are included in Appendix A while model selection rationale and model references are listed in Table 13. Yakama Nation wildlife biologists modified and/or developed several models to meet habitat conditions found on the Yakama Reservation.

Table 18. Yakima Nation HEP species models and selection rationale.

Species	Rationale
California quail (Bich et al. 1991)	A species commonly associated with brushy thickets, riparian shrubs, agricultural lands, and shrub-steppe/grasslands. This game bird feeds mostly on seeds and forbs in open brush and grassland areas.
Canada goose (Bich et al. 1991)	A migratory bird of national significance, sensitive to island nesting habitat and associated shoreline brooding areas. Cultural significance.
Mallard (Bich et al. 1991)	The mallard utilizes a broad range of shrub-steppe/grassland, riparian herb, and island nesting habitats to some degree for nesting. Wetlands are necessary for brood rearing while open water and agricultural areas provide winter rearing and feeding.
Spotted sandpiper (Bich et al. 1991)	A representative of migratory shorebirds which utilizes sparsely vegetated islands, mudflats, shorelines and sand and gravel bars.
Mink (Allen 1986)	Carnivorous furbearer, feeds on a wide range of vertebrates. Uses shoreline and adjacent shallow water habitats. HEP model available. Cultural significance.
Western meadowlark (Bich et al. 1991)	A species common to shrub-steppe/grassland habitat. This bird is well known for its melodious song and feeds primarily on insects and seeds. This model is an adaptation of the Eastern Meadowlark model by Schroeder and Sousa (1982).
Black-capped chickadee (Schroeder 1982)	Representative of species utilizing mature forest canopies and forest cavity nesters. HEP model available.
Yellow warbler (Shroeder and Sousa 1982)	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. HEP model which is sensitive to riparian shrub and wetland habitats. HEP model available.
Great blue heron (Bich et al. 1991)	Carnivore which forages on a variety of vertebrates in shallow water. The sand/gravel/cobble/mud shorelines of the Columbia River reservoirs are commonly used as foraging areas. HEP model available. Cultural significance.
Downy woodpecker (Shroeder 1983)	This woodpecker represents a species which feeds and reproduces in a tree environment. Its diet is primarily insects with some seeds and fruits. The downy woodpecker HEP model was selected to measure the riparian tree cover type. HEP model available.

The YN HEP model/cover type matrix is displayed in Table 14 (Bich et al. 1991).
In most cases, YN project biologists combined all species for individual cover types identified in the four lower Columbia River Dam loss assessments to evaluate each cover type. This resulted in more species used per cover type than were used in HEP analyses for individual dams (Table 15). For example, five species were utilized to evaluate the riparian forest cover type, whereas not more than two species were used to evaluate the same cover type in individual hydro project loss assessments.

Although the Yakama Nation agreed to conduct HEP analyses, the Yakama Nation has maintained that the current wildlife mitigation program will not compensate for habitat/wildlife losses due to hydro development on the lower Columbia River. The Yakama Nation requested that BPA fund the protection and maintenance of up to 27,000 acres of wildlife habitat on the Yakama Reservation in perpetuity. Furthermore, the YN does not consider the habitat unit concept as a legitimate method for determining when BPA has met its wildlife mitigation obligation. Because of this unique perspective, the YN has elected not to take a position on or be involved in the disbursement of habitat units generated from project lands (T. Hames, pers. comm.). The assignment of habitat unit gains to specific dams in this report were developed by Regional HEP Team staff and are not necessarily endorsed by the Yakama Nation (P. Ashley and T. Hames pers.comm.).

Table 19. Yakama Nation HEP model/cover type matrix.

HEP MODEL	YAKAMA NATION COVER TYPE/SPECIES MATRIX								
	Rip. Forest	Rip. Shrub	Rip. Herb	Riverine	Lacustrine (Open Water)	Sa/Gr/ Co/Mud[1]	Emergent Wetland	Shrub-steppe/ Grassland	Agricultural
California Quail		X	X					X	X
Canada Goose	X[2]		X		X	X		X	
Mallard			X	X	X		X	X	X
Spotted Sandpiper						X			
Mink	X	X		X		X	X		
Western Meadowlark								X	
Black-capped Chickadee	X								
Yellow Warbler		X							
Downy Woodpecker	X								
Great Blue Heron	X			X	X	X		X	
TOTAL	5	3	3	3	3	4	2	5	2

[1] Sand, gravel, cobble, and mud cover type.
[2] Canada goose was used to evaluate the riparian forest (RF) cover type in the 1990 and subsequent HEP analyses , but was not listed for the RF cover type in the 1991 YN Wildlife Mitigation Plan HEP species matrix (Page 17, Table 5).

Table 20. Comparison between HEP model stacking by the YN and what is listed in loss assessments for the lower four Columbia River Dams.

Entity/Hydro Project	YN/LOWER COLUMBIA RIVER HYDRO PROJECT COVER TYPES/NUMBER OF SPECIES PER COVER TYPE SUMMARY									
	Rip.[a] Tree # Species	Rip.[a] Shrub # Species	Rip.[a] Herb # Species	Riverine # Species	Lacustrine Palustrine # Species	Sa/Gr/[b] Co/Mud # Species	Emergent Wetland # Species	Shrub-steppe/ Grassland # Species	Agricultural # Species	Islands # Species	Conifer-Hardwood Forest # Species
Yakama Nation	5	3	3	3	3	4	2	5	2	0	0
McNary Dam	2	3	4	1	0	3	2	4	3	2	0
John Day Dam	1	2	2	0	0	2	2	2	1	2	0
The Dalles Dam	2	2	0	0	0	2	0	1	0	1	0
Bonneville Dam	2	1	0	2	4	4	0	2	0	1	1

[a] Riparian communities

[b] Sand/Gravel/Cobble/Mud

[c] **Includes pasture**

Sampling Design and Measurement Protocols

Three HEP "methods" have been employed since 1990 to quantify habitat unit gains generated on Yakama Nation mitigation project sites. Methods include the Yakama HEP study method (T. Hames, pers. comm.), the Delphi method (K. Raedeke and D. Raedeke 2000), and the Transect method (P. Ashley, pers.comm.). Raedeke and Raedeke (2000) described the Yakama Nation and Delphi techniques in detail and compared the results of the all three methods (Attachment 2).

Raedeke and Raedeke (2000) concluded that the Yakama, Delphi, and Transect methods produced similar results with experienced field staff. Raedeke and Raedeke (2000) further stated that more area could be evaluated in a given amount of time with less individual training using the Yakama and Delphi techniques when compared to the Transect method.

Even though the methods produced similar results, the Delphi method was largely subjective lacking objective, quantifiable data and may be difficult to compare to future estimates as field participants change over time (P. Ashley, pers. comm.). Raedeke and Raedeke (2000) argued, however, that the lack of repeatability may be somewhat compensated for by the increased sample size possible with the Delphi method considering like temporal constraints for all methods. Due to the subjective nature of this method, the Delphi technique was rejected as a monitoring tool for this project (T. Hames, pers. comm.).

Yakama Method

The Yakama method did not require direct measurement of field variables. Instead, Yakama wildlife department staff, with assistance from other participants, estimated model variable scores through group consensus during visits to representative sample sites in each management area and cover type (T. Hames and P. Ashley, pers. comm.). The parameter values for each species model were estimated species by species at each sample plot (HEP models and model stacking for each cover type followed Bich et al. [1991] as shown in Table 14). The estimated (ocular) habitat variable scores were used to calculate HEP model habitat suitability indices and associated habitat units (K. Raedeke and D. Raedeke 2000).

Delphi Method

The Delphi technique, developed to provide a quick, cost effective method to rate habitat quality, relied on verbal interpretation of HEP models, reference material, and professional experience to describe ideal and intermediate habitat conditions for individual wildlife species (K. Raedeke and D. Raedeke 2000). Similar to the Yakama method, the Delphi technique relied on ocular estimation of habitat quality. In contrast, this method provides a comprehensive model HSI score rather than ratings for individual HEP model variable suitability indices (SI).

HEP teams comprised of three to five individuals were assigned cover types/locations to sample. At each sample plot, the HEP team would review the word models for each species, discuss habitat conditions observed at the site, and then assign a HSI score. The HSI scores for each species were recorded on a data sheet that included all information that was to be recorded at each plot (see K. Raedeke and D. Raedeke 2000 for further detail).

Transect Method

In most cases, the Regional HEP team used measurement techniques and protocols described in HEP models to evaluate habitat variables; however, the Yakama Method was used when direct measurements could not be taken. Measured techniques were occasionally modified to meet unique habitat and/or physiographic conditions. Metrics generally followed those described by Hays et al. (1981) and/or Avery (1994).

Stratified (by cover type), random transects were established and documented using global positioning system (GPS) coordinates and, in many cases, rebar stakes. Ashley (2006) described the methods and protocols used by Regional HEP Team staff to collect HEP model variable data and additional floristic information (Appendix B). Collected field data was summarized and applied to HEP model variables to determine habitat suitability for each HEP species model and subsequent habitat units. Field data collection and processing procedures are illustrated in Figure 12 and summarized as follows.

HEP model variable field data was entered onto Allegro CE® data logger spreadsheets (1), or recorded on paper data sheets (2). The raw field data (3) was downloaded from the data loggers or manually entered from paper data sheets onto computers (transect photos were also downloaded and stored on field computers). The raw data and photos were compiled for each transect into three basic products/files (4) that are provided to project managers as report appendices and/or separate CD files.

Product files included raw field data downloaded from the data loggers (5), data summary spreadsheets (6) which are the results of compiling/processing the raw data, and transect photo files (7). Summarized/processed data from each transect was applied to appropriate HEP model variables to determine suitability index (SI) ratings that were combined on habitat suitability index (HSI) spreadsheets (8) to determine the HSI for a particular HEP species model/cover type. The habitat suitability index was then multiplied by the number of cover type acres to determine the number of habitat units (9).

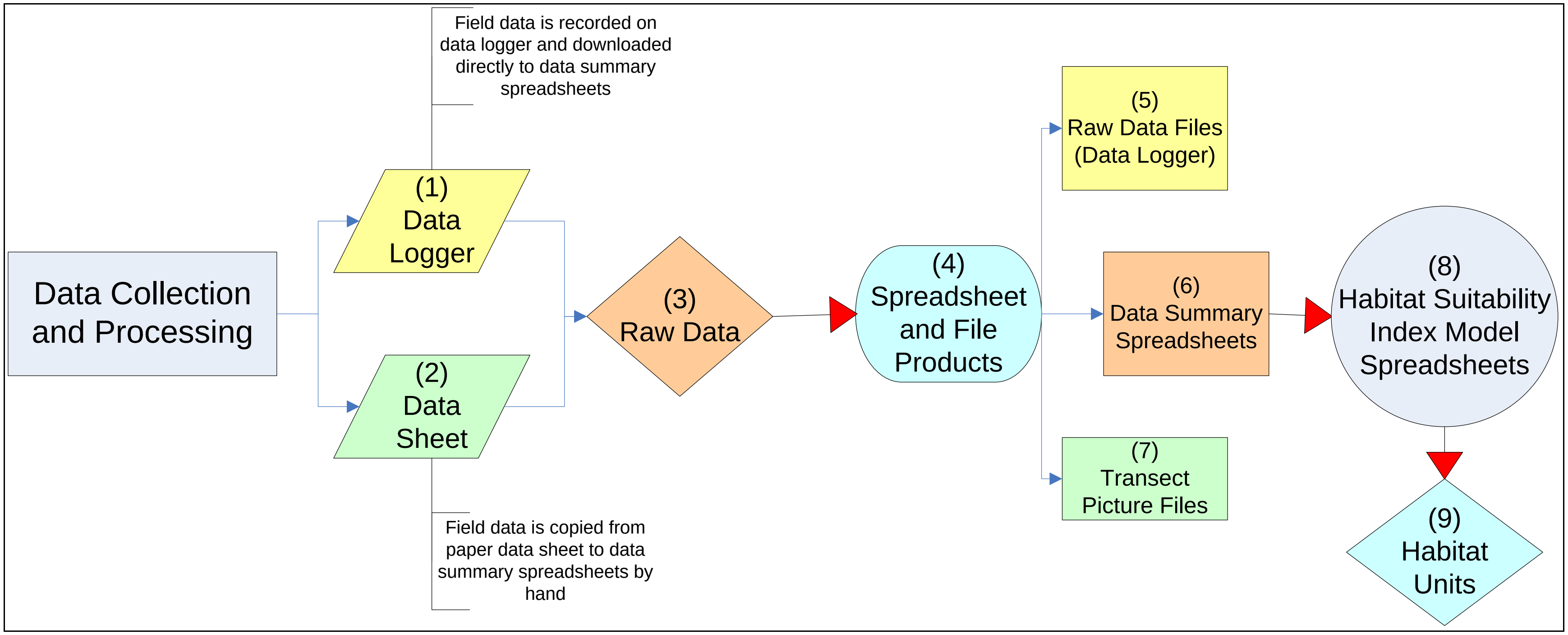


Figure 19. Transect method HEP data collection and processing flow chart.

Transect Locations

Transect locations were determined differently for each HEP method. The Yakama and Delphi techniques relied heavily on best professional judgment to select evaluation sites, whereas the Transect method relied on a proportional allocation strategy (Husch et al. 2003) to determine transect start points.

Specific transect point location coordinates are not available for transects established prior to 1999. Transect point coordinates were recorded in 1999 (Raedeke and Raedeke 2000) and documented for years 2002, 2003, 2004, 2005, and 2006 (P. Ashley, pers.comm.).

Yakama Method

Hames (pers. comm.) stated that the pre-project Yakama HEP (early 1990s) evaluations were designed to provide project managers and BPA with a sense of the habitat potential of the project area rather than a definitive number of habitat units to credit BPA. The following criteria were the key determinants in deciding where to locate evaluation plots.

1. Was a specific location representative of the cover type in question?
2. Was the site easily accessible?

HEP evaluators relied on their best professional judgment to locate evaluation sites and estimate habitat quality. Specific evaluation site locations are documented in YN Wildlife Department archives (T. Hames, pers. comm.).

Delphi Method

Raedeke and Raedeke (2000) indicated that prior to field sampling, HEP staff reviewed aerial photographs, cover type maps, and estimated numbers of samples needed for each area. They then marked candidate sample locations on both the aerial and cover type maps based primarily on whether sample plot locations were reasonably accessible by foot from access roads.

The number of samples in each cover type and in each management area was entered on a tally sheet at the end of each field day and candidate sample sites for the following day were then selected based on the anticipated size of the field crew. Sample site locations were numbered to correspond to latitude/longitude coordinates and are included in Raedeke and Raedeke (2000).

Transect Method

Transect initial points (IPs) were established based on stratified random sampling protocols with cover types defining the strata. In addition, the number of samples initially allocated per cover type strata were determined based on a proportional allocation strategy (Husch et al. 2003). Specific IP locations were identified by overlaying a 100m x 100m grid over cover types and selecting random numbers to identify “XY” point coordinates (P. Ashley, pers. comm.).

The proportional allocation strategy was modified in the field as needed to compensate for the relative homogeneity of a particular cover type, or to account for unanticipated access issues and/or physiographic restrictions. In addition, initial points were moved when they did not fall within the cover type(s) of interest, or were in inaccessible areas such as the middle of a pond or dense grove of Russian olive trees (additional transect information is located in Appendix B).

Transect UTM coordinates (NAD 27) for start, turn, and end points were recorded in the field on a Garmin IIIA ® GPS unit. IP/transect UTM coordinates, transect magnetic azimuths, transect length information is listed in Appendix C while transect coordinate maps from 2002 through 2006 are included in Attachment 1 (as with all other maps, transect coordinate maps were developed by Tom Elliot – Yakama Nation Wildlife Department).

Transect Photo Documentation

Transects were photographed in 2002, 2003, 2004, 2005, and 2006 with a Canon G1® 3.3 mega pixal digital camera (with and without magnification). Transect photographs recorded in 2003, 2004, 2005, and 2006 are included in Attachment 3 (2002 transect photographs were not available for inclusion into this document).

Photo Methods

Photo points were established at the start point of each transect to document extant habitat conditions. Digital photographs were recorded from a height of three feet at the beginning of each transect facing the same direction as the transect azimuth. A transect reference board (included transect number, project name, date, GPS reference number) was placed at the 15 foot interval while a cover board was placed at the 30 foot mark on each transect. Occasionally, panoramic photographs were also recorded e.g., dense vegetation, linear/narrow cover types. An example of a photo documentation point is illustrated in Figure 13.

Figure 20. Photo point example.

Results

From 1990 through 2006, acquisition/protection of 21,631.10 acres of wildlife habitat on the Yakama Reservation yielded 33,860.18 habitat units for a habitat unit to acre ratio of 1.57:1. Habitat unit gains resulting from the Yakama Nation's Wetlands and Riparian Restoration Project are summarized by target species for all four lower Columbia River Dams in Table 16 and for individual hydro projects in Table 17 through Table 20. Habitat unit gains for each applicable project year are located in Appendix D while mitigation site habitat units for each cover type are displayed in Appendix E.

Table 21. Combined habitat unit gains for McNary, John Day, The Dalles, and Bonneville Dams.

Project/Tract	YAKAMA NATION HABITAT UNIT GAINS FOR McNARY, JOHN DAY, THE DALLES, AND BONNEVILLE DAMS											Project Acres	HUs Per Acre
	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Downy Woodpecker	Total		
Total	7,325.55	2,549.98	656.43	165.33	12,838.77	1,150.82	2,995.20	5,034.51	171.86	971.73	33,860.18	21,631.10	1.57

Table 22. McNary Dam habitat unit gains.

Hydro Project	MCNARY HABITAT UNIT GAINS										
	Canada Goose	Mink	Downy Woodpecker	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total	Project Acres	HUs per Acre
McNary											
	6,613.58	1,502.88	971.73	9,292.93	849.90	969.10	4,081.26	164.10	24,445.48	12,123.30	2.02

Table 23. John Day Dam habitat unit gains.

