

**Hardner & Gullison**

Independent External Evaluation of  
The Columbia Basin Water Transactions Program  
(2003-2006)

*Prepared by:*

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## About Hardner & Gullison Associates, LLC

Hardner & Gullison Associates, LLC (HGA) is a private consulting firm that provides technical assistance in the field of conservation to foundations, conservation groups, governments, and corporations. Its work includes program evaluation, economic analysis, conservation finance, project design, and corporate environmental management. Members of the firm include among their past and present clients National Fish and Wildlife Foundation, Gordon & Betty Moore Foundation, U.S. Agency for International Development, The World Bank, Inter-American Development Bank, The Nature Conservancy, World Wildlife Fund, Conservation International, National Parks Conservation Association, U.S. Environmental Protection Agency, NOAA National Marine Fisheries Service, BP, Shell Oil Company, Rio Tinto, Compañía Minera Antamina, among others.

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## EXECUTIVE SUMMARY

The Columbia Basin Water Transactions Program (CBWTP) is a partnership between Bonneville Power Administration (BPA) and National Fish and Wildlife Foundation (NFWF) to support non-governmental organizations and state agencies in acquiring water rights for the purpose of enhancing instream flow for the benefit of threatened and endangered anadromous and resident fish species.

This report evaluates the performance of CBWTP in achieving three objectives since its inception in 2003:

- 1) Experimenting with open market transactions for acquiring water rights;
- 2) Increasing water flow in the streams and rivers of the Columbia Basin; and,
- 3) Restoring habitat for anadromous and resident fish in flow-limited reaches of the Columbia Basin.

In addition, it examines:

- 4) Sustainability of water transactions, and the ability of CBWTP to scale up current efforts to address all priority reaches in the Columbia Basin; and,
- 5) Strengths and weaknesses of the CBWTP model and its administration.

The evaluation found that CBWTP has been successful in developing a market for instream water (153 open-market transactions have been made to date), and QLEs have been innovative in the use of a range of transaction tools to do so, including short-term leases, partial season leases, irrigation efficiency projects, and complete transfers of water rights.

In general, the volume of water transacted each year has increased, however the majority of transactions are temporary. Unless temporary transactions are renewed or lead to permanent transactions, cumulative benefits will erode.

The CBWTP has been responsive to the need to conduct sufficient monitoring to ensure that water transactions result in actual increases in instream flow for over 90% of its transactions.

Where CBWTP can improve is in ensuring that water transactions are part of a package of habitat restoration measures that result in fully restored fish habitat. To date, the integration of water transactions with projects to address other ecological limiting factors has been weak. Until all limiting factors to habitat restoration are resolved (e.g. riparian habitat restoration), the benefits of restoring flow will not be fully realized. Over half of the reaches where CBWTP has invested suffer from two or more unresolved ecological limiting factors (such as inadequate riparian habitat). Furthermore, only one-third of the reaches have been scientifically assessed to determine the nature and magnitude of those limiting factors and have a strategy in place to resolve them. The result is that many river reaches with increased flow continue to lack other key ecological attributes to serve as adequate fish habitat.

Furthermore, the monitoring of changes in habitat quality is insufficient to make conclusive statements about the effectiveness of CBWTP in this regard, although this

situation is improving with 68% of reaches being monitored in 2006 (up from 38% at the start of the program in 2003).

CBWTP is a young program and in the opinion of the evaluators, has succeeded overall in making strong progress towards achieving the first two of its objectives. The final objective - restoring fish habitat - is ambitious, and will require time, resources, and sophisticated coordination with many other organizations and government agencies.

CBWTP demonstrates strong leadership at NFWF and has assembled a very constructive and collaborative community of grantees. In our experience as evaluators, this program distinguishes itself in this regard. All involved should be commended, and none should take for granted the unusually strong program of which they are a part.

In this context, we offer a series of recommendations for further improving what is otherwise a promising start for this young program. Our recommendations include:

- 1) Augment existing performance metrics to include measures of progress towards achieving biologically-based flow targets, and overall habitat restoration;
- 2) Integrate instream water transactions with efforts by other organizations to address other ecological factors that are limiting fish habitat;
- 3) Develop guidelines and standards for habitat monitoring;
- 4) Continue to support the full range of temporary and permanent transaction tools for instream flow restoration;
- 5) Accept that instream transactions have high transactions costs and adapt CBWTP funding to accommodate these;
- 6) Develop integrated land and water conservation transactions by promoting better partnership of CBWTP with land conservation organizations.

With the strong foundation that CBWTP has built to date, we believe that the program can continue to expand in scope and sophistication. Both the administrative success and programmatic accomplishments of the CBWTP suggest that the model can be scaled up to cover a broader geographic area in the U.S. West, *and* might be appropriate for other river restoration initiatives beyond water transactions. Certainly the strengths of the CBWTP – a demonstrated ability to strategically coordinate different stakeholder groups (e.g. government regulators and non-governmental organizations) working on common issues, the ability to act as an interface between small grantees and large donors, the ability to foster learning among grantees working on similar issues, and the ability to achieve economies of scale in capacity building – have broad applicability across the U.S. West, as well as in related conservation activities that complement water transactions.

We hope that the information and recommendations presented in this report will help CBWTP to continue to strengthen and grow. We are also confident that CBWTP's collaborative, thoughtful, and inspired community of partners will continue to find ways to improve the program as they go forward towards achieving their objectives for the Columbia Basin.

## INTRODUCTION

A variety of factors threaten anadromous<sup>1</sup> and resident fish in the Pacific Northwest. One of the most important factors is inadequate freshwater stream flow for passage, spawning and rearing habitat. Voluntary water transactions are a potentially important tool for increasing flow in river reaches crossing private land, where public agencies may have little influence and consequently few options for addressing instream flow needs. The National Fish and Wildlife Foundation (NFWF) and the Bonneville Power Administration (BPA) began the Columbia Basin Water Transactions Program (CBWTP) in 2003 to support innovative, voluntary, grassroots strategies that improve instream flows in Columbia Basin streams and rivers.

Since its founding, the program has invested approximately \$10 million through eight qualified local entities (QLE's) to design and negotiate transactions to increase streamflow. The water regulatory agencies of several states have also become QLEs, allowing the CBWTP to bring together some of the most important stakeholders in the voluntary water transaction market.

In November of 2006, NFWF contracted Hardner & Gullison Associates, LLC (HGA) to evaluate the results of CBWTP's investments over the period 2003-2006. The evaluation addresses progress towards three objectives for the Basin:

- 1) Experimenting with open market transactions for acquiring water rights;
- 2) Increasing water flow in the reaches of the Columbia Basin; and,
- 3) Restoring habitat for anadromous and resident fish in flow-limited reaches of the Columbia Basin.

Voluntary water transactions are a relatively novel approach to riparian flow restoration, as is the CBWTP model. In order to test the long-term benefits of such an approach, and the potential applicability of the CBWTP model to other aspects of habitat restoration or to other watersheds, two additional issues were addressed in the evaluation:

- 4) Understanding the sustainability of water transactions, and the ability of CBWTP to scale up current efforts to address all priority reaches in the Columbia Basin; and,
- 5) Evaluating the strengths and weaknesses of the CBWTP model and its administration, and understanding its broader applicability.

Box A contains the complete list of evaluation questions that were developed to address the five main evaluation objectives.

The remainder of this report is organized into three sections: an overview of methodology; a presentation of evaluation results; and finally, a discussion of the results with recommendations for the program.

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<sup>1</sup> *Anadromous* fish are those species such as salmon that spend a portion of their lifecycle in the ocean, but return to spawn in freshwater rivers, lakes and streams.

**Box A: CBWTP Evaluation Questions**

**Test transaction-based mechanisms**

1. Are deals occurring?
  - a. What are their types (lease, purchase, etc ), terms, costs, water volumes, geographic locations?
  - b. Are water transactions ever attached to land conservation deals?
2. What factors are limiting QLEs' ability to conduct water transactions?
3. Which factors create uncertainty for planning future transactions (1, 3, and 10 year timeframe)?
4. Is new knowledge about market development gained in program being effectively disseminated?
  - a. Within network?
  - b. Outside network?

**Increase in-stream flow**

1. Is there an entity monitoring flow in the reaches where transactions are occurring?
2. If so, has in-stream flow in targeted reaches increased as a result of QLE transactions?
  - a. Relative to flow targets (if known) for targeted reaches?
  - b. Is the timing appropriate to ecological needs in targeted reaches?
3. What options are there for increasing the monitoring of flow responses in targeted reaches and to allow for attributions to QLE water transactions?

**Improve habitat for anadromous fish**

1. Is there an entity monitoring habitat in the reaches where transactions are intended to produce benefits?
2. If so, has habitat improved as a result of QLE transactions?
3. What is the scientific basis for understanding the importance of increasing in-stream flow versus other factors in improving habitat to support restoration of anadromous fish populations?
  - a. If improving in-stream flow is not sufficient, what else was required?
  - b. Was it taken care of by QLE or other entities? (Sub-basin Plans, Operations Plan)
4. What options are there for increasing the monitoring of changes in habitat and to allow for attributions to QLE water transactions?

**Understanding the Sustainability of Water Transactions**

1. Are the limiting factors to water transactions being addressed effectively?
2. Can water transactions achieve the scope and scale necessary to restore river habitat in specified geographic priority areas?
3. To what extent are long-term trends (climate change, demographics, land use change) being incorporated into planning?
4. What practices have proven successful in generating cultural acceptance of water transactions? What have been the roles of QLEs in generating cultural acceptance? What have been the characteristics of first adopters among landowners?

**Program Administration**

1. Is CBWTP the appropriate model for implementing a water transactions program?
2. Is it effectively administered?
3. Would the CBWTP model be appropriate for other river restoration initiatives?

## METHODS

We developed the evaluation methodology in collaboration with donors, grantees (QLEs), and a technical advisory committee of the CBWTP in the belief that such an approach generates results and recommendations that are most likely to be relevant, useful, and ultimately accepted by all participants of the program. The following description of the methodology includes a series of iterative steps whereby participants contribute to the development of evaluation questions, criteria for interpreting performance, strategies for data collection, review of summary results, and formulation of recommendations. As a result, we expect that donors and grantees will find the report to be factually accurate and contain analyses and recommendations that are directly relevant to their work.

We conducted the evaluation in seven steps.

### *Step #1: Kickoff meeting with program funders and QLEs*

The evaluation began with an introductory meeting with program funders and QLEs in November 2006 in Portland, Oregon. The meeting served to provide evaluators with background information on the program, including the objectives of the program and the factors that limit the progress of the grantees in achieving those objectives (referred to in this report as “limiting factors”). At this first meeting, funders and grantees provided a suggested list of questions to be answered by the evaluation (see Box A). The evaluators also provided an overview of the evaluation approach and a timeline for its execution.

### *Step #2: Review of program documents, QLE self-evaluations, and relevant literature*

HGA reviewed publications and other technical documents (including those recommended by NFWF) as well as CBWTP program documents and QLE self-evaluation reports that were prepared in September 2006.

In addition, HGA had access to a NFWF database of all water transactions conducted since the beginning of the program in 2003<sup>2</sup>. For each transaction, the database included information on the type of transaction mechanism employed, the volume of water put instream, cost, location, and a number of other variables.

### *Step #3: Form Evaluation Committee*

NFWF, in consultation with BPA and Northwest Power and Conservation Council (NPCC), formed an Evaluation Committee to oversee the evaluation process and to provide technical guidance as needed by the evaluators. Three specialists in water issues in the Columbia Basin comprised the Evaluation Committee: Susan

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<sup>2</sup> The complete database is available to the public via an interactive web-based interface, accessible at [www.cbwtp.org](http://www.cbwtp.org). It is too large in size to include as an annex to this report.



Hannah of Oregon State University; Noelwah Netusil of Reed College and a member of the Independent Economic Advisory Board for NPCC; and, Gail Achterman of Oregon State University.

The evaluation committee assisted in finalizing the list of questions to be answered by the evaluation, the development of an *evaluation framework* (see next step and Annex 1), and the review and interpretation of results.

*Step #4: Develop evaluation framework*

Box A lists the final set of evaluation questions. The questions fall into five broad categories:

1. Test transaction-based mechanisms;
2. Increase instream flow;
3. Improve habitat for anadromous and resident fish;
4. Understand the sustainability of water transactions; and,
5. Evaluate the effectiveness of the CBWTP model and its administration.

To address the evaluation questions, we developed an *evaluation framework* that describes the metrics and source of data required to answer the questions. The complete evaluation framework is provided as Annex 1 of this report.

Embedded within the evaluation framework is an analysis of the *limiting factors* to performing water transactions. We developed the list of limiting factors based on QLE input, QLE self-evaluations, our review of published literature and program documents, and input from the Evaluation Committee. The limiting factors fall into eight basic categories, as described in Box B and fully described in Annex 2 of this report.

Once finalized, the evaluation framework guided the data collection and analysis detailed in the following steps.

Box B: Limiting Factors to Water Transactions in Columbia Basin

Much like a chain that is only as strong as its weakest link, any of the following eight categories of factors can limit the ability of a QLE to perform, or the effectiveness, of water transactions in the Columbia Basin.

Scientific Understanding: *Uncertainty regarding the priority locations for river restoration, flow requirements, long-term trends in hydrology, and relative importance of stream flow for habitat restoration can be a barrier to strategic decision making in the selection of water transactions.*

Public Policy, Legislation, and Regulatory Framework: *A policy or legal context where water rights are not adjudicated, that does not allow or enforce particular types of water transactions, and is not harmonized across government agencies (e.g., agriculture, fisheries, recreation, etc.), can impede water deals.*

Institutional Capacity: *QLEs require the staff and resources to conduct water deals and monitor their outcomes. They must also be supported by well-staffed and competent government agencies to process the transactions.*

Economic Pressures: *Economic activities may compete for water, and long-term trends (e.g. population growth) may result in increasing prices and speculation.*

Compliance and Enforcement: *Unless the terms of a deal can be monitored for compliance, and a practicable legal process exists to enforce them, the benefits of a contractual arrangement might not be realized.*

Stakeholder Support: *The development of an instream water market depends on an understanding among landowners and government agencies of water transactions, and their support for water transactions for instream flow as legitimate open-market activity.*

Finance: *QLEs require sufficient resources to run and expand their institutions, develop deals, and to pay for the acquisition of instream water. To do so, they need a full understanding of the costs of achieving their objectives, and broad donor support to ensure they can cover those costs.*

Market Maturity: *Without willing sellers/lesers, water transactions are not possible. Multiple sellers (and buyers) are generally required to develop clear and competitive price information. Transaction costs (i.e. cost associated with deal negotiation and legal process) may remain high until markets mature and deals become frequent and regular.*

*Step #5: Interviews with QLEs and stakeholders*

HGA performed 60 interviews with QLEs and CBWTP stakeholders. The evaluation began with teleconferences with each QLE to discuss limiting factors and the specific characteristics of their water transactions and monitoring. We also performed telephone interviews with program stakeholders such as State departments of fish and wildlife, biologists, and other government offices and private organizations.

In the course of interviews, QLEs also compiled data for the evaluation on each of the transactions they conducted with CBWTP funding since the beginning of the program in 2003.

HGA evaluators then visited QLEs for face-to-face interviews, at the same time conducting face-to-face interviews with private landowners<sup>3</sup>, water masters from irrigation districts with which QLEs conducted transactions, other NGOs involved in the water issues, and state and federal biologists. The evaluation included approximately one week of interviews in each of four states: Oregon, Washington, Idaho, and Montana.

*Step #6: Data quality assurance and analysis*

HGA compiled and analyzed the data generated in the evaluation and presented the preliminary results to QLEs in a meeting held in July 2007 in Missoula, Montana. The meeting afforded QLEs an opportunity to view the aggregate results of the data collection and to comment on how accurately they portrayed on-the-ground reality. Representatives of NFWF, BPA, and NPCC also attended the presentation and provided feedback. In addition to validating the aggregate data, meeting participants provided input to the interpretation of the data and the possible recommendations that could be made for improving the program.

HGA repeated the same process with the Evaluation Committee.

*Step #7: Writeup*

Building on feedback from donors, QLEs, and the Evaluation Committee, HGA developed this written report. The Evaluation Committee, NFWF, BPA and NPCC reviewed the report in draft form in August 2007 and provided a final round of input that was incorporated in to the final draft that was submitted to NFWF in September 2007.

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<sup>3</sup> Because of the potential for a third party to disrupt the sensitive and complicated nature of QLE-landowner relationships, evaluators talked only to landowners that were suggested by QLEs. However, we were able to corroborate landowner responses with those of the water masters who are familiar with landowner sentiments of the entire watersheds where transactions occur, and with other stakeholders working with landowners in the area.

## RESULTS

In this section we present the results of our data collection following the order of the evaluation questions (see Box A). The concise presentation of results here forms the basis for a synthesis discussion and recommendations in the final section of the report.

### 1. Test transaction-based mechanisms

The first set of evaluation questions address the performance of CBWTP as a pilot project in designing and implementing water transactions across the Columbia Basin, the learning about obstacles to water transactions that has been gained to date, and the degree to which this knowledge has been disseminated both within and outside the CBWTP network.

#### 1.1 Are transactions occurring?

##### 1.1.1 What are their types (lease, purchase, etc), terms, costs, water volumes, geographic locations?

The CBWTP transaction database made available to the evaluators contains information on 153 transactions conducted from 2003-2006 by eight QLEs (Table 1.1). CBWTP has amply shown that it is possible to conduct voluntary water transactions across the Basin, creating a market for instream flow.

The program has used a wide diversity of transaction tools, demonstrating the considerable flexibility of the approach and innovation on the part of QLEs. The majority of transactions have been short-term (5 years or less in duration), either leases (n=84), or agreements to reduce or stop diversion (n=29). There is no clear trend in the use of short-term transactions tools, although the period of time we are evaluating is short. The number of short-term leases implemented each year has remained roughly stable, while the use of short-term diversion reduction agreements is increasing. QLEs have conducted 12 long-term transactions (6 or more years in duration), and 17 permanent acquisitions.

Table 1.1: Number and type of water transactions in the CBWTP portfolio from 2003-2006 included in this evaluation. "Short Term" refers to transactions of 5 years duration or less; Long Term refers to non-permanent transactions over 5 years in duration.

	2003	2004	2005	2006	Total
<b>A. By Water Transaction Tool</b>					
Acquisition (permanent)	2	5	5	5	17
Short Term Donation	2	0	2	1	5
Long Term Donation	2	0	0	0	2
Short Term Lease	24	16	22	22	84
Long Term Lease	3	0	4	2	9
Short Term Diversion Reduction	3	4	9	13	29
Long Term Diversion Reduction			1		1
Short Term Miscellaneous	0	1	1	0	2
Long Term Miscellaneous	1	0	2	1	4
Total	37	26	46	44	153
<b>B. By Duration</b>					
Short Term	29	21	34	36	120
Long Term	6	0	7	3	16
Permanent	2	5	5	5	17
Total	37	26	46	44	153

QLEs have also demonstrated a considerable diversity in the methods used to increase flow within each of the major transaction tools (Table 1.2). Approaches include completely drying up land, irrigation efficiency projects, partial season leases that are triggered at either at a fixed date or quantity of water used, and partial season leases that only are triggered if in-stream flow drops below a certain threshold.