Project/Tract	JOHN DAY HABITAT UNIT GAINS									Project Acres	HUs Per Acre
	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
John Day												
Total	711.97	890.79	500.77	151.90	3,545.84	300.92	2,026.10	953.25	7.76	9,089.30	9,507.80	0.95

Table 24. The Dalles Dam habitat unit gains.

Hydro Project	THE DALLES HABITAT UNIT GAINS								Project Acres[1]	HUs Per Acre[1]
	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Western Meadowlark	Spotted Sandpiper	Total		
The Dalles										
Total	0.00	140.66	146.60	0.00	0.00	0.00	0.00	287.26		#DIV/0!

Table 25. Bonneville Dam habitat unit gains.

Hydro Project	BONNEVILLE HABITAT UNITS GAINS	Project	HUs Per

	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Spotted Sandpiper	Total	Acres[1]	Acre[1]
Bonneville									
Total	**0.00**	**15.65**	**9.06**	**13.43**	**0.00**	**0.00**	**38.14**		

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Discussion

Acquiring/protecting wildlife habitat and determining the types and numbers of habitat units to credit BPA is a challenge for all mitigation project managers/entities. Although individual loss assessments provide the framework for mitigating habitat losses by listing specific cover types, HEP model species, and associated numbers of habitat units, acquired/protected wildlife mitigation sites seldom if ever exactly match the cover types and relative number/ratio of HUs described in specific loss assessments.

Although Yakama Nation wildlife biologists used the same HEP species models described in loss assessments for the lower four Columbia River dams, they did not select HEP models for individual projects or apply habitat unit stacking based on a specific hydro facility's loss assessment matrix as done elsewhere in the Columbia River Basin Region (P. Ashley, pers. comm.). Instead, YN wildlife biologists constructed composite HEP species lists for each cover type based on the HEP species identified in all four lower Columbia River loss assessments (T. Hames, pers. comm.).

For example, four different HEP species models were identified as target species to evaluate the riparian forest (riparian tree) cover type in the original loss assessments for the lower four Columbia River dams (Rasmussen and Wright 1990). Only one or two species models, however, were chosen to represent this cover type in any given hydro project loss assessment (review Tables 9 through 12).

Rather than use one or two species to evaluate the riparian forest cover type as described within individual loss assessments, Yakama Nation wildlife biologists selected all four target HEP model species and added a fifth model (blue heron) to evaluate the riparian forest cover type (Table 14). As a result, the number of habitat units initially reported to BPA was excessive relative to the amount required to meet habitat unit stacking described in specific hydro project loss assessments.

YN wildlife biologists also elected not to provide BPA input regarding how to distribute HU gains, generated on specific mitigation sites, against HU losses at individual dams (T. Hames, pers. comm.). BPA responded by applying all HU gains to individual lower Columbia River hydro projects using all HU data provided by Yakama Nation wildlife biologists (J. DeHerrera, pers. comm.).

Regional HEP Team staff was tasked with reconciling YN HEP survey data with how other state, federal, and tribal entities credited BPA for acquisition and protection of wildlife mitigation lands across the Columbia Basin. To accomplish this task in a consistent and equitable manner, RHT staff assigned each YN mitigation project site to a "primary"[36] hydro facility and credited HUs generated from that specific project site based on species "stacking" identified in the loss assessment of the assigned "primary" hydro facility. This resulted in a reduction in the number of

[36] A "primary" hydro facility refers to the specific hydro project and loss assessment used to guide habitat unit stacking for each mitigation project site.

species used to credit some individual cover types/mitigation sites while increasing the number of species applied to others (P. Ashley, pers. comm.).

HUs associated with cover types and/or HEP species models different from those identified in primary facility loss assessments were assigned to a "secondary" [37] credited facility (P. Ashley, pers. comm.). An example of how crediting was applied for each project year at primary and associated secondary hydro facilities is shown in Table 21 and Table 22 respectively.

[37] A "secondary" credited facility refers to the specific hydro project credited with HUs generated from cover types not included in the "primary" loss assessment.

Table 26. An example of habitat unit crediting at a "primary" hydro facility.

Hydro Project	Project/Tract	MCNARY HABITAT UNITS GAINS										
		Canada Goose	Mink	Downy Woodpecker	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total	Project Acres	HUs per Acre
McNary	**Yakama Nation**											
Year-1999	**Lower Satus**	2,564.00	140.10	168.00	3,440.00	91.00	338.00	1,859.75	15.00	**8,615.85**	**3,694.00**	**2.33**
	Mosebar Pond	211.00	74.90	28.00	325.00	21.00	27.00	103.50	0.00	**790.40**	**432.00**	**1.83**
	Satus	2,032.00	758.30	261.00	3,186.00	518.00	301.00	1,054.75	122.00	**8,233.05**	**4,474.00**	**1.84**
	Toppenish Creek	521.00	263.60	8.00	974.00	152.00	36.00	442.00	0.00	**2,396.60**	**1,236.00**	**1.94**
	Wanity Slough	305.00	25.80	0.00	350.00	15.00	41.00	156.75	0.00	**893.55**	**361.00**	**2.48**
	Wapato	349.00	56.10	104.00	499.00	26.00	68.00	213.50	21.00	**1,336.60**	**770.00**	**1.74**
	Zimmerman (S. Lat. A)	237.00	73.40	3.00	237.00	1.00	44.00	86.50	0.00	**681.90**	**434.00**	**1.57**
	North Satus	394.58	110.68	53.30	281.93	25.90	114.10	164.51	6.10	**1,151.10**	**722.30**	**1.59**
	Subtotal	**6,613.58**	**1,502.88**	**625.30**	**9,292.93**	**849.90**	**969.10**	**4,081.26**	**164.10**	**24,099.05**	**12,123.30**	**1.99**

Table 27. An example of HU crediting at an associated "secondary" hydro facility.

Hydro Project	Project/Tract	JOHN DAY HABITAT UNITS LOSSES/GAINS										Project Acres[1]	HUs Per Acre[1]
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	California Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
John Day	**Yakama Nation**												
Year - 1999	**Lower Satus**	0.00	0.00	0.00	21.00	0.00	0.00	0.00	0.00	0.00	**21.00**		**#DIV/0!**
	Satus	0.00	0.00	0.00	96.00	0.00	0.00	0.00	0.00	0.00	**96.00**		**#DIV/0!**
	Wapato	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	**15.00**		**#DIV/0!**
	North Satus	0.00	0.00	0.00	14.80	0.00	0.00	0.00	0.00	0.00	**14.80**		**#DIV/0!**
	Subtotal	**0.00**	**0.00**	**0.00**	**146.80**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**146.80**		

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Conclusion

To date, YN wildlife mitigation projects account for the largest share (72%) of habitat unit gains associated with lower Columbia River wildlife mitigation. The number of habitat unit gains credited against lower Columbia River dams by the Washington Department of Fish and Wildlife (WDFW), Umatilla Tribe, Steigerwald National Wildlife Refuge, and Yakama Nation are summarized in Table 23 and listed for individual hydro projects in Table 24 through Table 27.

Table 28. The number of habitat units credited against lower Columbia River dams.

Entity	WDFW	Umatilla Tribe	Steigerwald NWR	Yakama Nation	Total HUs
HUs	11,166.00	1,729.00	201.00	33,860.18	46,956.18
Percent	23.78%	3.68%	0.43%	72.11%	100.00%

While several HEP species identified in lower Columbia River hydro project loss assessments have not been fully mitigated, the total number of habitat units gained through BPA funded mitigation projects exceed the number lost by more than 2,500 habitat units (Table 28). As a result, BPA proposes that lower Columbia River wildlife mitigation (Washington State) is complete; due largely to the success of the Yakama Nation's wildlife mitigation program (J. DeHerrera, pers. comm.).

This report describes a consistent approach regarding the distribution and crediting of habitat units generated by Yakama Nation wildlife mitigation projects. Bonneville Power Administration and/or the Yakama Nation, however, could elect to develop/adopt another crediting method.

Although not specifically addressed in this report-by not resolving over/under crediting of individual species associated with lower Columbia River hydro projects (Table 28), the Yakama Nation and other wildlife management entities could lose opportunities to acquire/protect additional critical habitat. The following six suggestions could be used as listed or combined to possibly resolve crediting issues relative to lower Columbia River wildlife mitigation and elsewhere if adopted:

1. Leave as is - do nothing.
2. Apply lower Columbia River habitat unit overages against lower Columbia River non-mitigated HUs i.e., the "HU is a HU" concept.
3. Apply over-mitigated HUs against undefined "operational" losses.
4. Credit a portion of lower Columbia River HU gains against Lower Snake River losses.
5. Credit Washington State lower Columbia River HU gains against Oregon State lower Columbia River HU losses. This precedent has already been established. Habitat unit gains have already been moved from one area to another and/or credited across state boundaries e. g., credited out of state/off reservation (Umatilla Tribe's Rainwater Project), credited beyond ceded boundaries (Burns-Paiute Tribe's Denny Jones Project), credited beyond sub-basin/hydro project boundaries (WDFW's Schlee acquisition and Oregon Willamette Valley mitigation sites).

6. Mitigation Banking – Rather than lose opportunities to acquire/protect valuable wildlife habitat because of crediting issues, BPA could elect to deposit habitat units resulting from over-mitigation, out of kind HUs, etc., into a mitigation bank for future mitigation. These habitat units could be utilized to offset habitat losses resulting from hydro facility operations, wind power generation, and power-line transmission corridors. This would allow, *through coordination with BPA, wildlife managers, and the Council*, project proponents to acquire/protect critical core habitats, key habitat links, etc., as opportunities arise without being stymied by crediting issues.

Table 29. Habitat unit summary for McNary Dam[38].

Project/Tract	McNARY HABITAT UNITS LOSSES/GAINS								
	Canada Goose	Mink	Downy Woodpecker	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total
	2,787.00	1,000.00	301.00	5,051.00	263.00	2,775.00	5,567.00	1,090.00	18,834.00
WDFW									
Desert WA	0.00	0.00	0.00	0.00	0.00	155.00	388.00	0.00	543.00
Sunnyside WA	106.00	411.00	88.00	687.00	125.00	576.00	603.00	0.00	2,596.00
Wenas WA	0.00	17.00	0.00	2,000.00	0.00	400.00	0.00	0.00	2,417.00
Umatilla Tribe									
Rainwater Ranch	0.00	447.00	1,100.00	0.00	28.00	154.00	0.00	0.00	1,729.00
Remaining HUs	2,681.00	125.00	(887.00)	2,364.00	110.00	1,490.00	4,576.00	1,090.00	11,549.00
Yakama Nation	6,613.58	1,502.88	971.73	9,292.93	849.90	969.10	4,081.26	164.10	24,445.48
Remaining HUs	(3,932.58)	(1,377.88)	(1,858.73)	(6,928.93)	(739.90)	520.90	494.74	925.90	(12,896.48)

Table 30. Habitat unit summary for John Day Dam[8].

Project/Tract	JOHN DAY HABITAT UNITS LOSSES/GAINS									
	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total

[38] Bracketed numbers in red font indicate the number of habitat unit gains that exceed HU losses.

	4,005.00	**719.00**	**435.00**	**1,593.00**	**3,162.00**	**543.00**	**2,530.00**	**3,700.00**	**1,593.00**	**18,280.00**
WDFW										
Desert WA	0.00	193.00	0.00	0.00	0.00	0.00	0.00	224.00	0.00	**417.00**
Sunnyside WA	0.00	0.00	48.00	120.00	0.00	117.00	0.00	0.00	0.00	**285.00**
Shillapoo WA	52.00	0.00	5.00	0.00	0.00	11.00	116.00	279.00	0.00	**463.00**
Wenas	0.00	84.00	189.00	0.00	1,400.00	0.00	1,000.00	0.00	0.00	**2,673.00**
Remaining HUs	**3,953.00**	**442.00**	**193.00**	**1,473.00**	**1,762.00**	**415.00**	**1,414.00**	**3,197.00**	**1,593.00**	**14,442.00**
Yakama Nation	**711.97**	**890.79**	**500.77**	**151.9**	**3,545.84**	**300.92**	**2,026.10**	**953.25**	**7.76**	**9,089.30**
Remaining HUs	**3,241.03**	**(448.79)**	**(307.77)**	**1,321.10**	**(1,783.84)**	**114.08**	**(612.10)**	**2,243.75**	**1,585.24**	**5,352.70**

Table 31. Habitat unit summary for The Dalles Dam[8].

Project/Tract	THE DALLES HABITAT UNITS LOSSES/GAINS							
	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Western Meadowlark	Spotted Sandpiper	Total
	220.00	**165.00**	**91.00**	**213.00**	**85.00**	**124.00**	**267.00**	**1,165.00**
WDFW								
Desert WA	0.00	33.00	0.00	0.00	0.00	0.00	0.00	**33.00**
Shillapoo WA	103.00	1.00	13.00	0.00	40.00	58.00	0.00	**215.00**
Remaining HUs	**117.00**	**131.00**	**78.00**	**213.00**	**45.00**	**66.00**	**267.00**	**917.00**
Yakama Nation	**0.00**	**140.66**	**146.60**	**0.00**	**0.00**	**0.00**	**0.00**	**287.26**
Remaining HUs	**117.00**	**(9.66)**	**(68.60)**	**213.00**	**45.00**	**66.00**	**267.00**	**629.74**

Table 32. Habitat unit summary for Bonneville Dam.

Project/Tract	BONNEVILLE HABITAT UNITS LOSSES/GAINS					
	Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Spotted Sandpiper	Total
	1,222.00	**811.00**	**511.00**	**2,150.00**	**82.00**	**1,383.00**	**6,159.00**
Steigerwald NWR							

Bliss	1.00	1.00	5.00	1.00	0.00	0.00	8.00
Burlington Northern	3.00	2.00	7.00	6.00	0.00	0.00	18.00
James	17.00	3.00	3.00	33.00	0.00	0.00	56.00
Straub	33.00	7.00	12.00	66.00	1.00	0.00	119.00
WDFW							
Shillapoo	574.00	381.00	240.00	290.00	39.00	0.00	1,524.00
Remaining HUs	**595.00**	**418.00**	**249.00**	**1,755.00**	**42.00**	**1,383.00**	**4,442.00**
Yakama Nation	**0.00**	**15.65**	**9.06**	**13.43**	**0.00**	**0.00**	**38.14**
Remaining HUs	**595.00**	**402.35**	**239.94**	**1,741.57**	**42.00**	**1,383.00**	**4,403.86**

Table 33. HEP species models and number of habitat units credited against McNary, John Day, The Dalles, and Bonneville Dams[8].

LOWER COLUMBIA HABITAT UNIT LOSS/GAIN SUMMARY											
HEP Species	**Canada Goose**	**Mink**	**B.C. Chickadee**	**G.B. Heron**	**Cal. Quail**	**Yellow Warbler**	**Western Meadowlark**	**Mallard**	**Spotted Sandpiper**	**Downy Woodpecker**	**Total**
Remaining HUs	**20.45**	**(1,433.98)**	**(136.43)**	**3,275.67**	**(8,712.77)**	**(538.82)**	**(25.20)**	**2,738.49**	**4,161.14**	**(1,858.73)**	**(2,510.18)**

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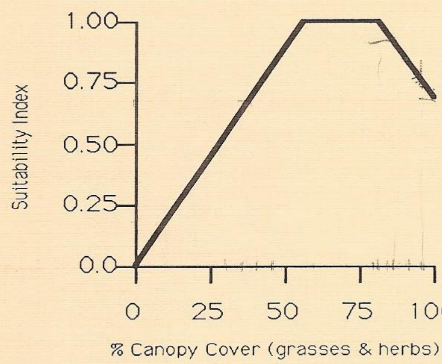
Appendix A – HEP Models

California quail model

Species:	CALIFORNIA QUAIL
Model:	U.S. Fish & Wildl. Serv. 1978
Cover Types:	Riparian Shrub, Agricultural, Shrub-steppe Grassland, Riparian Herb

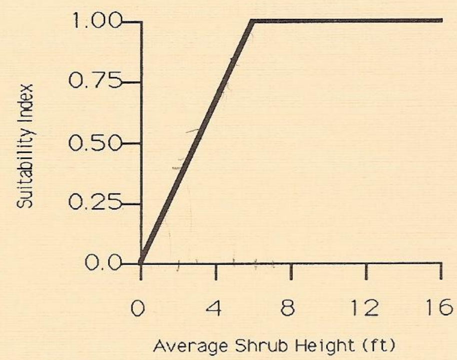
Variable 1: % Canopy cover of grasses and herbs



V1 Field Values

0%	=	0.0
1-20%	=	0.2
21-40%	=	0.6
41-90%	=	1.0
91-100%	=	0.8

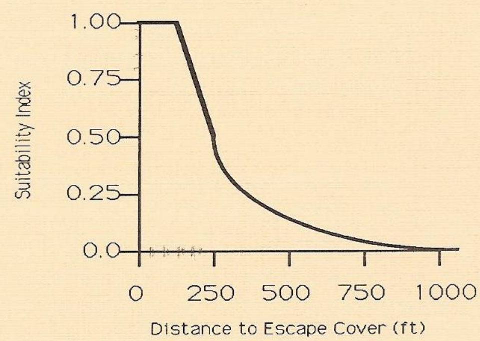
Variable 2: Average shrub height (ft)



V2 Field Values

0 ft	=	0.0
1-2 ft	=	0.2
3-4 ft	=	0.5
5-6 ft	=	0.9
≥ 7 ft	=	1.0

Variable 3: Distance to escape cover (ft) (escape cover = dense vegetation, > 8" high)

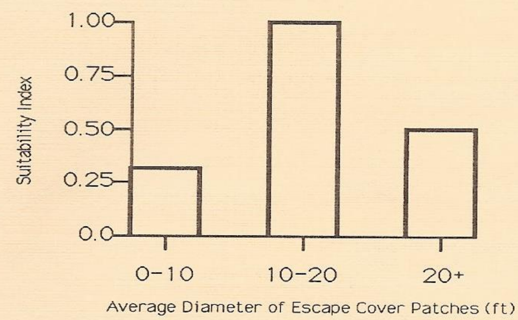


V3 Field Values

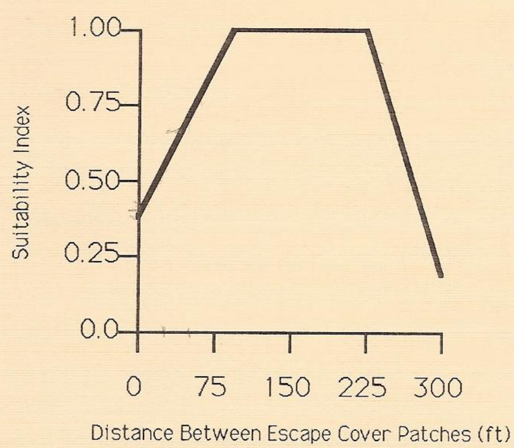
≤ 100 ft	=	1.0
101-180 ft	=	0.8
181-300 ft	=	0.5
301-500 ft	=	0.3
501-874 ft	=	0.1
≥875 ft	=	0.0

48

Variable 4: Average diameter of escape cover patches (ft)



Variable 5: Distance between escape cover patches (ft)



V5 Field Values

< 30 ft	=	0.4
31-90 ft	=	.75
91-200 ft	=	1.0
201-300 ft	=	0.6
> 300 ft	=	0.1

49

$$\text{Quail HSI} = \frac{V1 + V2 + (V3 \times V4 \times V5)^{1/3}}{3}$$

Notes: All variables were estimated at the field sampling sites using the field scales.

Canada goose model

Species: CANADA GOOSE
Model: De Waard 1990
Cover type: Sand/Gravel/Cobble/Mud, Agricultural, SS Grassland, Riparian Herb, Lacustrine.

Variable 1:	Mature riparian forest adjacent to river, snags, etc.	=	1.0
	Mature trees in limited supply, few snags	=	0.5
	Few mature trees	=	0.2
Variable 3:	Brood areas		
	Short grass, easy access <1 mile from nesting	=	1.0
	Short grass access restricted or 1-2 miles from nesting	=	0.5
	Brood areas not apparent or >2 miles from nesting areas	=	0.2
Variable 4:	Human disturbance > 1/2 mile away	=	1.0
	Human disturbance 1/4 - 1/2 mile away	=	0.5
	Human disturbance < 1/4 mile away	=	0.1

Canada Goose HSI = $[V1 \times (V3 + V4)/2]^{1/2}$

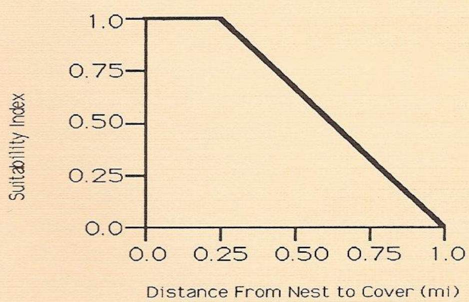
Notes: Nesting goose HUs lost through inundation by the Lower Columbia River Project were primarily associated with the mainstem Columbia island cover type. Due to the breadth of the Columbia channel and the distance from main shoreline to island shorelines, these islands offered isolation from nest predators. The size of the Columbia is unique within the Northwest; along the Yakima River, as well as most other regional streams, islands do not provide the same isolation from predators as was typical of the Columbia. Smaller islands in most regional streams also make them more prone to flooding during spring runoff, substantially reducing their value to ground nesting birds. Therefore, other local cover types provide the bulk of nesting goose habitat along the smaller order streams. Along the Yakima River, riparian forest communities provide the best, most secure habitat for nesting Canada geese. To reflect this, the goose model was modified to provide estimates of the HUs available for nesting geese in the local project area. Canada geese were selected in the loss assessment due to their regional significance, not due to the importance of islands per se.

Human disturbance was considered any disturbance associated with human presence. These disturbances included livestock, pets, machinery, traffic, etc.

Mallard model

Species: MALLARD
Model: Rasmussen and Wright, 1990b,d
Cover Type: Emergent Wetland, Agricultural, SS Grassland, Riparian Herb, Riverine, Lacustrine.

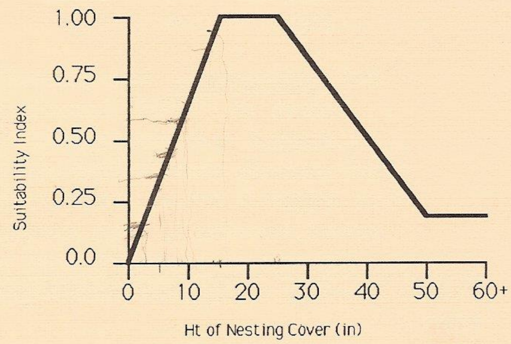
Variable 3: Distance between nest & water with emergent cover (miles)



V3 Field Values

< 0.25 mi	=	1.0
0.25-0.75 mi	=	0.5
> 0.75 mi	=	0.1

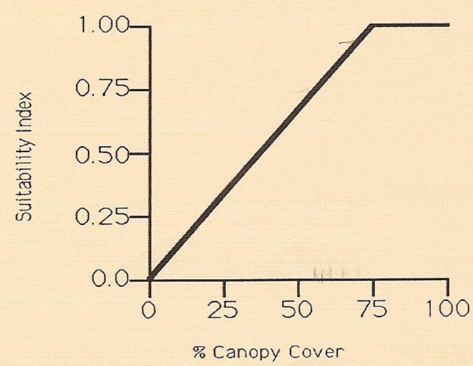
Variable 4: Height of residual nesting cover (inches)



V4 Field Values

0 in	=	0.0
1-15 in	=	0.5
16 - 24 in	=	1.0
25-48 in	=	0.6
> 48 in	=	0.3

Variable 5: % Canopy cover of nesting vegetation



V5 Field Values

<50%	=	0.3
51-75%	=	0.7
>75	=	1.0

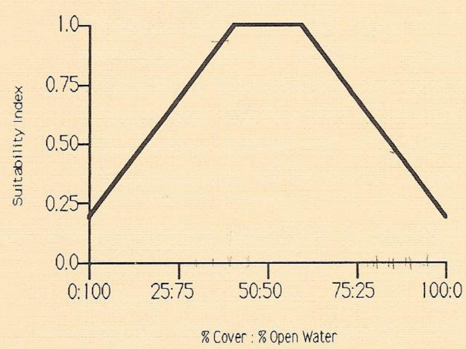
Variable 6: Human disturbance

None	=	0.8-1.0
Moderate	=	0.4-0.7
High	=	0-0.3

V6 Field Values

None	=	1.0
Moderate	=	0.5
High	=	0.2

Variable 7: Ratio of vegetative cover to open water



V7 Field Values

<40:60	=	0.5
40:60-60:40	=	1.0
>60:40	=	0.5

In emergent wetlands:
Mallard HSI = V7

In other cover types:
Mallard HSI = (V3 + V4 + V5)/3 X V6

Notes: All variables were estimated at the field sampling sites using the field scales.

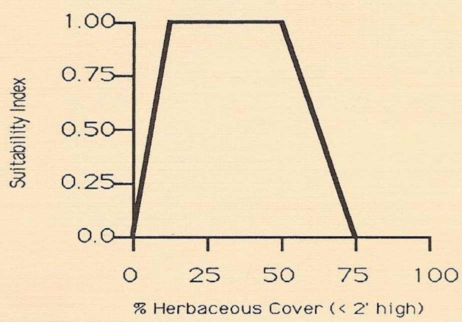
The mallard model was applied in the field considering estimated vegetative conditions on April 1, the approximate date of mallard nest initiation.

Human disturbance included any disturbance associated with human presence, such as livestock, pets, machinery, and traffic.

Spotted sandpiper model

Species: SPOTTED SANDPIPER
Model: Dorsey 1990
Cover Type: Sand/Gravel/Cobble/Mud

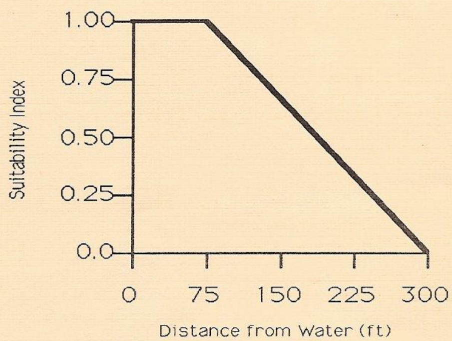
Variable 1: % Canopy cover of herbaceous plants < 2' high



V1 Field Values

< 10%	=	0.5
11-50%	=	1.0
51-75%	=	0.5
>75%	=	0.0

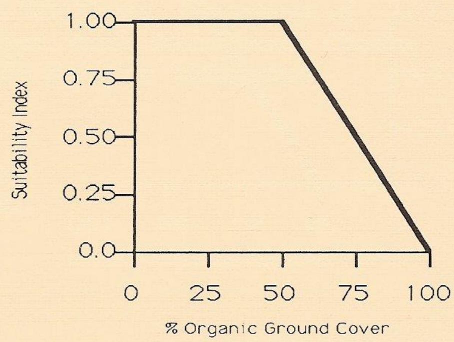
Variable 2: Minimum distance from water to nesting habitat (ft)



V2 Field Values

≤75 ft	=	1.0
76-150 ft	=	0.8
151-300 ft	=	0.3
> 300 ft	=	0.0

Variable 3: % Organic ground cover (debris or drift) within 150 ft of water's edge



V3 Field Values

≤50%	=	1.0
51-75%	=	0.7
76-100%	=	0.3

Spotted Sandpiper HSI $= \frac{V1 + V2 + V3}{3}$

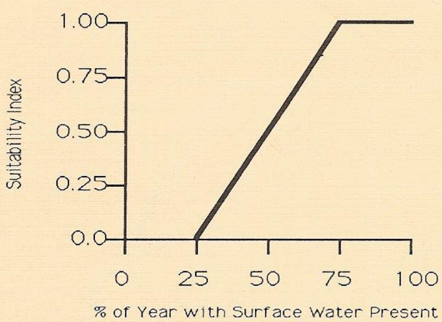
Notes: All variables were estimated at the field sampling sites using the field scales.

53

Mink model

Species: MINK
Model: Allen 1986
Cover Type: Riverine, Emergent Wetlands, Riparian Forest, Riparian Shrub, Sand/Gravel/Cobble/Mud

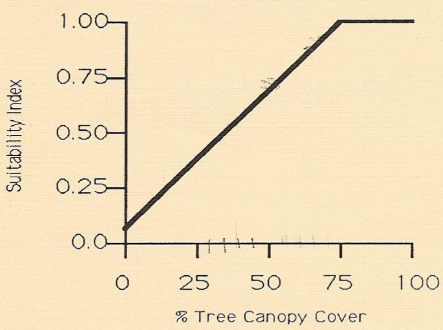
Variable 1: % of year w/surface water present



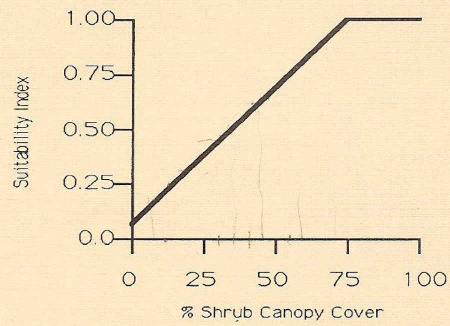
V1 Field Values

0-25%	=	0.0
26-50%	=	0.25
51-75%	=	0.75
> 75%	=	1.0

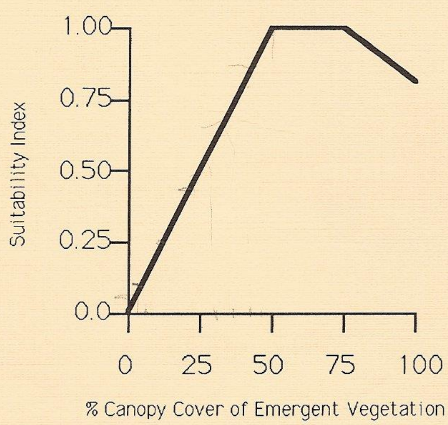
Variable 2: % Tree canopy cover



Variable 3: % Shrub canopy cover



Variable 4: % Canopy cover of emergent vegetation

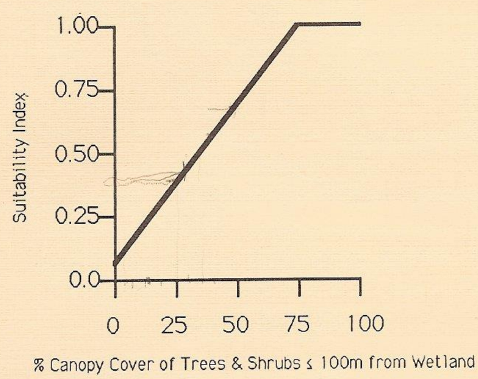


V4 Field Values

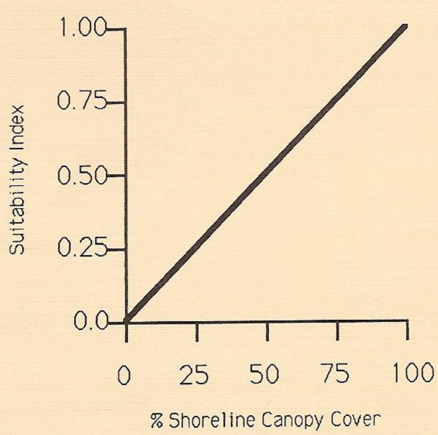
0%	=	0.00
1-25%	=	0.25
26-50%	=	0.75
51-75%	=	1.00
76-100%	=	0.90

54

Variable 5: % Canopy cover of trees and shrubs within 100m of wetland edge



Variable 6: % Canopy cover along shoreline



<u>V6 Field Values</u>

0%	=	0.00
1-20%	=	0.10
21-50%	=	0.35
51-80%	=	0.65
81-99%	=	0.90
100%	=	1.00

In Riparian Forest and Riparian Shrub:

Water SI = V1

Cover SI $= \frac{\text{MIN}(1.0; V2 + V3 + V4) + V5}{2}$

$= \frac{1.0: (V2 + V3 + V4) + V5}{2}$

In Emergent Wetlands:

Water SI = V1

Cover SI $= \frac{(4 \times V4) + V5}{5}$

In Riverine and Sand/Gravel/Cobble/Mud Shoreline:

Water SI = V1

Cover SI $= (V5 \times V6)^{1/2}$

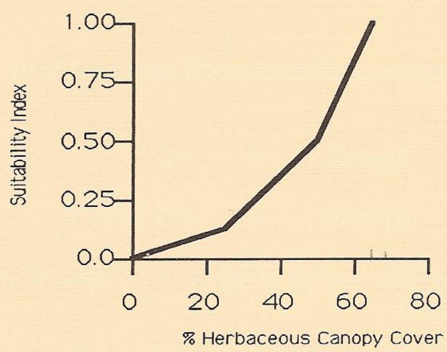
Mink HSI = Lowest Value for either Water SI or Cover SI.

Notes: Variables 2, 3, 5 were estimated from 1:20,000 color aerial photographs using the continuous variable functions; all other variables estimated at the field sampling sites using the field scales.

Western meadowlark model

Species:	WESTERN MEADOWLARK
Model:	modified from Schroeder and Sousa 1982
Cover Type:	Shrub-Steppe Grassland/Pasture

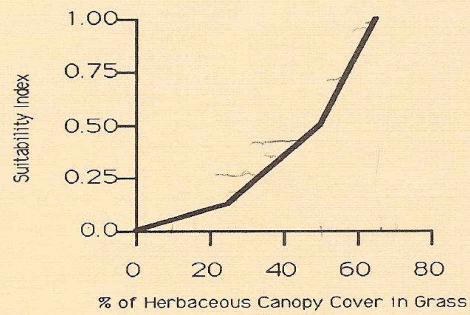
Variable 1: % Canopy cover of herbaceous plants



V1 Field Values

0%	=	0.0
1-30%	=	0.1
31-50%	=	0.3
51-64%	=	0.8
≥ 65%	=	1.0

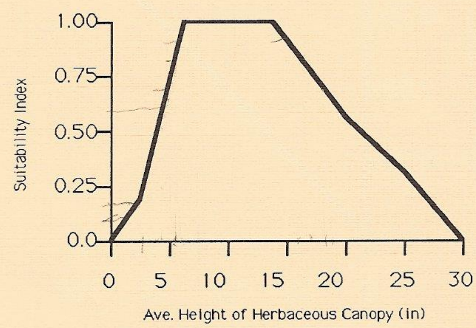
Variable 2: % of herbaceous canopy cover composed of grass.



V2 Field Values

0%	=	0.0
1-30%	=	0.1
31-50%	=	0.3
51-64%	=	0.8
>65%	=	1.0

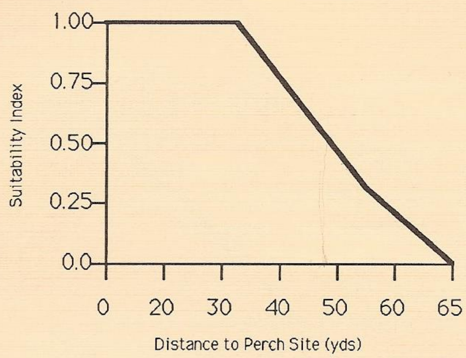
Variable 3: Average height of herbaceous canopy (inches)



V3 Field Values

0"	=	0.0
1-3"	=	0.2
4-6"	=	0.8
7-13"	=	1.0
14-20"	=	0.8
21-29"	=	0.3
> 29"	=	0.0

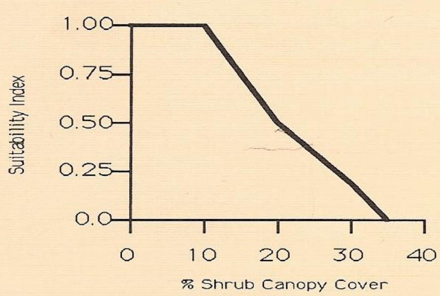
Variable 4: Distance to perch site (yds) (see notes below).