Table 1.2: Some methods of increasing flow  
for a sample of water transaction types.

Transaction Tool	Method of increasing flow
Acquisition	Conserved Water
	Diversion Relocation
	Dry up land
	Stored Water
Diversion reduction	Full season
	Partial season
	Split season
	Partial season, when flow hits threshold
Short Term Lease	Diversion Reduction
	Diversion Relocation
	Split Season
	Partial Season
	Full Season
	Full Season and Source Switch
	Stored Water Release

CBWTP contracts Westwater Inc. to summarize the terms of the transactions that have been conducted each year, including the volumes of water transacted, the types of transactions, their location, and price<sup>4</sup>. Based on the data presented by WestWater, it is clear that the program is steadily increasing its geographic coverage across the Basin. Transactions occur mainly in the Columbia Plateau and Mountain Columbia sub-basins – by 2006, 61 5<sup>th</sup>-field HUCCS<sup>5</sup> had transactions in them, with an average geographic expansion of 15 HUCCS per year since the program began<sup>6</sup>. Pricing is more difficult to generalize given the range of transaction mechanisms and their terms, and this in fact may be a reason for a somewhat lengthy process of arriving at consistent pricing across the portfolio.

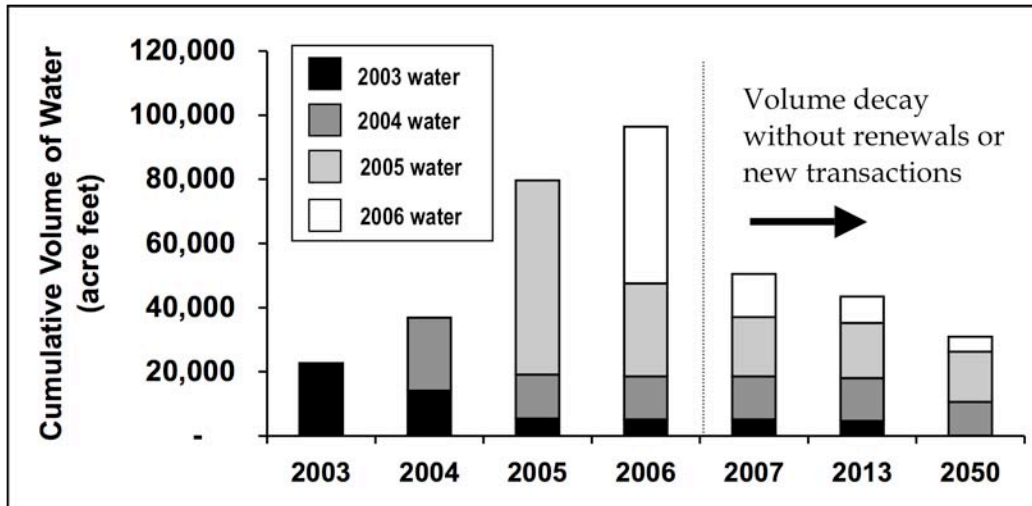
The volume of water transacted each year is generally increasing (although in 2006 less water was transacted than in 2005), and the cumulative water instream has increased each year since program inception (Figure 1.1.). However, as noted above, the majority of transaction tools employed are temporary and short term. Unless temporary transactions are renewed or lead to permanent transactions, or new transactions are found to replace the loss of temporary transactions, cumulative benefits will erode. To date, 67% of one-year diversion reduction agreements have led to renewals or transfers, and 81% of one-year leases, so there is no reason at present to believe this erosion will occur as long as CBWTP continues to support QLEs.

<sup>4</sup> For the latest report, see: WestWater Research Inc. 2007. *Columbia Basin Water Transaction Program: Annual Economic Report 2006*. Vancouver WA. 47 pp.

<sup>5</sup> HUCCS, or hydrologic unit codes, divide the U.S. into watersheds in order of decreasing scale.

<sup>6</sup> A general map of transaction distribution has been developed by WestWater Research and may be available upon request from CBWTP.

Figure 1.1 Volume of CBWTP acquisitions by year. (Calculations by J. Morin, Mentor Law Group)



What is not revealed from simple flow data, however, is the contribution towards ecological goals that the transacted water makes. Key information is missing in terms of determining the benefit of water transactions for fish populations. First, where is flow in relation to biological needs? If flow requirements are met, what other ecological limiting factors prevent this reach from being fully restored for the target species? What is the overall need for instream flow transactions across all the priority sub-basins, and how does this compare to the scale of work that has been accomplished to date?

Without the above information it is hard to say much about the cost effectiveness of water transactions. For example, what is the marginal benefit of acquired water if total flow in the river remains below a critical threshold, or if other critical ecological factors prevent the habitat from benefiting target fish species? The timing of flow with respect to fish needs will also impact cost effectiveness. For example, perhaps a partial year lease serves to restore flow, for less money than a full-year lease or complete transfer, but this difference is lost in aggregated cost figures that measure effectiveness in terms of units of water over time?

### 1.1.2 Are water transactions ever integrated with land conservation?

Interest is growing in the potential to link water transactions to land conservation. The potential advantages in doing so are many, including:

- The possibility that water rights can be permanently and cost-effectively acquired by buying land;
- The potential for tax benefits;
- The possibility that conservation easements can be placed on land to permanently reduce development pressure, thereby protecting riparian habitat and preventing future increase in water use; and,
- The potential to undertake a broader range of restoration activities, such as improving riparian habitat, than is possible by conducting water transactions on their own.

There are some barriers to a closer integration of water with land conservation, including a distrust by some land conservancies of how water transactions can impact the viability of maintaining a working landscape (which some land conservancies aim to protect), and the legal complexity that managing for both aquatic and terrestrial conservation values may introduce into conservation deals. Apparently though some CBWTP QLEs feel that the advantages outweigh the disadvantages, and they have participated in a number of integrated deals<sup>7</sup>, with several large integrated deals currently underway.

The potential benefits of integrating land and water conservation deals was a “Hot Topic” for discussion at the July 2007 QLE meeting in Montana and Idaho, and certainly merits more evaluation by CBWTP.

## 1.2 What factors are limiting QLEs’ ability to conduct water transactions?

Identifying the factors that are impeding the ability of QLEs to conduct water transactions when and where they need to conduct them is of critical importance for strategic planning for both the QLEs and the CBWTP program as a whole.

Limiting factor scores for the CBWTP portfolio are shown in Figure 1.2. The three highest median scores (meaning the largest barriers to conducting water transactions for QLEs) were:

- Coordination of donor support;
- Existence of adequate sellers; and,
- Transaction costs.

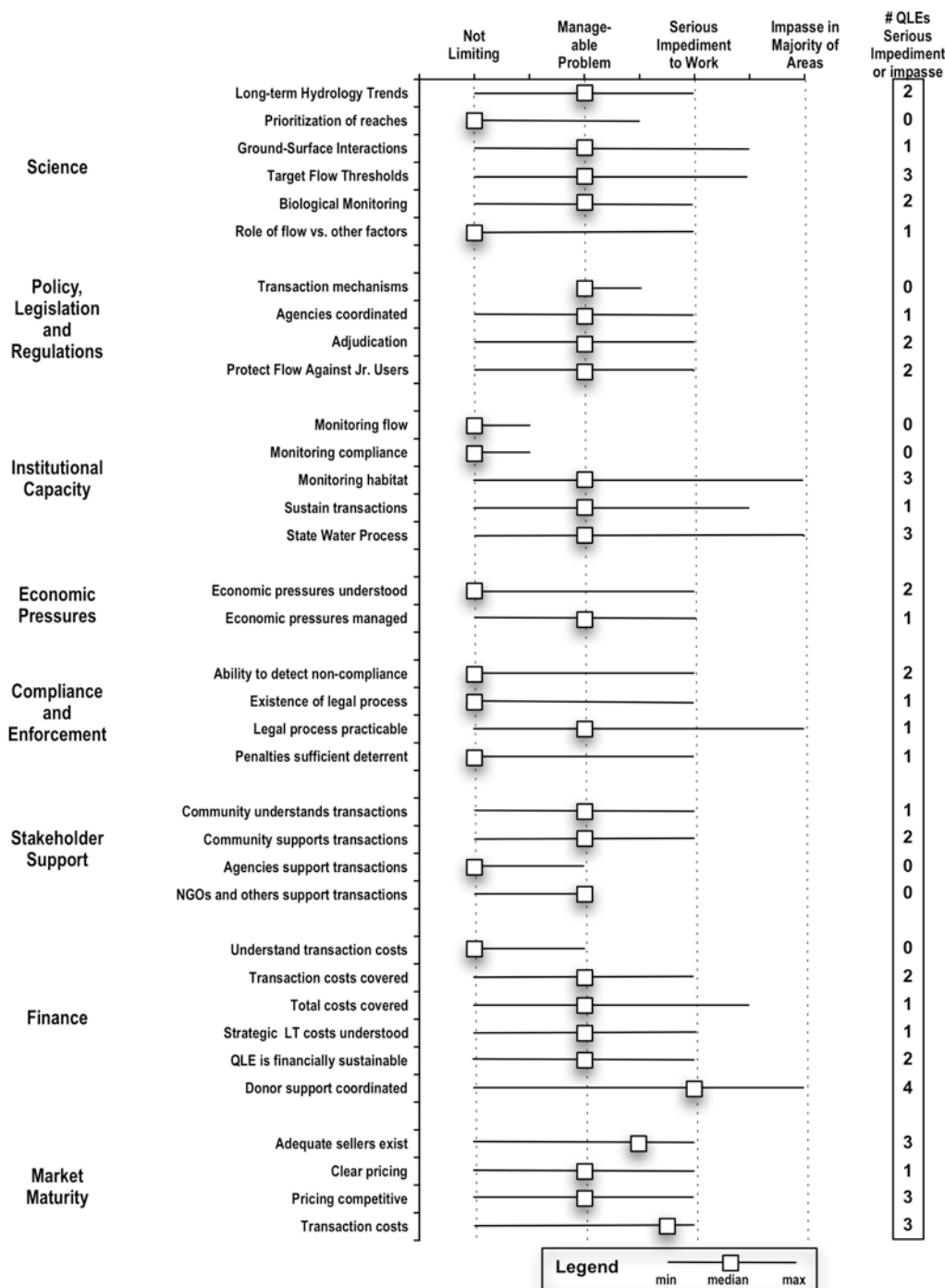
With the exception of these three limiting factors, the median score for all remaining limiting factors suggests that QLEs are able to manage most other issues. However, there is considerable variation in the extent that many of the limiting factors are impacting the QLEs, and in most cases one or more QLE finds a particular limiting factor to be creating serious difficulty.

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<sup>7</sup> QLEs report that the following number of transactions were integrated with land deals: in 2003 - 3 transactions, 2004 - 1 transaction, 2005 - 4 transactions, 2006 - 3 transactions.



Figure 1.2. Median, minimum and maximum scores for factors limiting the ability of eight QLEs to conduct water transactions in the CBWTP portfolio\*. Only the feedback from QLEs actively involved in conducting water transactions is considered here. The number of individual QLEs that scored each limiting factor as either a “serious impediment to work”, or an “impasse in the majority of areas” is shown in the final column.



\*Occasionally, QLEs scored limiting factors in between the four choices that they were offered; these are indicated as values between categories in the graph when they coincided with maximum values for a particular limiting factor.

### 1.3 Which factors create uncertainty for planning future transactions (1-, 3-, and 10-year timeframe)?

QLEs identified a number of limiting factors that create uncertainty in future planning. We attempted to put a finer point on the level of uncertainty by asking the timeframe in which this might be resolved (i.e. 1, 3, 10 years), but such precision proved difficult to achieve.

- Science – climate change – Although QLEs are generally aware that climate change is occurring and that it may impact the long term sustainability of the transactions in which they are involved, there is considerable uncertainty over the specific changes in total precipitation, evaporation, and timing of run-off that will result from climate change, and few if any QLEs are actively managing their portfolios to mitigate these risks (see also Results 4.3).
- Science – biological monitoring – QLEs typically rely on government agencies or other third parties to conduct habitat and biological monitoring, and the QLE may have little control over where and how these agencies do their work. Furthermore, it was noted in several states that agency budgets are under threat.
- Science – groundwater hydrology – There were several examples where the surface-groundwater interactions were poorly understood, particularly in Oregon and Washington. Until the science is improved in these areas, the net benefits of irrigation efficiency, or surface-groundwater swaps, may be unknown.
- Science – flow targets – Several states lack biological flow targets without which it is difficult or impossible for QLEs to determine “how much water is enough” and the marginal benefit of adding “some” water. Until robust biological flow targets are consistently available, the additional instream flow needed to meet biological targets and achieve CBWTP programmatic goals is highly uncertain.
- Public policy – lack of permanent transaction – Although the variety and flexibility of transaction tools available usually mean that there is a transaction tool that landowners are willing to accept, the majority of transactions are temporary. This creates significant uncertainty in what it will cost to renew these transactions when they are renewed at future dates.
- Economic pressures – managed – There are several economic trends whose net impact on instream flow is poorly understood. There is a new generation of large-scale landowner, typically wealthy and often living out of state, who may be more sympathetic to conservation objectives on their land than traditional landowners. On the other hand, ignorance of water law and inflated expectations of what their water is worth can at times make them more, rather than less, difficult to work with than traditional landowners. The net impact of increasing density from the development of agricultural land is poorly understood (at least by grantees). Finally, the impact of new agricultural crops such as biofuels on local hydrology is also poorly understood.
- Compliance and enforcement – legal process exists, is practicable, with sufficient deterrents – Problems enforcing against *junior* users in streams that are not adjudicated or decreed has not limited the work of QLEs to date, in part because they have chosen to do transactions where the need for enforcement is minimized (for

example, at the confluence of streams, where there are no junior users to worry about). However, as QLEs enter into transactions with greater exposure to junior users, then the lack of a practicable legal system with sufficient deterrents may become a limiting factor.

- Finance – understanding total costs – Neither the individual QLEs nor the CBWTP as a whole understand the total cost of resolving all the priority flow issues in their regions. Most QLEs simply work at their maximum capacity conducting transactions without a greater understanding of the resources required to comprehensively address all the priority instream flow problems in their region. This raises the possibility that current CBWTP funding levels are inadequate, although to what extent will not be known until strategic planning is carried out. A shift from temporary to permanent transactions that at least initially are more expensive to complete will also create uncertainty about adequacy of current financial resources. A final impediment to QLEs in understanding total costs is that the actual amount and cost of the instream flow component to restore a particular reach may not be known until the other components of restoration are completed; thus QLEs will need to work with other stakeholders to do their strategic financial planning.
- Market Maturity – adequate sellers exist – Many QLEs expressed concern that as the easy water transactions are done first, the availability of willing sellers of water may become a more important limiting factor down the road. A shift in CBWTP's focus from simply working on instream flow issues, to comprehensively addressing salmon recovery, would exacerbate this trend as QLEs would have much less flexibility regarding where and with whom they worked.
- Market Maturity – transaction costs – QLEs expressed considerable uncertainty of how transaction costs will evolve over time. Factors that might lead to higher transaction costs include:
  - because the easiest transactions are done first, future transactions will likely involve more parties and therefore greater complexity; and,
  - future transactions will also likely involve more junior users, which will increase monitoring and legal costs in reaches that are not decreed or adjudicated.Factors that might lead to a decrease in transaction costs include:
  - QLEs may become better at selecting transactions with fewer legal complications;
  - cultural acceptance for water transactions may increase over time, reducing the time and effort QLEs need to invest in setting up transactions;
  - the proportion of sub-basins that are adjudicated will increase over time, thereby reducing the time and effort that QLEs must invest in setting up and monitoring transactions; and,
  - scientific understanding of hydrology, and groundwater-surface interactions will improve, so there will be less need for QLE's to invest in obtaining this information.

Currently QLEs track the time and costs spent developing transactions. Analysis of existing transaction cost data suggests that transaction costs are increasing over time<sup>8</sup>.

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<sup>8</sup> Horne, A. A. Purkey & T. McMahon. 2007. Purchasing water for the environment in unregulated systems – what can we learn from the Columbia Basin. Unpublished draft manuscript. 9 pp.

However, the CBWTP program director expressed considerable uncertainty about whether the various QLEs have interpreted guidance on transaction cost reporting in a consistent manner, or even whether the same QLE has reported transaction costs in a consistent manner over time. This uncertainty precludes a more detailed analysis of existing transaction cost data.

#### 1.4 Is new knowledge gained in the program being effectively disseminated?

The final evaluation question in this section asks how effective the CBWTP has been in disseminating the considerable experience that has been gained in conducting water transactions both within and outside the CBWTP network.

##### 1.4.1 Within the CBWTP network?

The majority of QLEs felt that the twice-yearly QLE meetings provided an excellent opportunity to become familiar with the CBWTP staff and the activities and knowledge generated by the other QLEs, and that there was not much more that CBWTP staff could be doing to promote the exchange of new knowledge within the network.

Some QLEs lamented the fact that the number of meetings each year had decreased over time, while others felt that two meetings were sufficient. QLEs generally liked the format of the meetings, although some felt that the meetings might benefit from the attendance of fewer outsiders.

In addition to the time spent together at the meetings, most QLEs stated that the personal network they established with other QLEs enabled them to contact those QLE's outside of the meetings for help on issues. These "off-line" interactions seem to be where much of the knowledge sharing took place.

##### 1.4.2 Outside the network?

CBWTP contracts Jeff Gersh at NarrativeLabs to help publicize the program externally. In our opinion, the CBWTP annual reports and website are well designed, particularly for an NGO or donor audience. Some QLEs thought that the work of NarrativeLabs at publicizing CBWTP to higher-level stakeholders, such as government agencies, had been effective, while other QLEs were unaware of the impact of these materials.

QLEs were mainly able to comment upon the utility of NarrativeLab materials for their own work with landowners. Some QLEs felt that landowners had very little interest in CBWTP *per se*; rather, water transactions were developed on a personal (rather than institutional) level, and landowners viewed CBWTP as just one of several funding sources used to fund the transactions. As such, the NarrativeLab materials, at least as currently formulated, were not heavily utilized by QLEs to support their landowner interactions. QLEs did not think communication materials were unnecessary however; some expressed interest in engaging NarrativeLabs to develop locally appropriate materials, while others thought it would be easier to work with a local communications company, both for logistical reasons (easier to meet face-to-face to develop products), and because local companies might understand local stakeholder groups better.