V4 Field Values

if shrub steppe	=	1.0
if idle field	=	1.0
if fenced pasture	=	1.0
if unfenced pasture (no weeds or shrub)	=	0.2

Variable 5: % Shrub canopy cover



V5 Field Values

0-10%	=	1.0
11-20%	=	0.7
21-34%	=	0.2
≥35%	=	0.0

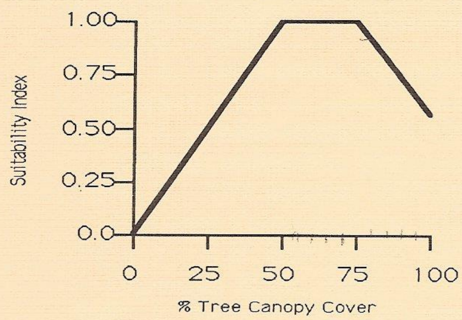
Meadowlark HSI = $(V1 \times V2 \times V3 \times V4)^{1/2} \times V5$

Notes: All variables were estimated at the field sampling sites using the field scales. For variable 4, it was assumed that where there are shrubs, erect woody forbs, or fences, perch sites would not be limited. In unfenced pastures where shrubs and erect forbs were absent, perch sites for western meadowlarks were assumed to be limited.

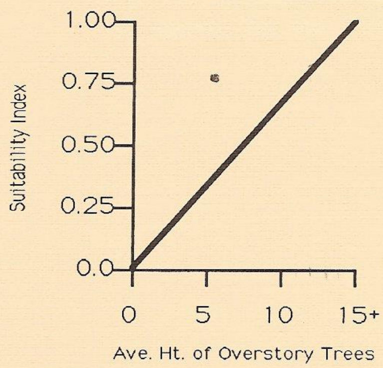
Black-capped chickadee model

Species: <u>BLACK-CAPPED CHICKADEE</u>
Model: Schroeder 1983a
Cover Types: Riparian Forest

Variable 1: % Tree canopy cover



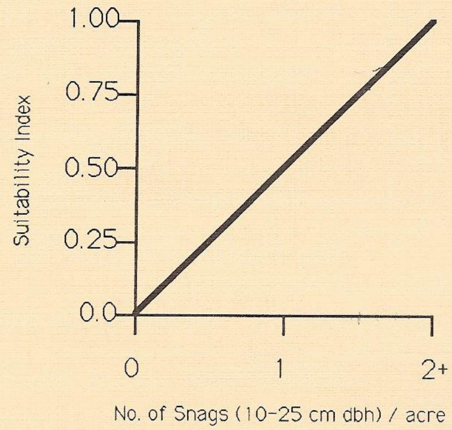
Variable 2: Average height of overstory trees (m)



<u>V2 Field Values</u>

0 feet	=	0.0
1-20 feet	=	0.2
21-50 feet	=	0.7
>50 feet	=	1.0

Variable 3: Number of snags 10-25 cm dbh per acre



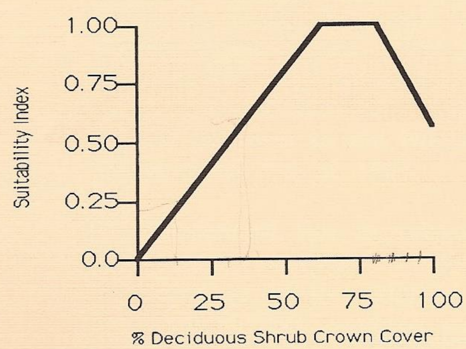
Chickadee HSI = Lowest individual SI value

Notes: Variable 1 was estimated from 1:20,000 color aerial photographs using the continuous variable function. For variable 3, field observations indicated snags were abundant (>2/acre) in the riparian forest cover type; therefore, it was assumed this variable would attain an SI = 1.0 throughout the study area.

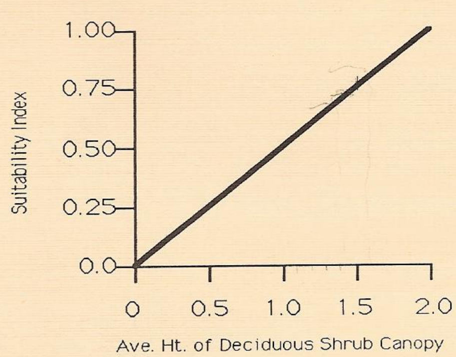
Yellow warbler model

Species: YELLOW WARBLER
Model: Schroeder 1982
Cover Type: Riparian Shrub

Variable 1: % Deciduous shrub crown cover



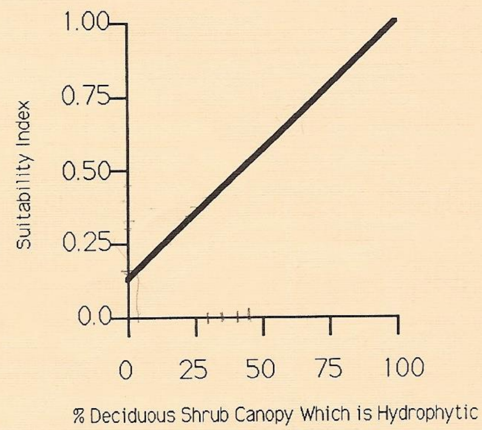
Variable 2: Average height of deciduous shrub canopy



V2 Field Values

<1.0 m	=	0.25
1.0 - 2.0 m	=	0.50
>2.0 m	=	1.00

Variable 3: % Deciduous shrub canopy comprised of hydrophytic shrubs



Warbler HSI = $(V1 \times V2 \times V3)^{1/3}$

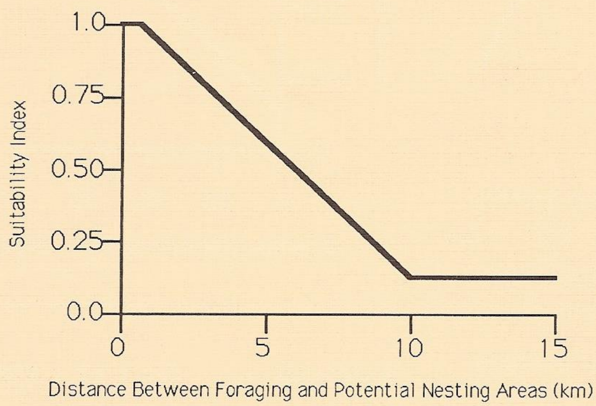
Notes: Variable 1 was estimated from 1:20,000 color aerial photographs using the continuous variable function. For variable 3, field observations indicated that all shrubs associated with the riparian corridors were hydrophytic in the proposed project area; therefore, V3 = 1.0.

59

Great blue heron model

Species: <u>GREAT BLUE HERON</u>
Model: Short and Cooper 1985.
Cover Type: Riparian Forest, Sand/Gravel/Cobble/Mud, SS Grassland, Riverine, Lacustrine.

Variable 1: Distance from feeding area to potential nesting area (km)



Variable 2: Foraging habitat quality

Shallow, clear water with firm substrate and forage fish	=	1.0
Wet pasture (see notes below)	=	0.5
Quality foraging conditions absent or scarce	=	0.0

Variable 3: Human disturbance level near potential foraging zone

No frequent human disturbance within 100m (or foraging zone ≥ 50m from low-use road)	=	1.0
Frequent disturbance within 100m	=	0.0

Variable 4: Availability of potential nesting areas

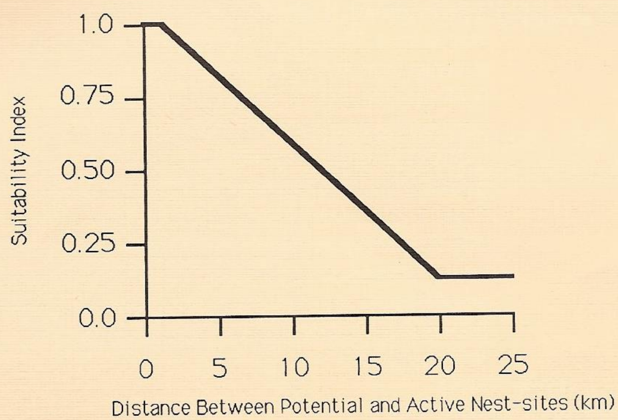
Trees ≥5m with an open canopy located ≤ 250m from water	=	1.0
Quality nesting conditions absent or scarce	=	0.0

Variable 5: Disturbance level in vicinity of potential nesting areas

Low disturbance within 250m on land or 150m on water	=	1.0
Disturbance sources within 250m on land or 150m on water	=	0.0

60

Variable 6: Distance between potential nest site and nearest active nest site



Heron HSI (Riparian Forest) = $(V1 \times V2 \times V3 \times V4 \times V5 \times V6)^{1/2}$

Heron HSI (all other cover types) = $(V1 \times V2 \times V3)$

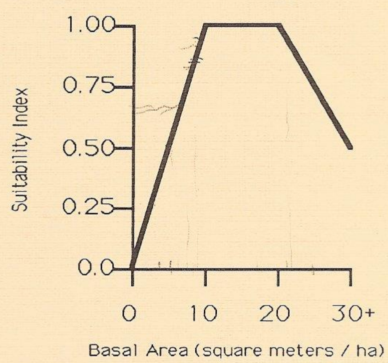
Notes: All variables estimated from 1:20,000 color aerial photographs. The continuous variable function was used for variable 1. Modification of variable 2 reflected some foraging value associated with wet pastures. Observations indicated herons foraged locally in wet pastures, apparently consuming small mammals, snakes, frogs, and possibly some invertebrates.

Human disturbance was considered any disturbance associated with human presence. These disturbances included livestock, pets, machinery, traffic, etc.

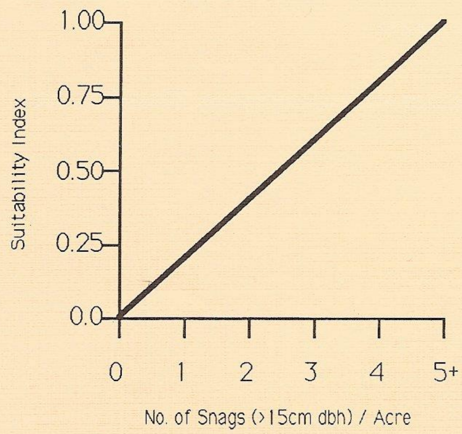
Downy woodpecker model

Species: DOWNY WOODPECKER
Model: Schroeder 1983b
Cover Type: Riparian Forest

Variable 1: Tree basal area



Variable 2: Number of snags >15 cm dbh / acre



Downy Woodpecker HSI = Lowest individual SI

Notes: In riparian forests associated with the Yakima River, it was assumed that basal area was at least 10m²/ha; therefore, V1 was assumed to range from 0.5 to 1.0; an average value of 0.75 was assigned to V1 to represent project area-wide conditions. Field reconnaissance indicated that these riparian forests also contained at least 4 snags/acre, yielding a V2 SI = 0.8-1.0. Because the model defined the overall HSI for downy woodpeckers as equal to the lowest individual variable SI, the HSI for downy woodpeckers was conservatively estimated to be 0.75 throughout the riparian forests of the Yakima River.

62

Appendix B – RHT Sampling Protocols

HABITAT EVALUATION PROCEDURES

STANDARD MEASUREMENT PROTOCOLS AND TECHNIQUES (Draft)

Compiled By
Paul R Ashley – RHT Coordinator
November 2006

Table of Contents

HEP Sampling Design and Measurement Protocols

Introduction

This document was developed to fulfill a request by the Upper Columbia United Tribes (UCUT) and Bonneville Power Administration (BPA) to develop a "stand alone" reference for Habitat Evaluation Procedures (HEP) transect protocols used by the Regional HEP Team (RHT). General and specific protocols are described. General protocols include a brief description of pre HEP survey pilot studies; transect establishment guidelines, and photo documentation parameters. In contrast, specific metrics detail actual habitat variable measurement techniques including diagrams where additional explanation is needed.

Specific metrics are identified with an alpha-numeric code. This allows project managers and others to identify specific measurement techniques in report tables without lengthy, redundant explanations. This report is intended to be a "living" document and will be modified as needed. The following standardized protocols and measurement techniques are used by the Regional HEP team to measure habitat variables described in HEP models.

General Protocols

Pilot Studies

Pilot studies are conducted in new habitat types and/or familiar habitat types that are comprised of unique structural conditions/key ecological correlates. Pilot study data is used to estimate the sample size needed for a confidence level ≥ 80% with a 10% tolerable error level (Avery 1994) and to determine the most appropriate sampling unit[39] for the habitat variable of interest i.e., a coefficient of variation analysis (BLM 1998). In addition, a power analysis is conducted on pilot study data (and periodically throughout data collection) to ensure that sample sizes are sufficient to identify a minimal detectable change of 20% in the variable of interest with a Type I error rate ≤0.10 and P = 0.9 (BLM 1998, Block et al. 2001). All field data is recorded on data loggers or data sheets and downloaded/transferred to data summary spreadsheets.

Transects

Transect cover sheets are used to document specific transect information including transect identification, cover type, HEP Team members, global positioning system (GPS) coordinates, and other pertinent information.
Transects are established at least 300 feet (100 meters), where possible, from ecotones, roads, and other anthropogenic influences. Transect starting points and azimuths (direction) are randomly selected for each cover type. Start points are selected based on superimposing a UTM grid over cover type maps and identifying specific X/Y

[39] Includes micro-plot grid size and shape etc.

coordinates with the aid of a random numbers table, or computer generated random number generator/point locater program.
Transect start, turn, and end points are marked with 14-inch (36 centimeter) 0.25 inch (0.6 centimeter) diameter rebar stakes[40] painted fluorescent orange or red. GPS positions (UTM coordinates-NAD 27) are recorded at start, turn, and end points. If cover types change or transect length is greater than 300 feet, another transect azimuth is randomly selected, or the original azimuth is varied by 45 degrees (direction [left or right] is determined by the flip of a coin where more than one choice is possible). Compass azimuths (headings) are magnetic bearings i.e., not corrected for local declination. Transects are divided into 100 foot (30 meter) sample units for statistical purposes.

Photo Points

Photo points are established at the start point of each transect. Pictures are recorded from a height of three feet at the beginning of each transect while facing in the direction of the transect azimuth. A transect reference board (includes transect number, project name, date, GPS reference number) is placed at the 15 foot interval while a cover board is placed at the 30 foot mark on each transect. Occasionally, panoramic photographs are also needed e.g., dense vegetation, linear/narrow cover types. Habitat conditions are photographed with a Canon G1® 3.3 mega pixal digital camera (with and without magnification).

Specific Metrics

Metrics generally follow those described by Hays et al. (1981) and/or Avery (1994) unless otherwise noted. Some metrics have been modified due to extreme field conditions and/or to better meet Regional HEP Team needs.

Herbaceous Measurements

Percent Cover

1. Herbaceous percent cover measurements are recorded at 20 or 25-foot intervals on the right side of the transect tape (the right side is determined by standing at 0 feet and facing the line of travel/transect azimuth). RHT members walk on the left side of the transect line to reduce sample disturbance.
A square $0.1m^2$ micro-plot grid is used in grasslands to estimate percent cover of herbaceous vegetation while a rectangular $0.5m^2$ grid is generally used in shrublands (the $0.5m^2$ grid may also be used in grasslands if desired). The near right hand corner of the grid is placed at the sampling interval (rectangle grids are placed with the long axis perpendicular to the tape, and the lower right corner on the sampling interval). An example of micro-plot grid placement is shown in Figure 1. Approximately 20% of the micro plot is covered by vegetation in the example. Grid samples are considered independent samples for statistical purposes.
    1A: $0.1m^2$ micro-plot grid/20' interval

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[40] Marking transect points with rebar stakes is at the discretion of the project proponent. Therefore, not all transects are marked in this manner.

1B: 0.1m^2 micro-plot grid/25' interval
1C: 0.5m^2 micro-plot grid/20' interval
1D: 0.5m^2 micro-plot grid/25' interval

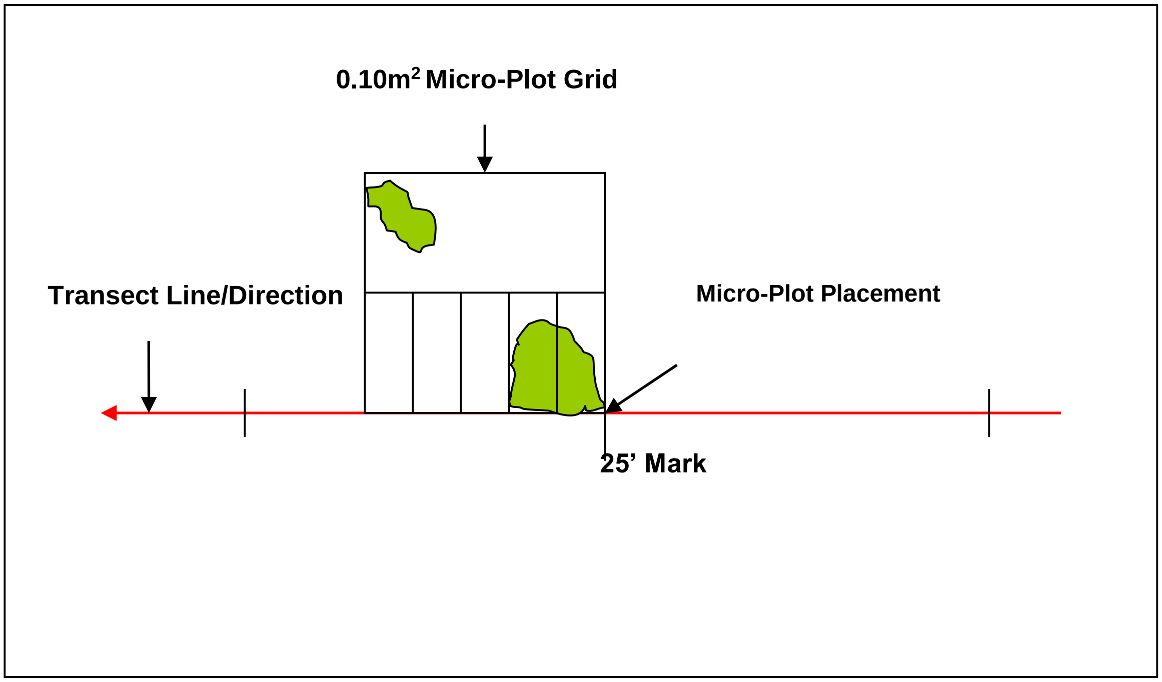

Figure 1. Micro-plot grid placement and percent cover example.