Independent of whoever creates them, the nature of communications materials to support transactions with landowners requires some careful thinking. At least at present, transactions tend to be very targeted (i.e., a QLE needs to work on a particular reach) meaning there is a very small number of potential landowners involved. Thus communications need to be focused on a small number of potentially very different types of people. Further, as mentioned above, landowners view the negotiations as taking place between individuals rather than institutions, so the communications materials may need to reflect more the personal qualities and history of the QLE staff rather than information on the institutions involved.

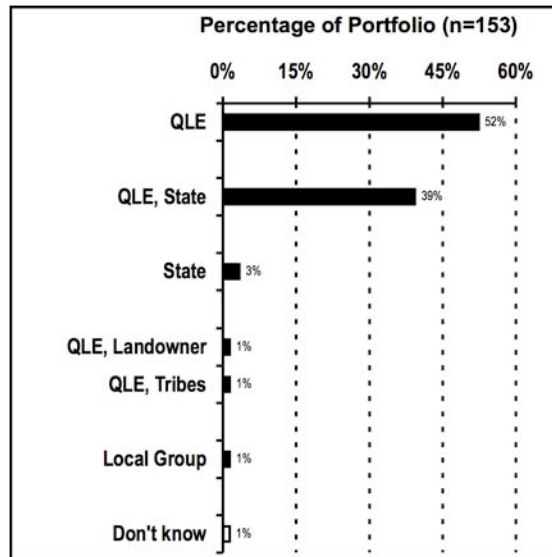
We suggest that QLEs be engaged directly, perhaps at the next QLE meeting, to determine whether and what type of support they would like, and how to achieve this. If QLEs express a general need for communications materials to support their transactions, perhaps a useful next step would be to have NarrativeLabs or local communications companies spend some time with QLEs attending public meetings and interacting directly with a sample of landowners.

## 2 Increase instream flow

The next series of evaluation questions address the extent to which QLEs are monitoring and achieving their targets in instream flow, and the relationship of these gains to biological flow targets for the reaches where the transactions take place.

2.1 Is there an entity monitoring flow in the reaches where transactions are occurring?

Figure 2.1. Flow monitoring by entity



An entity monitored flow for nearly all of the transactions in the CBWTP portfolio (Figure 2.1). QLEs, or QLEs in combination with the relevant state agency, were the entities responsible for measuring flow for the vast majority of transactions.

QLEs felt that flow monitoring was sufficiently rigorous to ensure the compliance of their partners to the terms of the water transactions for over 90% of the transactions, and reported virtually no instances of partners not complying with the terms of transactions.

Where illegal use of transacted water by junior water right holders was a possibility, QLEs also felt that flow monitoring was sufficient to enforce water rights against downstream junior users for the majority of transactions. Ninety-three percent of transactions either had sufficient monitoring to detect violations by junior users, or junior users were not a concern. QLEs reported many instances of water masters enforcing against junior users during the normal administration of water resources. In unadjudicated reaches, there were no examples where action had to be taken against junior users. It should be noted though that many transactions have been specifically designed to minimize exposure to junior users, so this issue may become more important in the future when there is less flexibility where transactions are carried out.

These findings reinforce those of the limiting factor analysis in section 1.2 that showed that flow monitoring, and compliance monitoring to other terms of water transaction agreements, were some of the factors least limiting the activities of QLEs.

## 2.2 If so, has instream flow in targeted reaches increased as a result of QLE transactions?

In order to help ensure that transacted water generates benefits for fish, we examined whether the reaches where transactions were conducted had biological flow targets, and whether the transaction had been able to meet these flow needs.

### 2.2.1 Relative to flow targets (if known) for targeted reaches?

Eighty percent of transactions took place in reaches where flow targets exist (Figure 2.2). However, there is considerable heterogeneity in how those targets were generated. Generally, targets break down into three groups: flow-based targets, which may not be specifically linked to the requirements of fish (e.g., estimated natural average flow); passage targets (derived from Physical Habitat Simulation Software (PHABSIM) or other method); and, habitat targets (derived from wetted perimeter, R2Cross Software, PHABSIM or other method).

Examining the incidence of flow targets by transaction tool and over time can help determine whether there are any systematic differences among transactions that occurred in reaches with biological flow targets, and those that did not. The incidence of flow targets by transaction tool is shown in Figure 2.3. Long-term donations and long-term leases had higher incidence of flow targets than did short-term transactions of these types. This pattern makes sense, with QLEs investing more resources in transactions of longer duration in areas where biological needs were known (or investing more in generating biological flow targets where they had invested more in long-term agreements). There does not appear to be any trend in the incidence of flow targets over the four-year evaluation period (Figure 2.4).

Figure 2.2: Incidence and type of flow targets for CBWTP transactions according to QLEs.

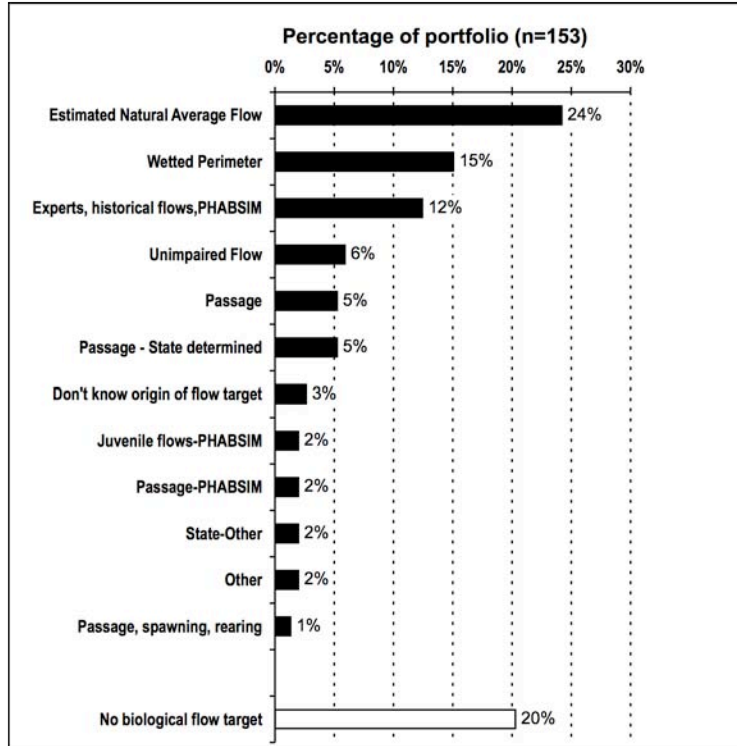


Figure 2.3: Incidence of flow targets by transaction tool used

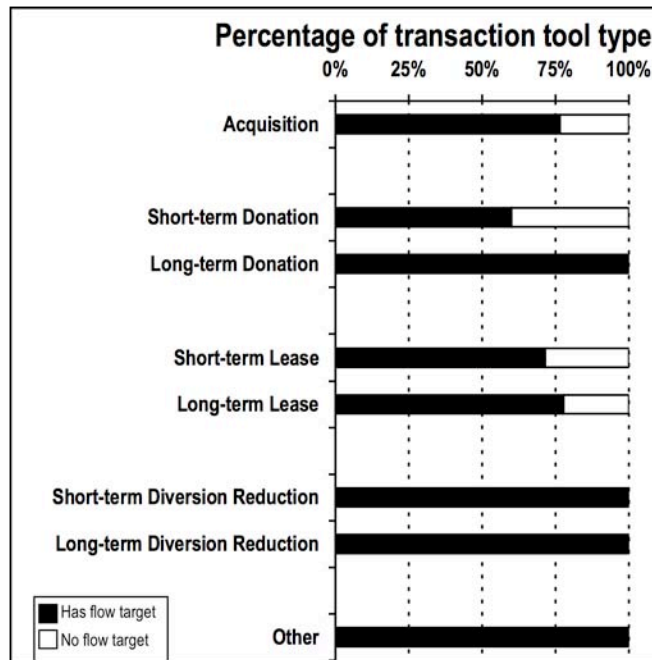
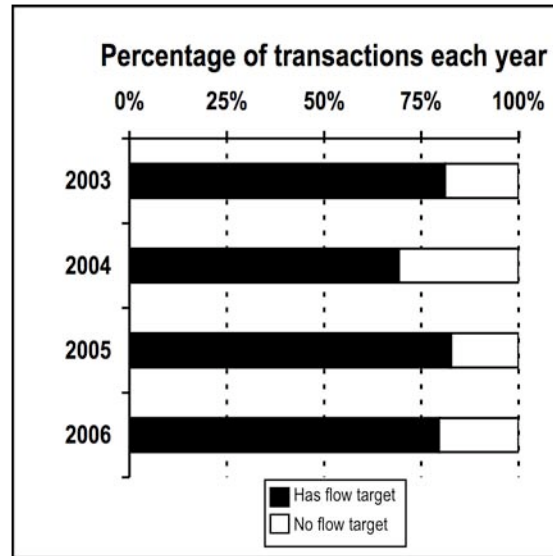


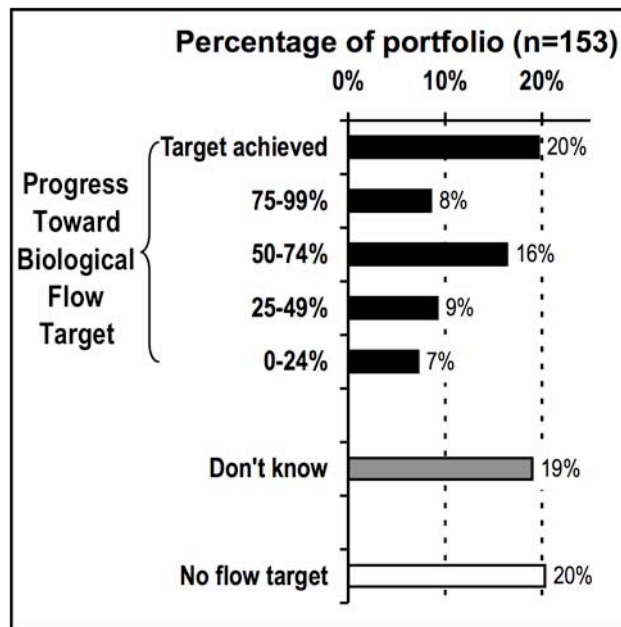


Figure 2.4: Frequency of transactions with flow targets over time



Finally, QLEs reported that biological flow targets had been fully achieved for 20% of reaches where transactions occurred (Figure 2.5). Another 40% of reaches still had need for additional flow to meet targets, the median status of current flow being one-half to three-quarters of what was needed to meet the biological target. Finally, QLEs did not know where post-transaction flow was in relation to the biological target for the reach in 20% of the transactions, although QLEs were aware that a biological flow target did exist.

Figure 2.5: Progress towards flow targets according to QLEs



### 2.2.2 Is the timing appropriate to ecological needs in targeted reaches?

Not only must the *quantity* of water transacted be sufficient to meet biological flow targets, but the timing of water delivery must be appropriate. QLEs reported that the timing of water delivery was appropriate for ecological needs for 39% of the transactions; timing was not appropriate for 22% of transactions; and QLEs either did not know if timing was appropriate, or there were no flow targets, for 39% of the transactions.

### 2.3 What options are there for increasing the monitoring of flow responses in targeted reaches and to allow for attributions to QLE water transactions?

The results show that QLEs have been effective in ensuring monitoring of flow responses in targeted reaches. Virtually all transactions have (or had) sufficient monitoring in place to ensure compliance to the terms of the transaction, and to protect transacted water instream against junior users.

The next issue with which the CBWTP must grapple is to ensure that all transactions are occurring in reaches that have robust biological flow targets. This is of critical importance because without flow targets, the CBWTP and QLEs do not have a defensible basis to decide how much water is needed in a particular reach.

The results show that according to the perception of QLEs, a significant portion of the transactions in the CBWTP portfolio are occurring in reaches with no biological flow target, or have flow targets that are based on historical rates (e.g., estimated natural average flow (ENAF)), but that may not be entirely adequate to ensure the flow needs of anadromous fish. Furthermore, for those reaches that do have biological flow targets, the majority still require additional instream flow to meet these targets. In short, a great deal of work remains to be done to ensure that all of the reaches where QLEs conduct transactions have rigorous flow targets, and that these targets are fully met.

It is possible that the true incidence of flow targets is greater than the QLEs are aware of and reported. If this is the case, it indicates a lack of integration and understanding by the QLEs of their efforts in the context of all the restoration activities taking place in the region, which is concerning. A lack of integration of the efforts of some QLEs into the larger restoration efforts is suggested by the fact that for nearly 20% of the reaches where transactions had taken place, QLEs knew that there were flow targets, but did not know where post-transaction flow was in relation to these targets.

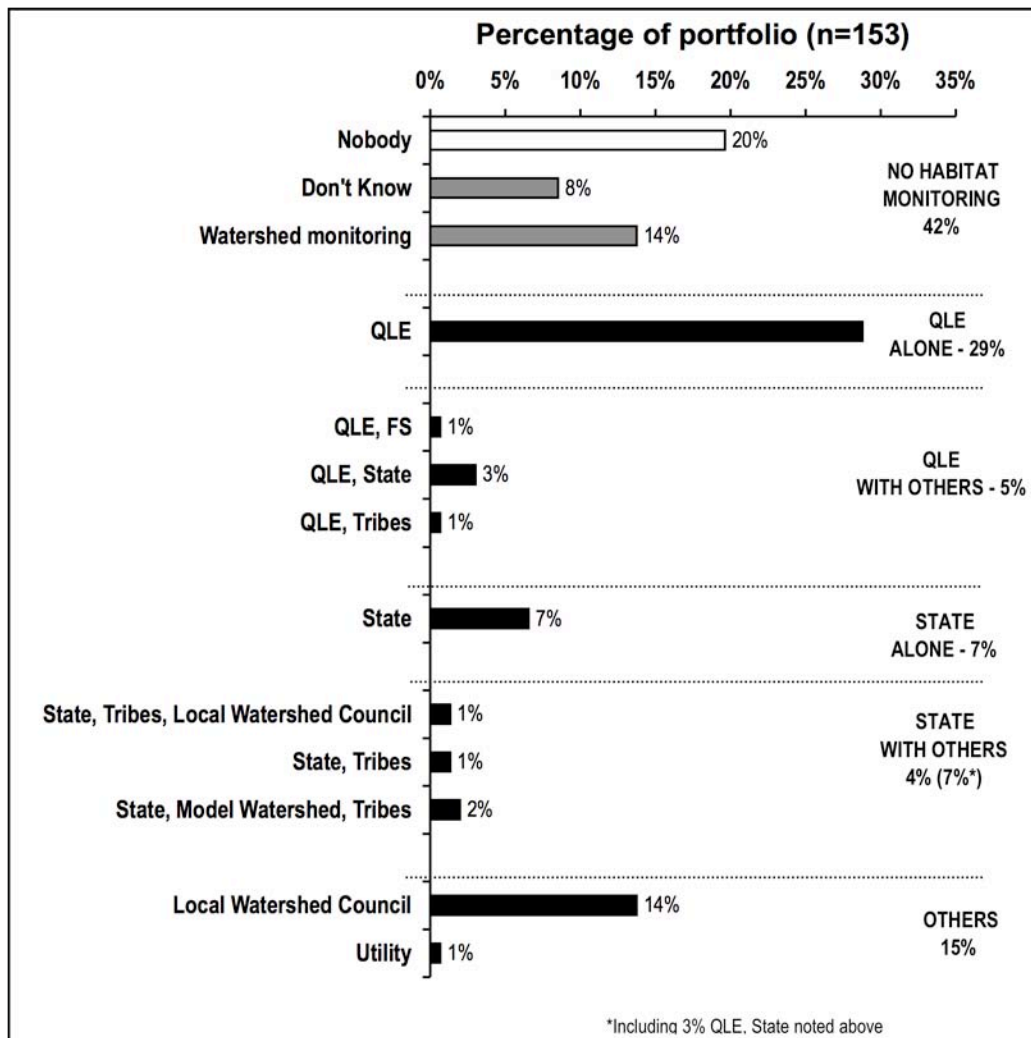
## 3 Improve habitat for anadromous fish

The next set of evaluation questions addresses the issue of whether the transactions in the CBWTP can be demonstrated to have generated habitat improvements likely to benefit fish populations. This includes whether QLEs or others are conducting habitat monitoring, and whether there has been an assessment and restoration plan for other ecological factors that might prevent fish populations from responding to increases in instream flow.

3.1 Is there an entity monitoring habitat in the reaches where transactions are intended to produce benefits?

QLEs were aware of an entity measuring some aspect of habitat (it is possible that monitoring is occurring but the QLE is not aware and not using this information) for 58% of the reaches where transactions had occurred (Figure 3.1). Habitat monitoring was most often carried out by the QLEs themselves or in combination with a third party (34% of reaches). Relevant state agencies monitored habitat for about 7% of the transactions, and another 7% of transactions in combination with other entities. Local watershed councils monitored habitat for a significant number of reaches as well. Forty-two percent of transactions either had nobody monitoring habitat (to the best knowledge of QLEs), the QLEs did not know if anyone was monitoring habitat or not, or there was no monitoring of the specific reach where the transaction occurred, but there was larger scale habitat monitoring elsewhere in the watershed.

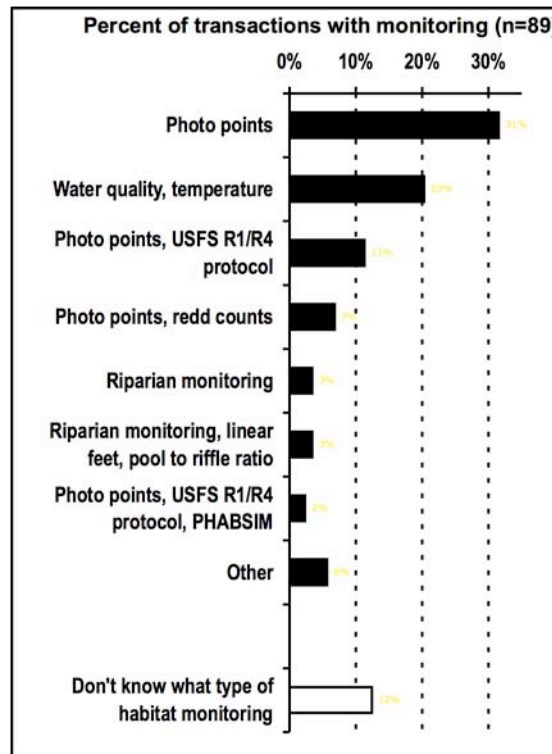
Figure 3.1: Incidence and entities conducting habitat monitoring of CBWTP transactions. (“Watershed monitoring” refers to transactions with no specific monitoring of the reach where they were carried out, but with larger scale watershed monitoring occurring).