Height

2. Herbaceous height is measured with a measuring rod placed within the grid frame (scale = 10ths/ft.). Three evenly spaced measurements are recorded and averaged for each sample. Only leaf material is measured (leaves provide the greatest amount of cover). "Leaf material" may include residual cover and/or new growth predicated on HEP model variable requirements. <u>Grass inflorescence is not included in height measurements.</u>

2A. Four measurements, one from each corner of the micro plot grid, are recorded and averaged for each sample. Only leaf material is measured (leaves provide the greatest amount of cover). Grass inflorescence is not included in height measurements.

2B. A measuring rod is held vertical at the interval point: the highest vegetation to cross the measuring rod at that point is measured to the nearest tenth of a foot.

2B-1: 10' interval
2B-2: 20' interval
2B-3: 25' interval

Visual Obstruction Readings (VOR)

3. A Robel pole (Robel 1975) is used to document vertical and/or horizontal cover for herbaceous vegetation i.e., visual obstruction readings (VOR). Measurements are recorded at 20, 25, or 50-foot intervals. Intervals are determined by the length

of each transect, i.e., a minimum of 12 measurements are required for each transect, or cover type heterogeneity (structurally diverse cover types generally require larger sample sizes).

The Robel pole (Robel 1975) is placed on the transect line at the appropriate interval. Four observations are taken from a distance of four meters from the Robel pole and averaged to obtain a single visual obstruction reading or VOR. Observers sight over a one meter pole and record how much of the Robel pole is totally obscured from the ground up (Figure 2). Measurements are reported in 0.25 decimeter increments.

Two measurements are taken on the transect line on opposite sides of the Robel pole; two identical measurements are taken from the same point perpendicular to the transect line for a total of four "readings" (Figure 3). Sample size is determined to be adequate when the "running mean" varies ≤ 10% of the mean. VOR samples are considered independent for statistical purposes.

3A: 20' interval
3B: 25' interval
3C: 50' interval

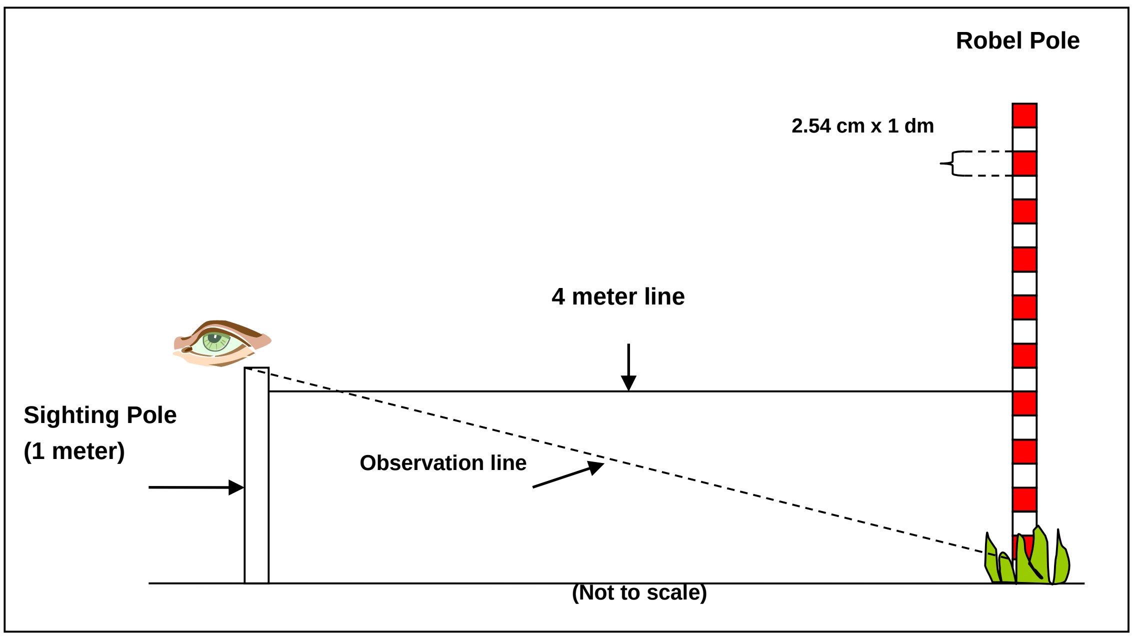

Figure 2. Visual obstruction reading diagram.

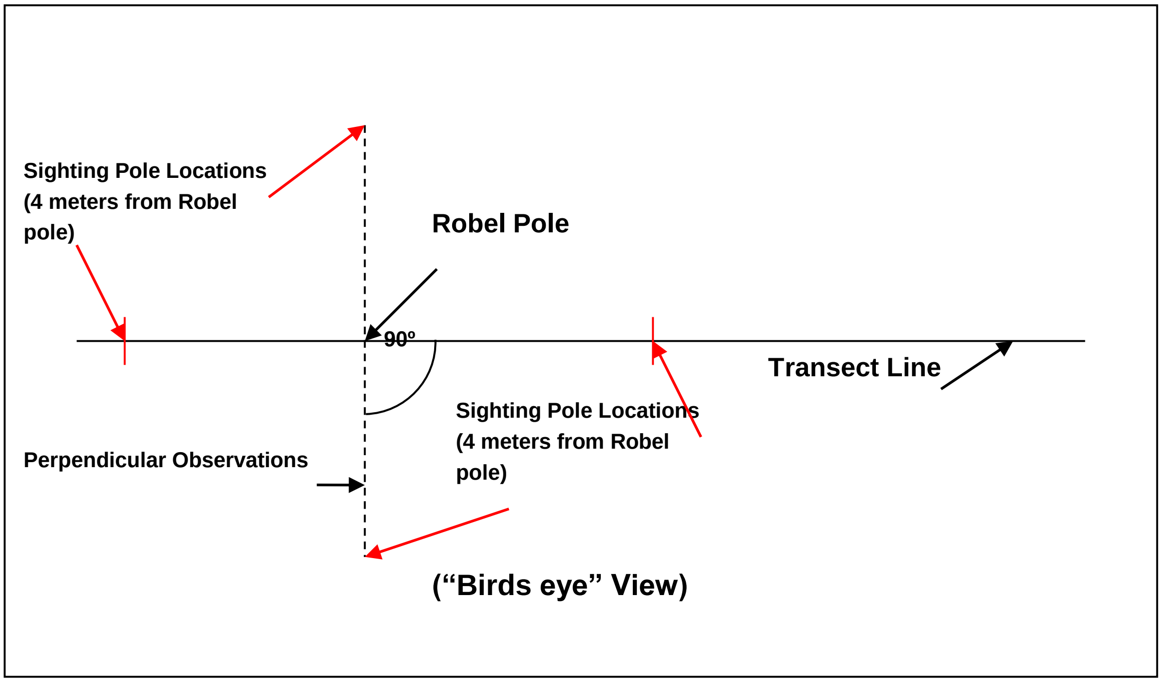

Figure 3. Robel pole "readings" layout diagram.

Shrub Measurements

Percent Cover

4. Line intercept or point intercept (USFWS 1981) is used to determine shrub cover. Line intercept is generally used when shrub cover is estimated at < 5% (the most accurate results are obtained using the line intercept method). In contrast, the point intercept method is used if shrub cover is estimated at > 5%.

4A: Line intercept is used to measure the amount of cover that intercepts the transect line as illustrated by the red lines shown in Figure 4. Measurements are in 10^{ths} of feet. Gaps in vegetation less than four tenths of a foot (5 inches) are ignored. The amount covered by shrubs is added to determine shrub intercept for each transect. For example, if 7.5 feet of a 100-foot long transect is covered by shrubs, percent cover is 7.5%.

Shrub cover is recorded by species. Where shrubs overlap, shrub intercept is recorded for the tallest shrub and noted for the lower shrub(s).

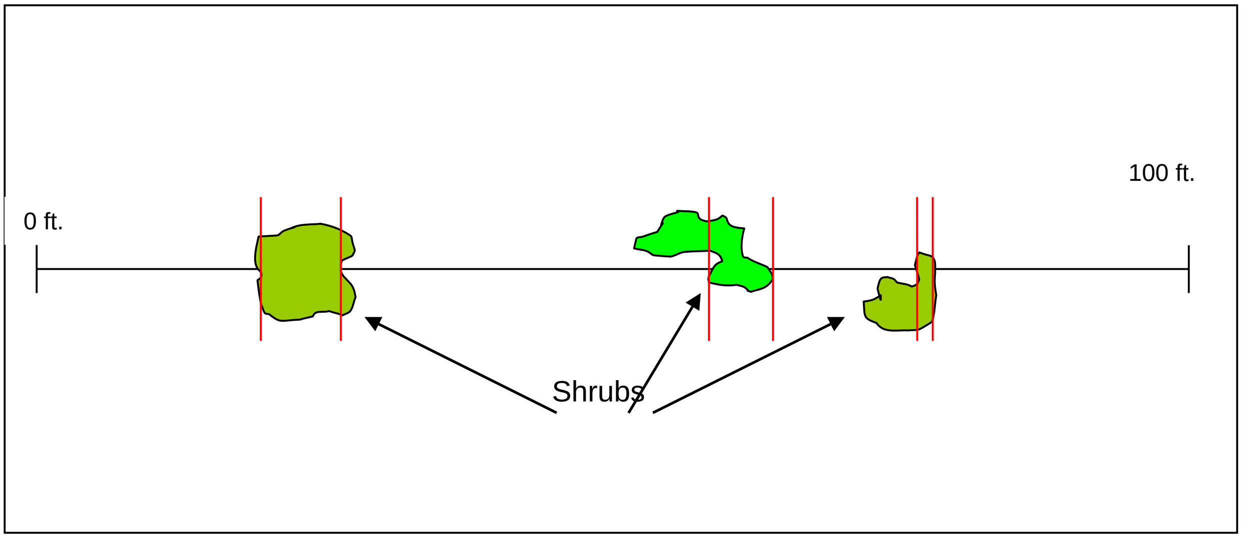

Figure 4. Line intercept method example.

4B: Point intercept is used when shrub canopy cover is estimated at ≥5%. Shrub cover is determined by recording the number of "hits" at specific intervals along a transect line. To be counted as a "hit", a portion of the shrub must cross the transect tape's interval number line e.g., 2', 4', 6'…. nth. If a portion of the shrub does not break the vertical plane at the interval number line, it is reported as a miss (Figure 5). Either a "hit" or "miss" is recorded on data loggers and/or paper data sheets for each designated interval.

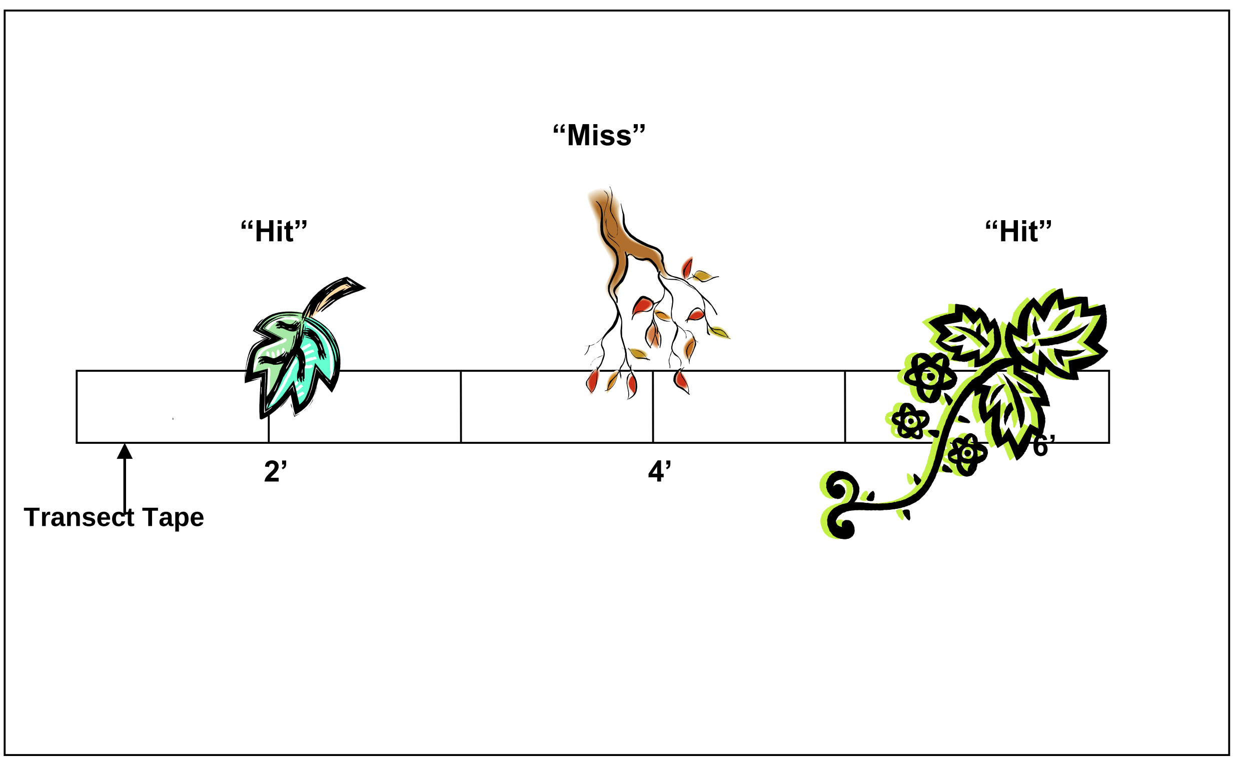

Figure 5. Point intercept method example showing “hits” and “misses” at two foot intervals.

From 5% to 20% cover, point data is collected at two-foot intervals (50 possible “hits” per 100 ft. sample unit). If shrub cover is estimated at >20%, shrub point data is collected at five foot intervals (20 possible “hits” per 100 ft. sample unit). On rare occasions, ten-foot intervals may be used when shrub cover exceeds 50% (10 possible “hits” per 100 ft. sample unit). The ten-foot interval is generally applied to shrub monocultures, or areas with few shrub species that exhibit relatively equal shrub distribution/density.
Shrub “hits” are recorded by species. Where shrubs overlap, shrub intercept is recorded for the tallest shrub and noted for the lower shrub(s).

4B-1: 2’ interval
4B-2: 5’ interval
4B-3: 10’ interval

4C: Modified point method is used when shrub cover is impenetrable or otherwise inaccessible. A baseline transect is established along the shrub edge. A six-foot measuring rod is then inserted into the shrub cover at right angles to the baseline tape at appropriate intervals. Recorders estimate shrub “hits”, species information, and height data where the end of the six-foot measuring rod intercepts the shrub cover (Figure 6). As with point intercept, intervals may very. Shrubs are identified by species.

4C-1: 2’ interval
4C-2: 5’ interval
4C-3: 10’ interval

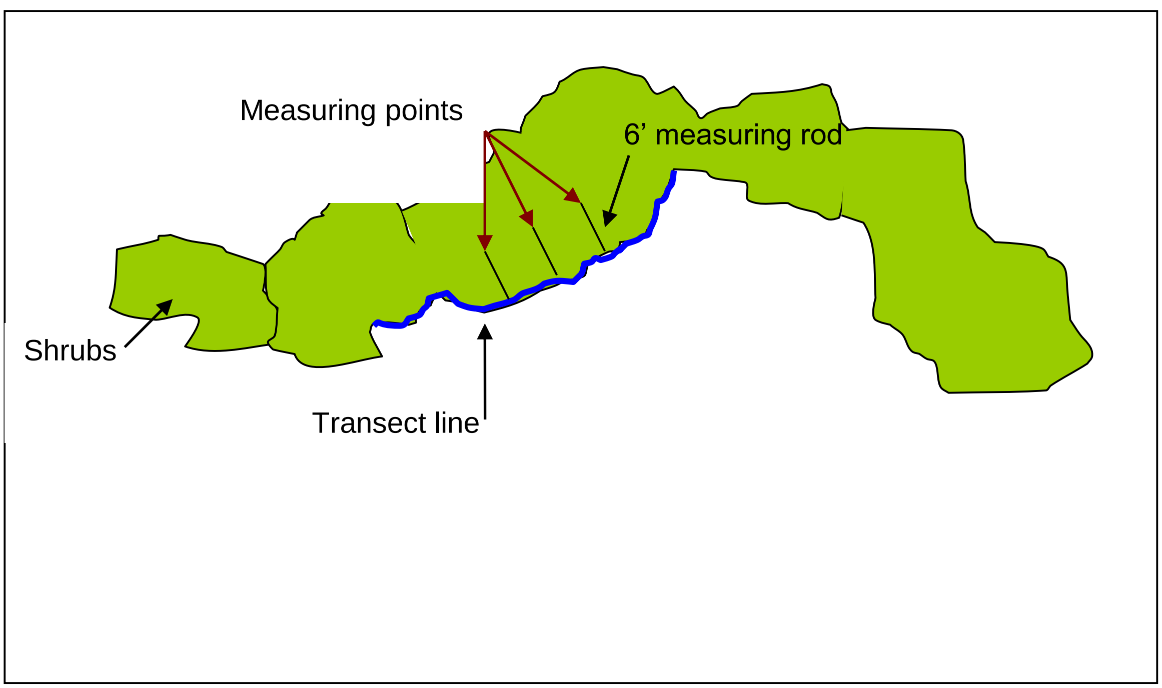

Figure 6. Modified point intercept layout example.

4D: Complex shrub intercept is used to determine percent shrub cover in multi strata shrub communities. This method is generally associated with point intercept methods whereas overlapping shrubs are identified for each stratum. Percent cover is determined for each of four possible strata as well as total percent shrub cover and overlapping percent cover.

The complex shrub intercept method is identified by adding the suffix “4D” after the appropriate line or point intercept method. For example, “4B-1-4D designates that complex shrub point intercept measurements were taken at two foot intervals. Similarly, 4C-2-4D designates that modified point intercept at five foot intervals was used to determine percent shrub cover for strata in a complex shrub community.

Shrub Height

5. Shrubs are defined as woody vegetation including trees <16 feet in height unless otherwise defined in HEP models. The Regional HEP Team assumes that trees <16 feet tall function ecologically more like shrubs than trees.

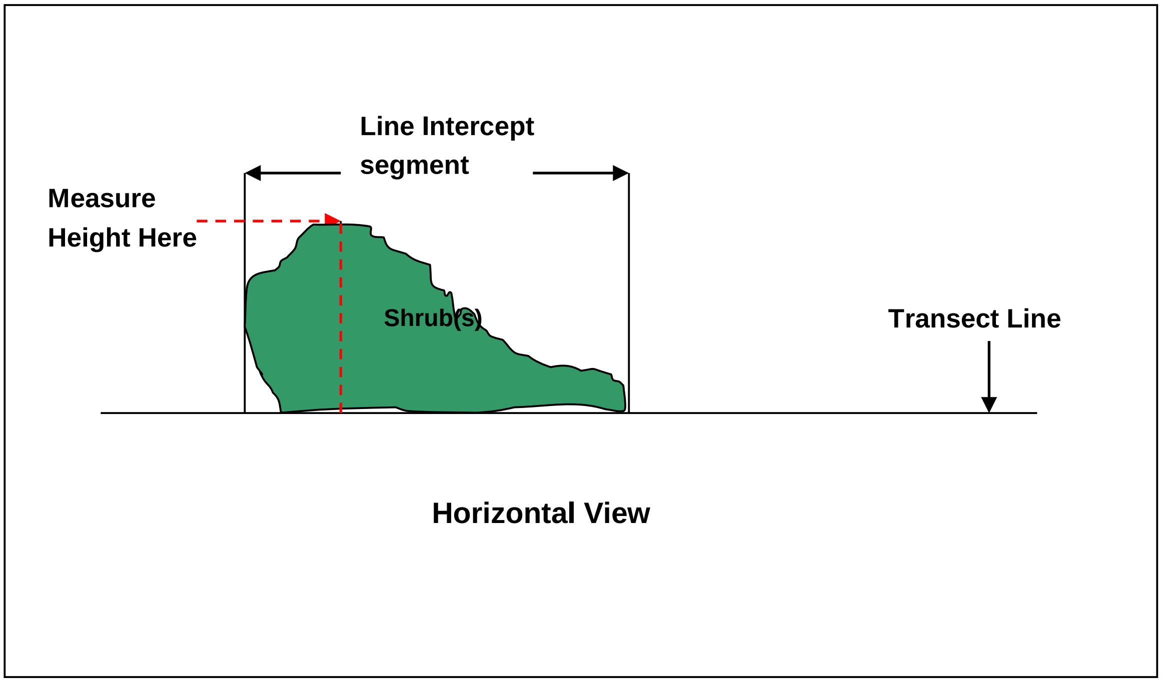

Figure 7. Line intercept shrub height measurement example.

Shrub height is measured in 10ths of feet at the highest point for each uninterrupted line intercept segment as depicted in Figure 7, or the highest point that crosses each point intercept interval mark on the transect tape (Figure 8).
In structurally complex (overlapping) shrub communities, height is measured for each stratum (maximum of four) as illustrated in Figure 9. It is assumed that shrub height measurements correspond to the method used to determine percent shrub cover. For example, if percent shrub cover is determined using the line intercept

method (Figure 4), then it is assumed that shrub height will be obtained as illustrated in Figure 7.

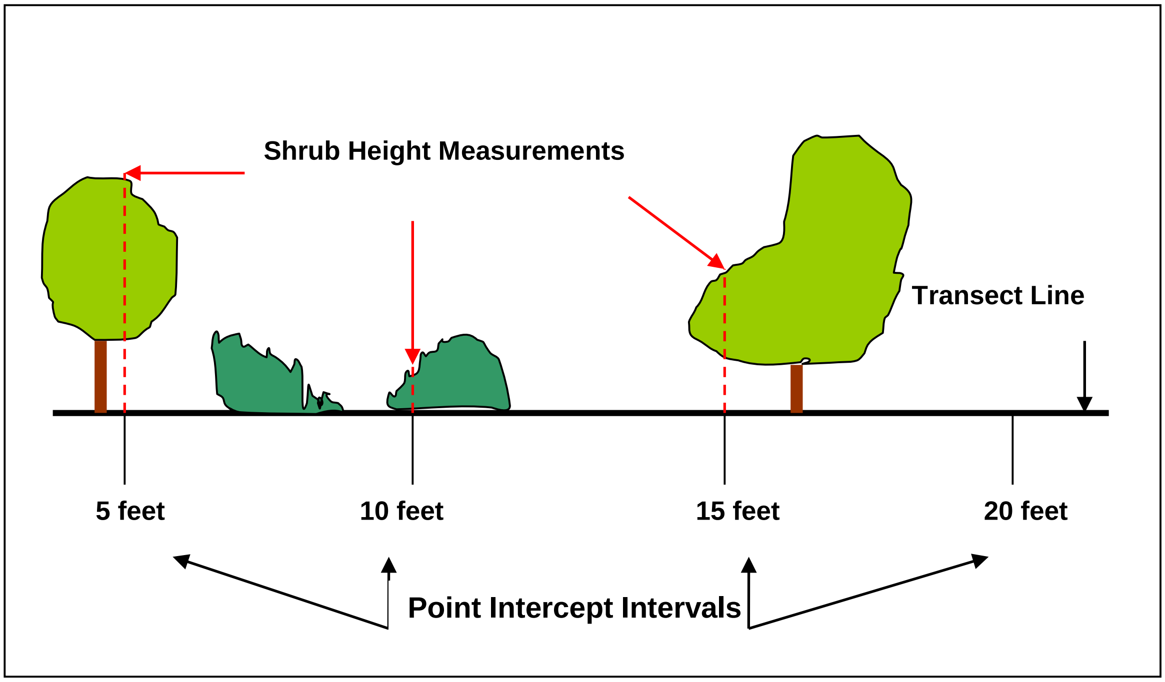

Figure 8. Point intercept shrub height example.

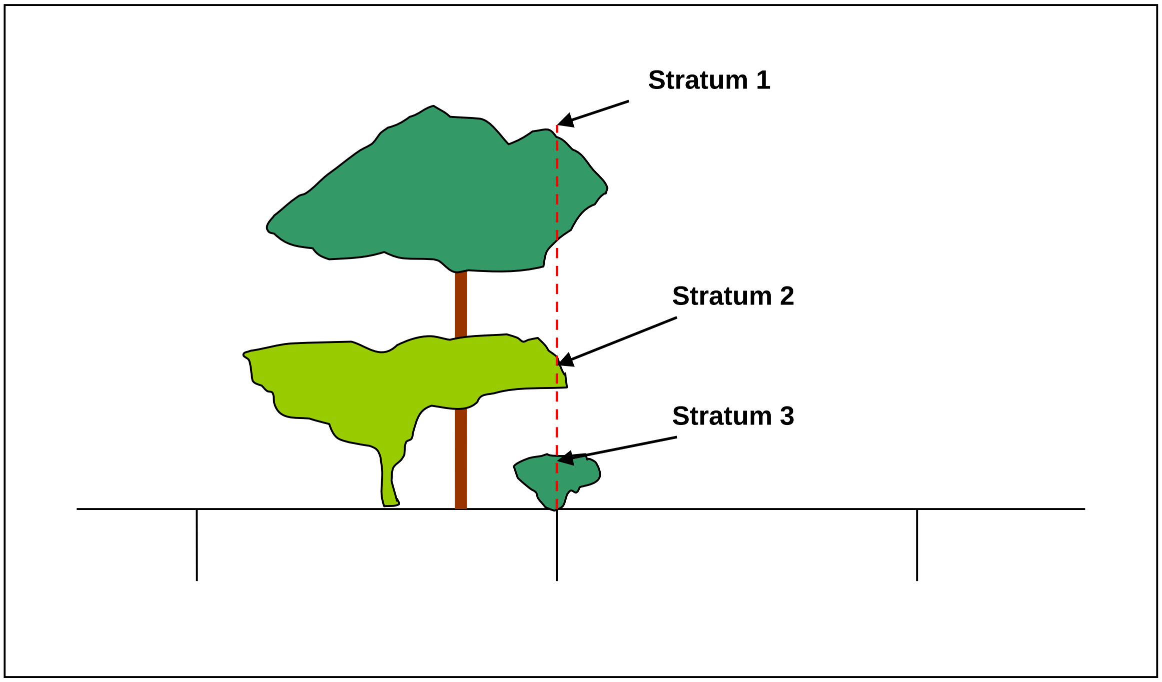

Figure 9. Complex shrub community shrub height measurement example.

Tree Measurements

Percent Canopy Cover

6. Tree canopy cover measurements are recorded at five or ten foot intervals with a densitometer (point intercept). Measurement intervals are determined by visually estimating tree canopy closure prior to initiating the survey. If estimated canopy closure is < 20% and estimated transect length ≤ 900 feet, measurements are recorded at five-foot intervals; if estimated canopy closure is > 20% and estimated transect length is ≥ 600 feet, ten-foot intervals are used. The size of the sample area strongly influences transect length. In small areas, data from several short (300 foot) transects may be "pooled" in order to determine percent tree canopy cover. As with shrubs, sampled trees are identified by species and the sampling unit is a 100 foot segment of the transect.

6A: 5' interval
6B: 10' interval

Height

7. Tree height is determined generally using a clinometer. In open areas, an electronic height measurement instrument may be used. Measurements are taken at the beginning and end of each transect and at 100 foot intervals. Additional samples may be taken if needed. HEP model variable requirements determine the extent of tree height measurements e.g., multi-canopy, overstory, etc.

Basal Area

8. Tree basal area data is collected at 100-foot intervals using a "factor 10" prism. Each 100-foot interval basal area observation (all tree "hits" at each 100-foot point) is considered an independent sample.

Snag DBH

9. Snag data is collected on belt transects. RHT members collect snag data in conjunction with tree canopy closure measurements using the same baseline transect. The diameter breast height (DBH) of all snags present within tenth-acre belt transects paralleling the baseline transect is measured. Either the actual DBH is recorded, or snag data is reported by class e.g., 5 snags <4" DBH, 2 snags >20" DBH etc.

Belt transects are 44 feet wide by 100 feet long i.e., 22 feet on each side of the baseline transect. Belt transect layout is depicted in Figure 10. As with shrubs and trees, the sampling unit is each 100-foot segment.

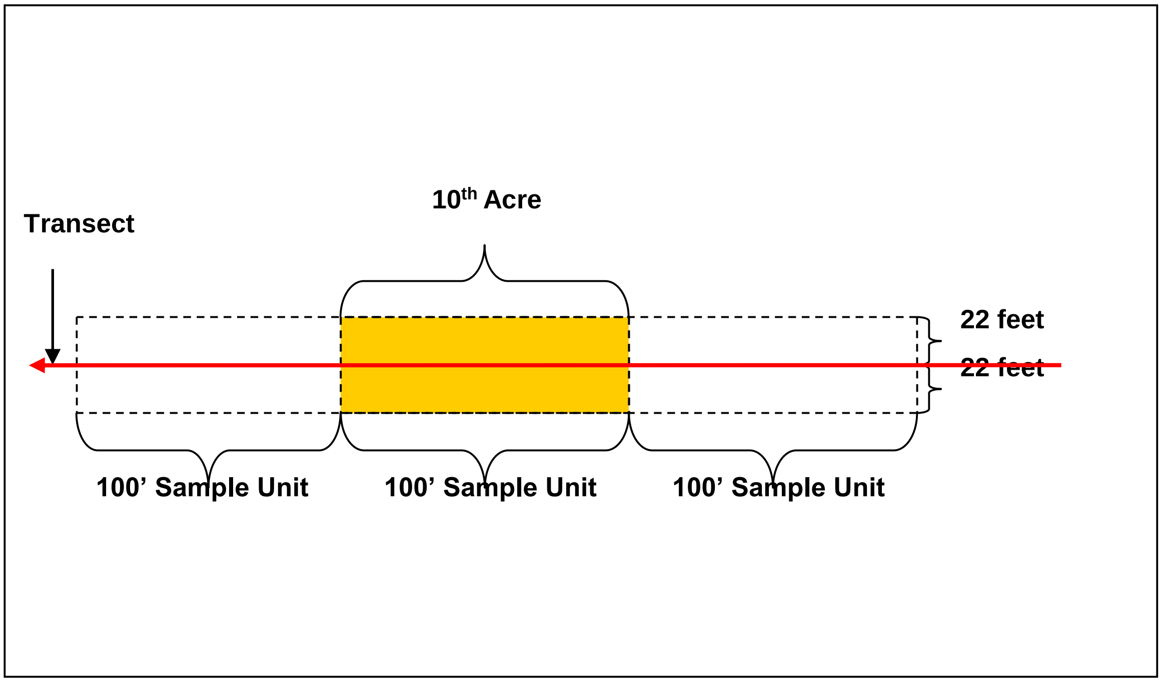

Figure 10. Belt transect layout diagram.

Sample Size Determination

The process for determining sample size (transect length) varies based on the variable measured. Shrub and tree cover and grid sample sizes are estimated as follows:

> The amount of cover within each 100 foot sample unit is divided by sample unit length to obtain percent shrub/tree cover per sample unit (e.g. 10 feet of cover/100 feet = 10% shrub cover). The standard deviation for each transect is calculated for percent cover data from transect sample units. Sample size (transect length) is then determined through use of the following equation (Avery 1994):
>
> $$n = \frac{t^2 s^2}{E^2}$$
>
> Where: t = t value at the 95 percent (0.05) confidence interval for the appropriate degrees of freedom (df); s = standard deviation; and E = desired level of precision, or bounds (± 10 percent). Confidence intervals may vary from 80 percent (0.20) to 95 percent (0.05) depending on habitat variable heterogeneity and project management needs. The same method is used to determine sample size for micro plot samples based on total percent cover for herbaceous species.

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Appendix C – Transect Locations

Year 2002

START POINTS ONLY

Old Goldendale UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0702194	5131861	190	300	**300**
2	start	0702199	5131872	60	300	**300**
3	start	0702290	5131930	260	300	**300**
4	start	0702726	5131944	120	300	**300**
5	start	0702616	5132019	270	300	**300**
6	start	0701785	5132077	24	600	**600**
7	start	0702764	5131645	N/A	300	**300**
8	start	0703242	5131628	130	300	**300**

Parker UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0694423	5153379	290	300	**300**
2	start	0694592	5153669	270	300	**300**

Sunnyside Dam UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0696020	5152252	250	300	**300**
2	start	N/A	N/A	N/A	N/A	**N/A**

South Barker UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0680930	5139679	N/A	300	**300**
2	start	0680942	5139595	120	300	**300**
3	start	0681006	5139568	N/A	300	**300**

Lawrence I UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0674420	5140086	N/A	300	**300**
2	start	0674658	5140215	80	200	**200**

Plank Road UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0717096	5128429	N/A	300	**301**
2	start	N/A	N/A	N/A	N/A	**N/A**
3	start	0717191	5128121	N/A	300	**300**
4	start	0717301	5127957	N/A	300	**300**

Tillman UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0675334	5139715	50	300	**300**
2	start	0675271	5139783	N/A	300	**300**

Campbell UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0697072	5132639	270	300	**300**
2	start	0696966	5132385	174	300	**300**
3	start	0697041	5132385	N/A	600	**600**
4	start	0697079	5132233	73	300	**300**
5	start	0697944	5132162	N/A	600	**600**

Dry Creek UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0699764	5125275	N/A	300	**300**
2	start	0699897	5125460	N/A	300	**300**

Lawrence II UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0691505	5132534	N/A	300	**300**
2	start	0691316	5132839	N/A	300	**300**
3	start	0691339	5132801	232	200	**200**

Satus Corridor UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0698668	5122413	9	300	**300**
2	start	0698511	5122122	N/A	300	**300**
3	start	0696508	5120869	N/A	300	**300**
4	start	0694351	5118614	196	300	**300**
5	start	0694559	5119473	N/A	300	**300**

Year 2003

Meninick North UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0712546	5139218	343	300	**300**
	end	0712541	5139308			
2	start	0712566	5140088	110	600	**600**
	end	N/A	N/A			
3	start	0711999	5139779	80	600	**600**
	end	0712132	5139632			
4A	start	0711399	5140177	74	600	**600**
	end	0711553	5140257			
5	start	N/A	N/A	N/A	N/A	**N/A**
	end	0683393	5139740			
6B	start	N/A	N/A	N/A	N/A	**Ocular**
	end	0683362	5139642			
10B	start	N/A	N/A	N/A	N/A	**Ocular**
	end	0683443	5139617			