3.2 If so, has habitat improved as a result of QLE transactions?

Habitat monitoring took many forms, most of it quite rudimentary (Figure 3.2). The most common approach utilized was photo points to qualitatively monitor riparian cover. The next most prevalent form of habitat monitoring was simple measures of water quality, such as temperature and sedimentation. A small number of transactions took place in reaches with more comprehensive habitat monitoring.

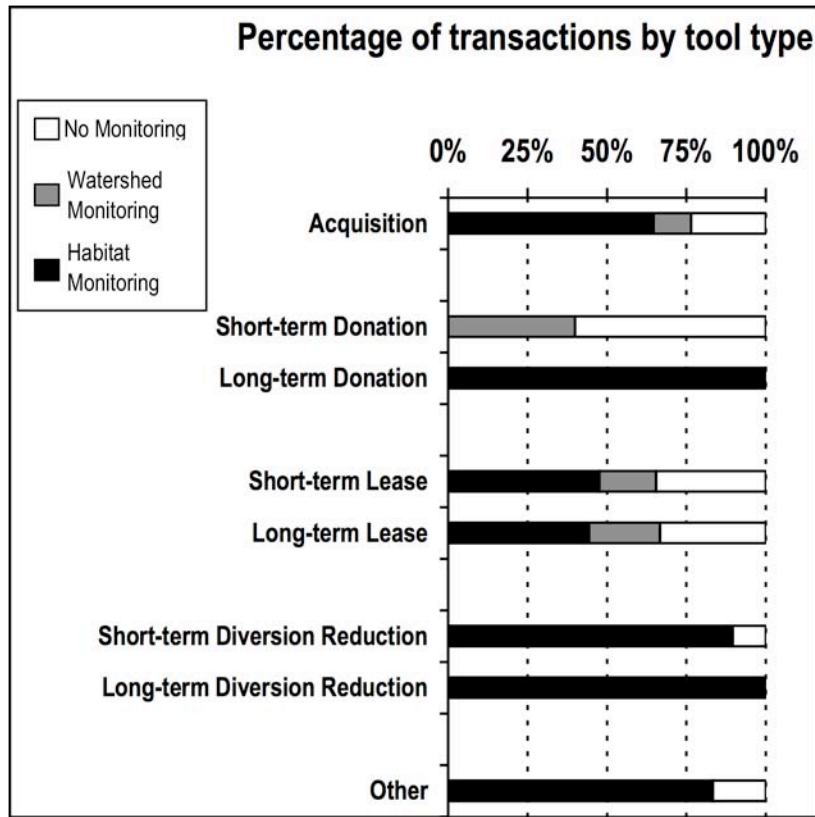
Figure 3.2: type of monitoring occurring for those transactions with habitat monitoring



Examining the incidence of habitat monitoring by transaction tool and over time can help determine whether there are any systematic differences among those transactions that occurred in reaches with habitat monitoring, and those that did not.

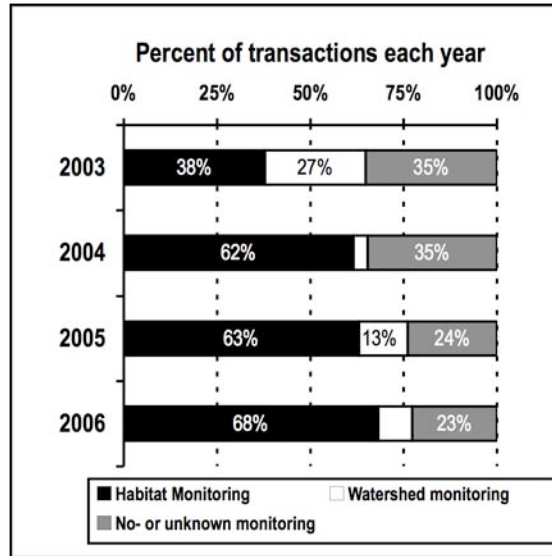
Only about half of the short- and long-term leases occurred in reaches with habitat monitoring (Figure 3.3), while nearly all of the short-term and long-term diversion reduction agreements were located in reaches with habitat monitoring. As was the case with the incidence of biological flow targets, this result is somewhat counterintuitive, with the highest incidence of monitoring occurring for the weakest class of transaction tool.

Figure 3.3: Incidence of habitat monitoring by transaction tool



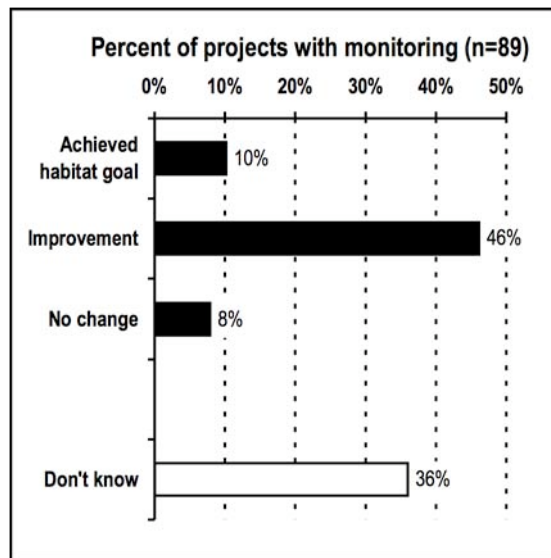
Habitat monitoring has steadily increased over the four years of the program. By 2006, nearly 70% of the transactions (all tools described above) occurred in reaches with some type of habitat monitoring (Figure 3.4).

Figure 3.4: Incidence of habitat monitoring over time



Of the 89 transactions (58% of the entire CBWTP portfolio) that monitored some aspect of habitat, about 10% of these transactions had attained their habitat objective (Figure 3.5). For 46% of the transactions with habitat monitoring, QLEs stated that habitat was improving, but had not yet met the objectives. No change was noted for 8% of the transactions. For the remaining 36% of transactions with habitat monitoring, QLEs didn't know where habitat was in relation to the objectives, either because there was monitoring but no target, another agency was doing the monitoring and QLE was not aware of the results, or it was too soon to identify any trends.

Figure 3.5: Improvement in habitat where transactions have occurred



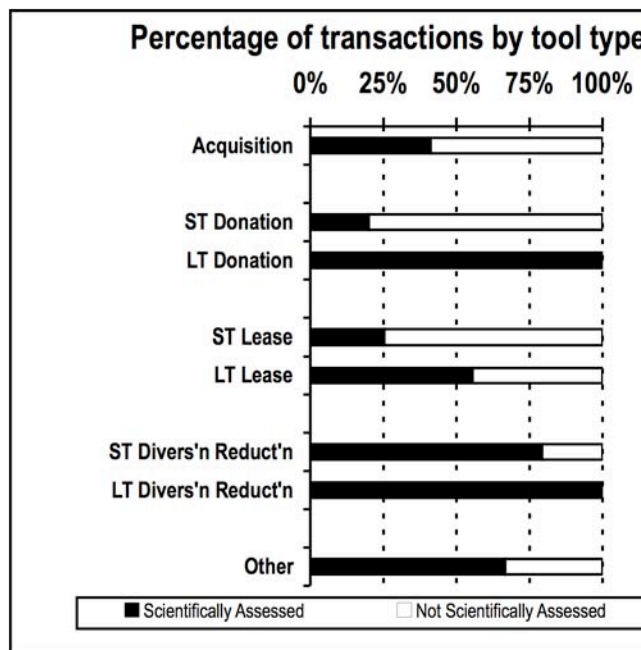
3.3 What is the scientific basis for understanding the importance of increasing instream flow versus other factors in improving habitat to support restoration of anadromous fish populations?

QLEs reported that less than half of the transactions (42%, or 63/150) took place in reaches that had been scientifically assessed for all ecological limiting factors (biology, riparian cover, geomorphology, water quality, and connectivity<sup>9</sup>). Another 48% (72/150) of reaches had been either non-scientifically assessed, or only partially assessed, for other ecological limiting factors. QLEs were unable to provide any information on ecological limiting factors for the remaining 10% of the reaches.

Examining the incidence of scientific assessment by transaction tool and over time can help determine whether there are any systematic differences among those transactions that occurred in reaches with a scientific assessment for limiting factors, and those that did not.

The incidence of scientific assessment was highest for diversion reduction agreements (Figure 3.6), paralleling the findings for the incidence of habitat monitoring and flow targets. The incidence of scientific assessment for permanent acquisitions was only 40%, surprisingly low for a transaction tool that requires the largest financial investment. Short-term donations, leases and diversion reduction agreements had lower incidences of scientific assessments than their long-term counterparts, as might be expected.

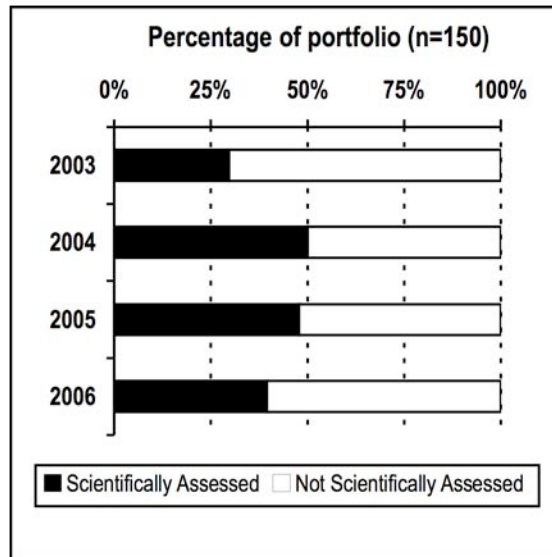
Figure 3.6: Incidence of scientific assessment of ecological limiting factors by transaction tool



<sup>9</sup> As described in: Annear, T. and 14 other authors. 2004. *Instream Flows for Riverine Resource Stewardship, revised edition*. The Instream Flow Council, Cheyenne, WY.