Shuster Road UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	717518	5133197	73	300	**300**
	end	717609	5133206			
2	start	717768	5133480	330	300	**300**
	end	717722	5133566			
2A	start	717760	5133482	N/A	300	**300**
	end	717747	5133421			
3	start	717587	5133513	190	600	**600**
	end	717510	5133343			
4	start	717435	5133151	147	300	**300**
	end	717457	5133088			
5	start	717513	5133342	N/A	600	**600**
	start	717317	5133285			
6A	start	717831	5133223	N/A	300	**300**
	end	717917	5133163			
6C	start	717900	5133287	80	300	**300**
	end	717990	5133276			
7	start	717839	5132920	74	300	**300**
	end	717936	5132914			
8A	start	717311	5132518	90	300	**300**
	end	717401	5132498			
8B	start	718675	5132885	N/A	N/A	**Ocular**
9	start	718926	5132928	306	600	**600**
	end	718794	5133012			
10A	start	717603	5133797	360	600	**600**
	end	717518	5133910			

Year 2004

Garcia UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
3	start	0675057	5132888	19	600	**600**
	end	0675126	5133052			
4	start	0674927	5132977	320	600	**600**
	end	0674862	5133148			
8	start	0674973	5133213	26	600	**600**
	end	0675083	5133356			

Lawrence UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
2	start	0674256	5139987	234*	600	**600**
	end	0674121	5137050			
8	start	0674182	5140078	315	300	**300**
	end	0674113	5140191			

* along greenline

Plank Road UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0714684	5129928	76*	700	**700**
	end	0714826	5129784			
2	start	0714364	5129696	66	800	**800**
	end	0714610	5129729			
3	start	0714966	5129510	52	300	**800**
	turn	0715053	5129625	100	200	
	turn	0715107	5129599	50	300	
	end	0715193	5129633			

T-2126 UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
2	start	0701701	5130837	240	300	**300**
	end	0701612	5130808			
3	start	0701450	5130970	316	300	**300**
	end	0701402	5131044			
4	start	0701470	5131208	40	300	**300**
	end	0701565	5131353			
5	start	0701403	5131050	331	300	**300**
	end	0701267	5131342			

T-3669 UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0703669	5131017	323	300	**300**
	end	0703632	5131117			
2	start	0703767	5131078	70	300	**300**
	end	0703847	5131092			
3	start	0704384	5131028	280	300	
	end	0704287	5131074			

T-4433 UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0695528	5132079	302	300	**300**
	end	0695402	5132214			
2	start	0695466	5132139	266	300	**600**
	turn	0695451	5132048	240	300	
	end	0695365	5132072			

T-565 UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0695588	5133274	340	300	**300**
	end	0695589	5133354			
2	start	0695529	5133363	270	300	**300**
	end	0695441	5133383			
3	start	0695320	5133252	329	300	**300**
	end	0695325	5133344			
4	start	0695455	5133038	180	300	**300**
	end	0695426	5132951			
5	start	0695412	5132972	210	300	**300**
	end	0695341	5132916			
6	start	0695330	5132812	247*	600	**600**
	end	0695211	5132702			
7	start	0695352	5132697	30	300	**300**
	end	0695352	5132698			
8	start	0695408	5132765	64*	600	**600**
	end	0695527	5133205			

* along greenline

T-570 UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0696543	5132009	58*	600	**600**
	end	0696720	5132046			
2	start	0696750	5132066	332	300	**300**
	end	0696730	5132156			
3	start	0696499	5132336	60	600	**600**
	end	0696671	5132334			
4	start	0696499	5132336	130	300	**300**
	end	0696545	5132258			
5	start	0696610	5132329	210	300	**300**
	end	0696548	5132268			
6	start	0696694	5132348	360	300	**300**
	end	0696718	5132436			
7	start	0696652	5132505	290	300	**300**
	end	0696579	5132559			
8	start	0696712	5132628	240	300	**400**
	turn	0696626	5132630	270	100	
	end	0696601	5132640			

* along creek

Year 2005

Island Road UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0685472	5134804	274	300	**300**
	end	0685385	5134835			
2	start	0685277	5134963	244	300	**300**
	end	0685185	5134948			
3	start	0685372	5135120	104	300	**750**
	turn	0685456	5135086	100	300	
	turn	0685549	5135065	102	150	
	end	0685588	5135042			
4	start	0685644	5134937	124	300	**600**
	turn	0685710	5134875	79	100	
	turn	0685743	5134877	124	200	
	end	0685743	5134834			
5	start	0684831	5135050	130	300	**300**
	end	0684666	5134983			
6	start	0684666	5134856	143	300	**300**
	end	0684694	5134768			
7	start	0685809	5134641	292	300	**300**
	end	0685729	5134694			
8	start	0685809	5134641	292	300	**300**
	end	0685729	5134694			
9	start	0685873	5134708	342	400	**300**
	end	0685873	5134825			
10	start	0684965	5135064	152	300	**300**
	turn	0684969	5134976		300	
	end	0684936	5134899			
11	start	0685644	5134937	124	300	**300**
	turn	0685710	5134875	79	100	
	turn	0685743	5134877	124	300	
	end	0685743	5134834			

Lower Satus Creek UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0714023	5128760	193	300	**300**
	end	0713982	5128680			
2	start	0714031	5128886	295	300	**300**
	end	0713960	5128939			
3	start	0713739	5128869	312	300	**300**
	end	0713686	5128954			
4	start	0713652	5129058	241	300	**600**
	turn	0713563	5129035	196	300	
	end	0713517	5128956			
5	start	0712743	5128006	NNW	300	**600**
	turn	0712717	5128085		300	
	end	0712679	5128151			
6	start	0712654	5127936	331	300	**600**
	turn	0712635	5128027	17	300	
	end	0712678	5128107			
7	start	0712707	5128353	SW	300	**300**
	end	0712616	5128361			
8	start	0712737	5128278		300	**300**
9	start	0712793	5129013	36	150	**300**
	turn	0712829	5129043	81	150	
	end	0712870	5129033			

Meninick UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0712894	5137090	232	300	300
	end	0712805	5137050			
2	start	0712776	5136985	276	150	150
	end	0712732	5137001			
3	start	0712746	5136974	263	300	300
	end	0712652	5136967			
4	start	0712633	5137063	162	300	300
	end	0712637	5136975			
5	start	0712516	5137047	159	300	300
	end	0712542	5136963			
6	start	0713014	5137121	334	300	300
	end	0712994	5137207			
7	start	0713782	5137523	200	300	900
	turn	0713716	5137445	254	300	
	turn	0713706	5137448		*	
	turn	0713609	5137448	147	300	
	end	0713622	5137351			
8	start	0713644	5137250	177	150	300
	turn	0713638	5137200	263	150	
	end	0713592	5137201			
9	start	0713628	5137348	233	300	300
	end	0713538	5137317			
10	start	0713980	5137753	118	300	300
	end	0714047	5137691			
11	start	0713841	5137475	345	300	300
	end	0713843	5137553			

* break from turn point 100 foot gap

Pumphouse East 80 UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0688402	5133157	60*	300	**600**
	turn	0688482	5133162		300	
	end	0688549	5133129			
2	start	0688402	5133157	190	300	**300**
	end	0688510	5133047			
3	start	0688482	5133162	178	300	**300**
	end	0688457	5133077			
4	start	0688475	5132997	152	300	**300**
	end	0688491	5132910			
5	start	0688533	5132839	204	300	**300**
	end	0688474	5132772			
6	start	0688568	5132832	N/A	N/A	**Ocular**
7	start	0688412	5132438	11	300	**300**
	end	0688480	5132488			

*along greenline

Meninick South UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0714142	5136311	97	300	**500**
	turn	0714283	5136223	97	200	
	end	0714327	5136210			
2	start	0714327	5136210	N/A	N/A	**Ocular**
3	start	0714112	5136305	291	300	**300**
	end	0714047	5136349			
4	start	0714047	5136021	N/A	N/A	**Ocular**
5	start	0714078	5135886	166	300	**300**
	end	0714077	5135796			
6	start	0714169	5135758	96	300	**300**
	end	0714253	5135733			
7	start	0714389	5135766	54	200	**200**
	end	0714433	5135787			
8	start	0714174	5135845	360	300	**300**
	end	0714186	5135893			
9	start	0714035	5136166	65	100	**300**
	turn	0714047	5136164	25	200	
	end	0714065	5136236			
10	start	0714114	5136116	134	300	**300**
	end	0714161	5136041			
11	start	0714276	5136037	N/A	N/A	**Ocular**
12	start	0714116	5136043	338	200	**200**
	end	0714109	5136106			
13	start	0714039	5136007	N/A	N/A	**Ocular**

Zimmerman UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	694017	5133897	98	300	**300**
	end	694102	5133867			
2	start	694078	5133760	132	300	**300**
	end	694127	5133682			
3	start	693877	5133591	247	300	**300**
	end	693787	5133568			
4	start	693950	5133701	265	300	**600**
	turn	693861	5133710	245	300	
	end	693774	5133694			
5	start	693949	5133628	187*	300	**300**
	end	693922	5133549			
6	start	694025	5133667	116	300	**300**
	end	694104	5133620			
7	start	694124	5133563	102	300	**300**
	end	694210	5133529			

*along greenline

Year 2006

Mill Creek North UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0683007	5138326	346	300	**600**
	turn	0683012	5138419	6	300	
	end	0683051	5138505			
2	start	0683132	5138558	143	300	**300**
	end	0683162	5138472			
3	start	0683225	5138488	340*	600	**600**
	end	0683119	5138581			
4	start	0683306	5138137	295	300	**300**
	end	0683237	5138198			

* initial azimuth, followed green-line

Mill Creek South UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
5	start	0683218	5137261	320	300	**600**
	turn	0683187	5137345	308	300	
	end	0683139	5137422			
6	start	0683285	5137348	94	300	**600**
	turn	0683377	5137325	84	300	
	end	0683465	5137303			

Bailey UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0670420	5137135	N/A	N/A	**Ocular**

Olney Drain UTM transect locations, lengths, and magnetic azimuths

Transect	Point	GPS		Magnetic Azimuth	Length	Total Length
		E	N			
1	start	0682423	5141088	146	300	**300**
	end	0682455	5141002			
2	start	0682390	5140503	191	300	**300**
	end	0682340	5140501			
4	start	0682151	5139743	290	300	**200**
	end	N/A	N/A			
6	start	0683084	5139521	324	300	**300**
	end	0683036	5139600			
7	start	0683058	5139833	118	300	**300**
	end	0683134	5139775			
8	start	0683147	5139764	N/A	N/A	**Ocular**
9	start	0683299	5139761	88	300	**300**
	end	0683393	5139740			
10	start	0683361	5139554	344	300	**300**
	end	0683362	5139642			
11	start	0683401	5139674	135	300	**300**
	end	0683443	5139617			
12	start	0683674	5139750	256	300	**300**
	end	0683577	5139747			
13	start	0683512	5140710	196	140	**300**
	turn	0683488	5140680	302	125	
	turn	0683452	5140710	35	35	
	end	0683460	5140713			
17	start	0682070	5139835	75	300	**300**
	end	0682162	5139848			
18	start	0682095	5140487	106	300	**600**
	turn	0682172	5140433	66	300	
	end	0682265	5140443			

Appendix D – Habitat Unit Crediting

Year 1999

Primary Credited Hydro Facility

Hydro Project	Project/Tract	MCNARY HABITAT UNIT GAINS										
		Canada Goose	Mink	Downy Woodpecker	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total	Project Acres	HUs per Acre
McNary	**Yakama Nation**											
Year-1999	**Lower Satus**	2,564.00	140.10	168.00	3,440.00	91.00	338.00	1,859.75	15.00	**8,615.85**	**3,694.00**	**2.33**
	Mosebar Pond	211.00	74.90	28.00	325.00	21.00	27.00	103.50	0.00	**790.40**	**432.00**	**1.83**
	Satus	2,032.00	758.30	261.00	3,186.00	518.00	301.00	1,054.75	122.00	**8,233.05**	**4,474.00**	**1.84**
	Toppenish Creek	521.00	263.60	8.00	974.00	152.00	36.00	442.00	0.00	**2,396.60**	**1,236.00**	**1.94**
	Wanita Slough	305.00	25.80	0.00	350.00	15.00	41.00	156.75	0.00	**893.55**	**361.00**	**2.48**
	Wapato	349.00	56.10	104.00	499.00	26.00	68.00	213.50	21.00	**1,336.60**	**770.00**	**1.74**
	S. Lat. A (Zimmerman)	237.00	73.40	3.00	237.00	1.00	44.00	86.50	0.00	**681.90**	**434.00**	**1.57**
	North Satus	394.58	110.68	53.30	281.93	25.90	114.10	164.51	6.10	**1,151.10**	**722.30**	**1.59**
	Subtotal	**6,613.58**	**1,502.88**	**625.30**	**9,292.93**	**849.90**	**969.10**	**4,081.26**	**164.10**	**24,099.05**	**12,123.30**	**1.99**

Secondary Credited Hydro Facility

Hydro Project	Project/Tract	JOHN DAY HABITAT UNIT GAINS										Project Acres[1]	HUs Per Acre[1]
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
John Day	**Yakama Nation**												
Year - 1999	**Lower Satus**	0.00	0.00	0.00	21.00	0.00	0.00	0.00	0.00	0.00	**21.00**		**#DIV/0!**
	Satus	0.00	0.00	0.00	96.00	0.00	0.00	0.00	0.00	0.00	**96.00**		**#DIV/0!**
	Wapato	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	**15.00**		**#DIV/0!**
	North Satus	0.00	0.00	0.00	14.80	0.00	0.00	0.00	0.00	0.00	**14.80**		**#DIV/0!**
	Subtotal	**0.00**	**0.00**	**0.00**	**146.80**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**146.80**		

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Year 2002

Primary Credited Hydro Facility

Hydro Project	Project/Tract	JOHN DAY HABITAT UNIT GAINS										Project Acres	HUs Per Acre
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
Year - 2002	**Satus Corridor**	8.51	44.94	457.70	3.02	1,014.82	89.88	534.02	17.38	6.16	**2,176.43**	**2,718.00**	**0.80**
	Lawrence II	0.45	0.00	5.23	0.00	13.20	0.00	7.55	0.90	0.00	**27.33**	**40.00**	**0.75**
	Sunnyside Dam	0.00	0.00	0.45	0.60	10.69	0.00	5.54	0.00	0.60	**17.88**	**22.00**	**0.81**
	Plank Road	15.00	25.33	0.00	0.00	39.93	8.57	4.49	20.20	0.00	**113.52**	**168.00**	**0.68**
	Parker	3.30	1.20	0.00	0.00	8.46	7.20	4.36	2.20	0.00	**26.72**	**36.00**	**0.74**
	Tillman	0.00	3.00	0.00	0.00	42.85	1.21	16.01	0.00	0.00	**63.07**	**79.00**	**0.80**
	Dry Creek	2.00	1.00	0.00	1.48	67.30	5.00	73.74	0.00	1.00	**151.52**	**160.00**	**0.95**
	Campbell	25.94	12.35	0.00	0.00	27.30	42.60	0.00	9.20	0.00	**117.39**	**360.00**	**0.33**
	Old Goldendale	6.01	13.08	0.00	0.00	45.22	0.00	23.94	24.28	0.00	**112.53**	**184.00**	**0.61**
	South Barker	6.01	1.48	1.00	0.00	21.65	0.00	26.87	28.93	0.00	**85.94**	**75.00**	**1.15**
	Lawrence I	26.41	0.00	5.00	0.00	13.20	0.00	7.55	0.00	0.00	**52.16**	**61.00**	**0.86**
	Totals	**93.63**	**102.38**	**469.38**	**5.10**	**1,304.62**	**154.46**	**704.07**	**103.09**	**7.76**	**2,944.49**	**3,903.00**	**0.75**

Secondary Credited Hydro Facility

Hydro Project	Project/Tract	BONNEVILLE HABITAT UNIT GAINS							Project Acres[1]	HUs Per Acre[1]
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Spotted Sandpiper	Total		
Year 2002	Sunnyside Dam	0.00	0.80	0.00	0.60	0.00	0.00	1.40		#DIV/0!
	Dry Creek	0.00	6.00	0.00	1.80	0.00	0.00	7.80		#DIV/0!
	Campbell	0.00	1.50	0.00	4.50	0.00	0.00	6.00		#DIV/0!
	Old Goldendale	0.00	1.90	9.00	0.00	0.00	0.00	10.90		#DIV/0!
	Lawrence 1	0.00	1.90	0.06	0.00	0.00	0.00	1.96		#DIV/0!
	Subtotals	**0.00**	**12.10**	**9.06**	**6.90**	**0.00**	**0.00**	**28.06**		**#DIV/0!**

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Year 2003

Primary Credited Hydro Facility

Hydro Project	Project/Tract	JOHN DAY HABITAT UNIT GAINS										Project Acres	HUs Per Acre
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
Year - 2003	Meninick North	213.44	476.64	0.00	0.00	285.11	13.69	52.60	313.53	0.00	**1,355.02**	**1,052.00**	**1.29**
	Shuster Road	300.22	203.65	0.00	0.00	308.19	68.88	110.26	350.98	0.00	**1,342.17**	**667.00**	**2.01**
	Subtotal	**513.66**	**680.29**	**0.00**	**0.00**	**593.31**	**82.57**	**162.86**	**664.51**	**0.00**	**2,697.19**	**1,719.00**	**1.57**

Secondary Credited Hydro Facility

Hydro Project	Project/Tract	MCNARY HABITAT UNIT GAINS										
		Canada Goose	Mink	Downy Woodpecker	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total	Project Acres[1]	HUs per Acre[1]
Year - 2003	**Meninick North**	0.00	0.00	281.45	0.00	0.00	0.00	0.00	0.00	281.45		**#DIV/0!**
	Shuster	0.00	0.00	64.98	0.00	0.00	0.00	0.00	0.00	64.98		**#DIV/0!**
	Subtotal	**0.00**	**0.00**	**346.43**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**346.43**		**#DIV/0!**

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Year 2004

Primary Credited Hydro Facility

Hydro Project	Project/Tract	JOHN DAY HABITAT UNIT GAINS										Project Acres	HUs Per Acre
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
John Day	**Yakama Nation**												
Year - 2004	**Buena**	0.00	1.21	13.12	0.00	23.42	1.81	25.06	0.00	0.00	**64.62**	**157.00**	**0.41**
	Garcia	0.00	0.00	0.00	0.00	45.75	0.16	21.86	0.00	0.00	**67.77**	**82.00**	**0.83**
	Lawrence	0.00	0.00	18.27	0.00	46.82	0.00	22.47	0.00	0.00	**87.56**	**81.00**	**1.08**
	Plank	0.00	4.10	0.00	0.00	382.48	4.38	0.00	0.00	0.00	**390.96**	**685.00**	**0.57**
	T2126	0.00	0.00	0.00	0.00	51.68	0.00	30.85	33.33	0.00	**115.86**	**94.50**	**1.23**
	T3669	0.00	0.00	0.00	0.00	59.52	0.00	74.01	0.00	0.00	**133.53**	**116.00**	**1.15**
	T4433	0.00	0.00	0.00	0.00	23.17	0.00	4.22	2.98	0.00	**30.37**	**44.30**	**0.69**
	T565	5.83	4.39	0.00	0.00	41.20	6.02	29.43	3.08	0.00	**89.95**	**80.00**	**1.12**
	T570	6.94	0.27	0.00	0.00	39.88	1.93	22.79	20.14	0.00	**91.95**	**73.00**	**1.26**
		12.77	**9.97**	**31.39**	**0.00**	**713.92**	**14.30**	**230.69**	**59.53**	**0.00**	**1,072.57**	**1,412.80**	**0.76**

There is no secondary credited hydro facility for Year 2004.

Year 2005

Primary Credited Hydro Facility

Hydro Project	Project/Tract	JOHN DAY HABITAT UNIT GAINS										Project Acres	HUs Per Acre
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
John Day	**Yakama Nation**												
Year - 2005	**Meninick**	1.00	0.00	0.00	0.00	154.00	0.30	196.20	0.20	0.00	**351.70**	**428**	**0.82**
	Meninick South	1.20	0.00	0.00	0.00	10.30	1.40	0.00	3.80	0.00	**16.70**	**68**	**0.25**
	S. Lat. A (Zimmerman)	0.00	83.92	0.00	0.00	136.40	14.00	198.30	0.00	0.00	**432.62**	**432**	**1.00**
	Island Road	15.20	5.55	0.00	0.00	98.70	6.20	91.60	10.68	0.00	**227.93**	**243**	**0.94**
	E 80 Pumphouse	46.80	0.00	0.00	0.00	0.00	1.10	91.60	47.17	0.00	**186.67**	**78**	**2.39**
	L. Satus Creek	0.00	0.00	0.00	0.00	220.00	19.80	93.40	0.00	0.00	**333.20**	**409**	**0.81**
	Totals	**64.20**	**89.47**	**0.00**	**0.00**	**619.40**	**42.80**	**671.10**	**61.85**	**0.00**	**1,548.81**	**1,658.00**	**0.93**

Secondary Credited Hydro Facility

Hydro Project	Project/Tract	THE DALLES HABITAT UNIT GAINS								Project Acres[1]	HUs Per Acre[1]
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Western Meadowlark	Spotted Sandpiper	Total		
The Dalles	**Yakama Nation**										
Year - 2005	**Meninick**	0.00	65.65	85.10	0.00	0.00	0.00	0.00	**150.75**		#DIV/0!
	Meninick South	0.00	33.78	28.50	0.00	0.00	0.00	0.00	**62.28**		#DIV/0!
	E. 80 Pumphouse	0.00	26.75	13.20	0.00	0.00	0.00	0.00	**39.95**		#DIV/0!
	L. Satus Creek	0.00	14.48	19.80	0.00	0.00	0.00	0.00	**34.28**		#DIV/0!
	Subtotal	0.00	140.66	146.60	0.00	0.00	0.00	0.00	287.26		#DIV/0!

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Year 2006

Primary Credited Hydro Facility

Hydro Project	Project/Tract	JOHN DAY HABITAT UNIT GAINS										Project Acres	HUs Per Acre
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Cal. Quail	Yellow Warbler	Western Meadowlark	Mallard	Spotted Sandpiper	Total		
John Day	**Yakama Nation**												
Year - 2006	**Bailey**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**40.00**	**0.00**
	Mill Creek North	10.37	1.40	0.00	0.00	51.65	1.48	52.35	21.56	0.00	138.81	**159.00**	**0.87**
	Mill Creek South	17.34	0.00	0.00	0.00	55.95	0.00	56.72	42.71	0.00	172.72	**165.00**	**1.05**
	Olney Drain	0.00	7.28	0.00	0.00	206.99	5.31	148.31	0.00	0.00	367.89	**451.00**	**0.82**
	Subtotal	**27.71**	**8.68**	**0.00**	**0.00**	**314.59**	**6.79**	**257.38**	**64.27**	**0.00**	**679.42**	**815.00**	**0.83**

Secondary Credited Hydro Facility

Hydro Project	Project/Tract	BONNEVILLE HABITAT UNITS GAINS							Project Acres[1]	HUs Per Acre[1]
		Canada Goose	Mink	B.C. Chickadee	G.B. Heron	Yellow Warbler	Spotted Sandpiper	Total		
Bonneville	**Yakama Nation**									
Year - 2006	**Mill Creek North**	0.00	1.80	0.00	0.40	0.00	0.00	2.20		**#DIV/0!**
	Olney Drain	0.00	1.75	0.00	6.13	0.00	0.00	7.88		**#DIV/0!**
	Subtotals	**0.00**	**3.55**	**0.00**	**6.53**	**0.00**	**0.00**	**10.08**		**#DIV/0!**

[1] Project acres/HUs per acre are calculated only if hydro project is the primary credited facility.

Appendix E – Habitat Unit Gains by Project Site/Cover Type

Year – 1999

PROJECT ACRES (1999)	TOTAL ACRES	Covertype/HUs																								TOTAL HUs
		Riparian Forest		Riparian Shrub			Riparian Herb				Shrub-steppe/Grassland				Agricultural			Lacustrine	Riverine	Open Water	E. Wetland		Sand/Gravel/Cobble/Mud			
		Canada Goose	Downy Woodpecker	California Quail	Mink	Yellow Warbler	California Quail	Canada Goose	Mallard	Mink	California Quail	Canada Goose	Mallard	Western Meadowlark	California Quail	Canada Goose	Mallard	Mallard	Mallard	Mallard	Mallard	Mink	Canada Goose	Spotted Sandpiper	G.B. Heron	
Lower Satus	**3,694.00**	168.00	168.00	203.00	132.00	91.00	31.00	28.00	12.00	3.10	2,252.00	2,252.00	1,351.00	338.00	954.00	95.00	477.00		14.75		5.00	5.00	21.00	15.00	21.00	**8,636.85**
Mosebar Pond	**432.00**	30.00	28.00	53.00	42.00	21.00	109.00	76.00	0.00	10.90	119.00	99.00	44.00	27.00	44.00	6.00	31.50	6.00			22.00	22.00				**790.40**
Satus	**4,474.00**	345.00	261.00	869.00	562.00	518.00	463.00	324.00	0.00	46.30	1,752.00	1,226.00	647.00	301.00	102.00	15.00	108.00		20.75	86.00	193.00	150.00	122.00	122.00	96.00	**8,329.05**
Toppenish Creek	**1,236.00**	10.00	8.00	190.00	171.00	152.00	66.00	50.00	7.00	6.60	460.00	424.00	69.00	36.00	258.00	37.00	251.50	0.00	3.50		111.00	86.00				**2,396.60**
Wanity Slough	**361.00**			34.00	22.00	15.00	38.00	34.00	15.00	3.80	270.00	270.00	135.00	41.00	8.00	1.00	4.00		2.75							**893.55**
Wapato	**770.00**	145.00	104.00	51.00	51.00	26.00	31.00	23.00	3.00	3.10	194.00	136.00	97.00	68.00	223.00	22.00	111.50	0.00			2.00	2.00	23.00	21.00	15.00	**1,351.60**
S. Lat. A (Zimmerman)	**414.00**	3.00	3.00	1.00	1.00	1.00	4.00	3.00	0.00	0.40	231.00	231.00	33.00	44.00	1.00	0.00	0.50				53.00	72.00				**681.90**
North Satus	**722.30**	82.57	53.30	92.10	92.56	25.87	64.71	100.47	45.40	12.97	125.13	198.61	109.18	114.09	0.00	0.00	1.85	2.93	0.00		5.15	5.15	12.94	6.12	14.85	**1,165.93**
TOTAL	**12,103.30**	**783.57**	**625.30**	**1,493.10**	**1,073.56**	**849.87**	**806.71**	**638.47**	**82.40**	**87.17**	**5,403.13**	**4,836.61**	**2,485.18**	**969.09**	**1,590.00**	**176.00**	**985.85**	**8.93**	**41.75**	**86.00**	**391.15**	**342.15**	**178.94**	**164.12**	**146.85**	**24,245.88**

NOTES:

Credit against McNary Dam except as noted for heron

Rip. Herb-McNary-add mink ie., 4 species
Estimate mink as 0.1 - Hames pers comm

AG: Add Mallard & C. Goose i.e., 3 species
Substitute goose for heron, add mallard=0.5 - Hames

S/G/C/M: Substitute heron for mink
Credit heron to John Day Dam - Hames

Year - 2002

PROJECT ACRES (2002)	TOTAL ACRES	Covertype/HUs												TOTAL HUs
		Riparian Forest	Riparian Shrub		Riparian Herb		Shrub-steppe/Grassland		Agricultural	Emergent Wetland		Sand/Gravel/Cobble/Mud		
		B.C. Chickadee	Mink	Yellow Warbler	Canada Goose	Mallard	Cal. Quail	Western Meadowlark	Canada Goose	Mallard	Mink	Spotted Sandpiper	G.B. Heron	
Satus Corridor	2,718.00	457.70	44.58	89.88	8.51	17.02	1,014.82	534.02		0.36	0.27	6.16	3.02	2,176.34
Lawrence II	40.00	5.23			0.45	0.90	13.20	7.55						27.33
Sunnyside Dam	22.00	0.45					10.69	5.54				0.60	0.60	17.88
Plank Road	168.00		20.13	8.57	0.60	0.60	39.93	4.49	14.40	19.60	5.21			113.53
Parker	36.00		1.20	7.20	3.30	2.20	8.46	4.36						26.72
Tillman	79.40		3.00	1.21			42.85	16.01						63.08
Dry Creek	160.00		1.00	5.00	2.00	0.07	67.30	73.74				1.00	1.48	151.60
Campbell	360.00		11.55	42.60	8.40	8.40	27.30	0.00	17.54	0.80	0.80			117.39
Old Goldendale	184.00				6.01	13.78	45.22	23.94		10.50	13.08			112.52
South Barker	75.00	1.00			6.01	28.33	21.65	26.87		0.60	1.48			85.94
Lawrence I	60.80	5.00					13.20	7.55	26.41					52.17
TOTAL	3,903.20	469.38	81.46	154.46	35.28	71.30	1,304.64	704.07	58.35	31.86	20.84	7.76	5.10	2,944.49

NOTES: Year 2002 riverine cover type HUs were credited against Bonneville Dam. All other cover types credited against John Day Dam.

Sunnyside Dam - riverine: Bonneville Dam

	Mink	G.B. Heron
HSI	0.80	0.60
HUs	0.80	0.60

Dry Creek- riverine: Bonneville Dam

	Mink	G.B. Heron
HSI	1.00	0.30
HUs	6.00	1.80

Campbell- riverine: Bonneville Dam

	Mink	G.B. Heron
HSI	0.10	0.30
HUs	1.50	4.50

Old G.D.- riverine: Bonneville Dam

	Mink	G.B. Heron
HSI	0.06	0.30
HUs	1.90	9.00

Lawrence 1- riverine: Bonneville Dam

	Mink	G.B. Heron
HSI	0.40	0.10
HUs	1.90	0.06

Year - 2003

PROJECT ACRES (2003)	TOTAL ACRES	Riparian Forest		Riparian Shrub			Riparian Herb				E. Wetland		Shrub-steppe/Grassland				Agricultural			TOTAL (HUs)
		Mink	Downy Woodpecker	Cal. Quail	Mink	Yellow Warbler	Cal. Quail	Canada Goose	Mallard	Mink	Mallard	Mink	Cal. Quail	Canada Goose	Mallard	Western Meadowlark	Cal. Quail	Canada Goose	Mallard	
Meninick North	**1,052.00**	433.00	281.45	36.47	37.00	13.69	18.51	38.99	33.00	4.00	3.00	2.64	230.14	174.45	280.53	52.60				**1,639.47**
Shuster Road	**667.00**	84.75	64.98	118.65	94.90	68.88	74.28	180.00	156.00	18.00	3.60	6.00	78.22	99.22	121.88	110.26	37.05	21.00	66.50	**1,404.15**
TOTAL	**1,719.00**	**517.75**	**346.43**	**155.11**	**131.90**	**82.57**	**92.78**	**218.99**	**189.00**	**22.00**	**6.60**	**8.64**	**308.36**	**273.67**	**402.41**	**162.86**	**37.05**	**21.00**	**66.50**	**3,043.62**

NOTES: HUs credited against John Day except downy woodpecker

Rip. Herb: add Mink

Ag.: add Canada goose

	(McNary Dam)	Meninick & Schuster: 0.1 (Hames)		Hames: 0.3

Year – 2004

PROJECT	JOHN DAY HABITAT UNIT GAINS									TOTAL (HUs)	PROJECT ACRES	HUs PER ACRE
	Riparian Forest	Rip Shrub/Riverine/Cobble			Riparian Herb/Wetland			Shrub-steppe/Grassland				
	B.C. Chickadee	Cal. Quail	Mink	Yellow Warbler	Cal. Quail	Canada Goose	Mallard	Cal. Quail	Western Meadowlark			
Buena	13.12	2.81	1.21	1.81				20.61	25.06	**64.62**	**157.00**	**0.41**
		23.42										
Garcia		0.45	0.00	0.16				45.30	21.86	**67.77**	**82.00**	**0.83**
		45.75										
Lawrence	18.27							46.82	22.47	**87.56**	**81.00**	**1.08**
Plank		5.52	4.10	4.38				376.96	0.00	**390.96**	**685.00**	**0.57**
		382.48										
T2126					18.51	0.00	33.33	33.17	30.85	**115.86**	**94.50**	**1.23**
					51.68							
T3669								59.52	74.01	**133.53**	**116.00**	**1.15**
T4433					8.26	0.00	2.98	14.91	4.22	**30.37**	**44.30**	**0.69**
					23.17							
T565		6.63	4.39	6.02	8.54	5.83	3.08	26.03	29.43	**89.95**	**80.00**	**1.12**
		41.20										
T570		1.90	0.27	1.93	15.46	6.94	20.14	22.52	22.79	**91.95**	**73.00**	**1.26**
		39.88										
TOTAL	**31.39**	**17.31**	**9.97**	**14.30**	**50.77**	**12.77**	**59.53**	**645.84**	**230.69**	**1,072.57**	**1,412.80**	**0.76**

Year - 2005

PROJECT ACRES (2005)	TOTAL ACRES	Riparian Forest		Riparian Shrub		Riparian Herb		E. Wetland		Shrub-steppe/Grassland		TOTAL HUs
		Mink	B.C. Chickadee	Mink	Yellow Warbler	Canada Goose	Mallard	Mallard	Mink	Cal. Quail	Western Meadowlark	
Meninick	**428.00**	64.50	85.14	0.50	0.30	1.05	0.00	0.20	0.65	153.98	196.20	**502.53**
Meninick South	**68.00**	28.50	28.50	2.00	1.41	1.18	1.80	2.00	3.28	10.25	0.00	**78.92**
S. Lat. A (Zimmerman)	**432.00**			12.10	14.03			0.00	71.82	136.43	198.30	**432.69**
Island Road	**243.00**			4.15	6.24	15.19	8.68	2.00	1.40	98.76	91.60	**228.02**
E 80 Pumphouse	**78.00**	17.00	13.17	1.50	1.12	46.78	42.77	4.40	8.25	0.00	91.57	**226.56**
L. Satus Creek	**409.00**	14.48	19.80	0.00	19.69					219.97	93.42	**367.36**
TOTAL	**1,658.00**	**124.48**	**146.60**	**20.25**	**42.80**	**64.20**	**53.25**	**8.60**	**85.40**	**619.40**	**671.10**	**1,836.08**

Notes:	**Riparian forest credited against The Dalles Dam. All other HUs credited to John Day Dam.**

Year - 2006

PROJECT ACRES	TOTAL ACRES	Riparian Forest	Riparian Shrub		Riparian Herb		Riverine		E. Wetland		Shrub-steppe/Grassland		TOTAL HUs
		BC Chickadee	Mink	Yellow Warbler	Canada Goose	Mallard	Mink	G.B. Heron	Mallard	Mink	California Quail	Western Meadowlark	
Bailey	**39.90**				0.00	0.00					0.00	0.00	**0.00**
Mill Creek North	**158.60**		1.40	1.48	10.37	21.56	1.80	0.40			51.65	52.35	**141.02**
Mill Creek South	**165.40**				17.34	42.71					55.95	56.71	**172.72**
Olney Drain	**451.40**		7.28	5.31			1.75	6.13			206.99	148.31	**375.77**
TOTAL	**815.30**		**8.68**	**6.79**	**27.71**	**64.27**	**3.55**	**6.53**	**0.00**	**0.00**	**314.59**	**257.37**	**689.50**

Notes:	**Riverine HUs credited against Bonneville Dam- all other HUs credited against John Day Dam.**