There was no clear trend in the incidence of scientific assessment over the four-year evaluation period (Figure 3.7).

Figure 3.7: Incidence of scientific assessment of ecological limiting factors over time



3.3.1 If improving instream flow is not sufficient, what else was required?

The median number of other ecological limiting factors was 2 for the 63 reaches that had been scientifically assessed (min=1; max =4) (Figure 3.8). The median is the same when we also consider reaches with partial or non-scientific assessments. QLEs most often cited riparian vegetation as the ecological factor limiting habitat where water transactions have taken place, closely followed by water quality, then geomorphology and connectivity (Figure 3.9)

Figure 3.8: Number of other ecological factors limiting habitat

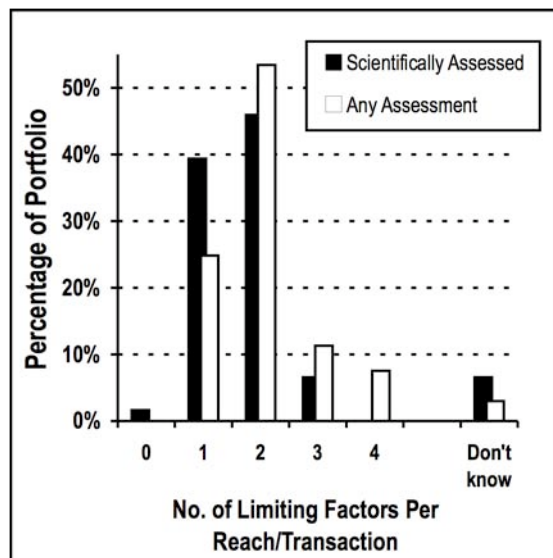
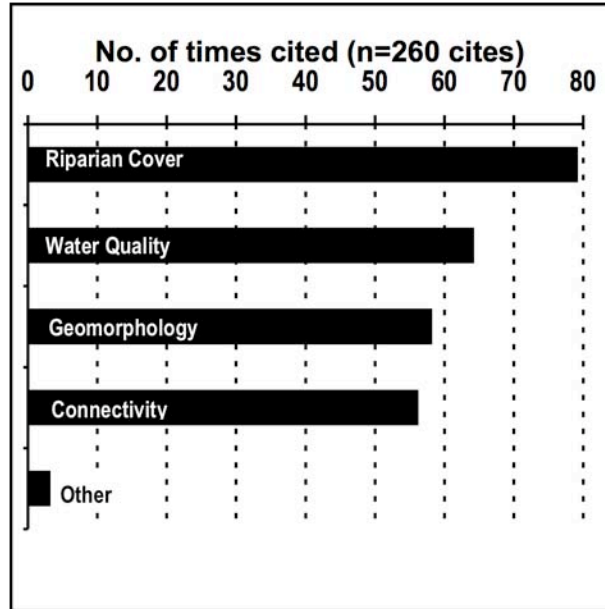




Figure 3.9: Frequency ecological factors are cited as limiting fish habitat in reaches that have been scientifically assessed

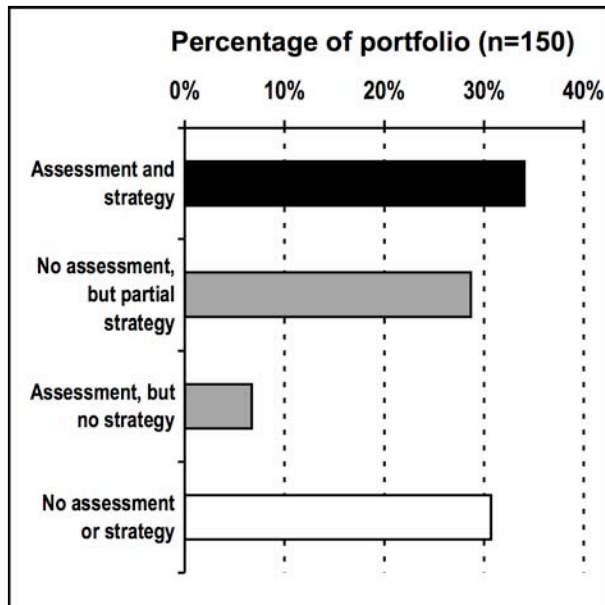


With regard to the extent that QLEs had designed and implemented strategies to resolve ecological limiting factors (Figure 3.10):

- 34% of the transactions in the CBWTP portfolio had a scientific assessment and a strategy to resolve ecological limiting factors
- 29% had no scientific assessment, but had put together a strategy to address the limiting factors of which they were aware
- 7% had a scientific assessment, but did not have a strategy to follow through to resolve the ecological limiting factors that had been identified
- 31% had no scientific assessment or strategy

For those transactions that had a strategy to address scientific or partial assessment of limiting factors, 16% had successfully implemented the strategy, and 84% have not yet fully implemented it.

Figure 3.10: Degree ecological limiting factors are scientifically assessed *and* addressed in reaches where transactions are occurring



### 3.3.2 Were other ecological limiting factors “taken care of” by QLE or other entities?

Multi-stakeholder teams drawn from relevant state/federal agencies and the NGO community typically conduct the scientific assessments of ecological limiting factors, and subsequently design and implement the strategy to resolve them. CBWTP QLEs may or may not take part of the scientific assessment, and their role in restoration is typically limited to the instream flow component of restoration.

Some examples of the guiding documents and team composition from sub-basins where particularly good examples of an integrated approach to restoration have taken place include: The Blackfoot - the Blackfoot Action Plan<sup>10</sup>; and, The Salmon - the SHIPUSS multi-agency priority list<sup>11</sup>.

It is important to note that a sub-basin plan approved by the Northwest Power and Conservation Council (see [www.nwcouncil.org](http://www.nwcouncil.org) for more details of the sub-basin planning process) may not be sufficient to drive restoration activity at the level of individual reaches.

<sup>10</sup> The Blackfoot Challenge, Big Blackfoot Chapter of Trout Unlimited, Montana Fish Wildlife & Parks, and others. 2005. A Basin-Wide Restoration Action Plan for the Blackfoot Watershed. Prepared for Montana Department of Natural Resources and Conservation *and* The Blackfoot Watershed Restoration and Monitoring Partners. 63 pages plus appendices.

<sup>11</sup> Upper Salmon Basin Watershed Project Technical Team. 2005. Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin (SHIPUSS). Prepared for the Upper Salmon Basin Watershed Project and Custer *and* Lemhi Soil and Water Conservation Districts. 67 pp.

### 3.4 What options are there for increasing the monitoring of changes in habitat and to allow for attributions to QLE water transactions?

The results in this section suggest that CBWTP is still a considerable distance from being able to demonstrate that all of the water transactions in its portfolio are leading to improvements in fish habitat. As far as the QLEs are aware, only about a third of the transactions have been conducted in reaches that have both been scientifically assessed for ecological limiting factors, and have a strategy to resolve any remaining habitat issues that were identified. Further, only 58% of the transactions occurred in reaches where habitat monitoring was taking place, and much of this monitoring is rudimentary.

It is possible that the true incidence of scientific habitat assessment, restoration and monitoring is actually greater than the QLEs are aware of and reported. Some QLEs, for example, were aware that a particular aspect of habitat such as riparian cover was monitored by state agencies, but the QLE was not clear on the information being collected, or the methodology used. To the extent that QLEs are not aware of the work of other institutions, and not coordinating their own efforts with other scientific assessment and restoration activities in the region, they are missing a real opportunity to maximize the ecological benefits generated by their water transactions.

## 4 Understanding the Sustainability of Water Transactions

The next group of evaluation questions address aspects of the sustainability of water transactions, including: the ability to overcome factors that are currently limiting the ability of QLEs to conduct transactions, the ability to scale up the volume of transactions to meet the need to address all priority reaches in the Columbia Watershed, and the ability to anticipate and manage for risks that may threaten the gains in flow over the long-term.

### 4.1 Are the limiting factors to water transactions being addressed effectively?

The Results Section 1.2 provides an overview of the various factors that are limiting the ability of QLEs to conduct water transactions where and when they need to in order to achieve their flow objectives. In order for the program to increase in scale to the point that it can address all the flow needs for priority reaches in the Columbia Basin, CBWTP and its network of QLEs need to design effective strategies to address these limiting factors.

There are a number of considerations that will enter into strategy design, including:

- *Should actions to address a particular limiting factor be supported by CBWTP staff, or be the sole responsibility of individual QLEs?* CBWTP staff should consider taking an active role if there are many QLEs impacted by a particular limiting factor; if there are economies of scale in addressing a particular limiting factor; if institutions and agencies that must be engaged to address a limiting factor span more than one state; or if the QLEs affected are of a particular importance for the CBWTP priorities. In other cases, it may be more appropriate

for individual QLEs to lead the efforts to resolve the limiting factors that they face.

- *Is the limiting factor within or outside the control of QLEs?* To some extent this depends upon the time horizon considered, since it is conceivable that any limiting factor could eventually be overcome if given enough time. For example, in the short-term, QLEs may view the lack of transaction tools to create permanent transactions as outside of their control, but over the longer term, QLEs may actively lobby for the creation of such a mechanism, bringing the resolution of the limiting factor within their control.<sup>12</sup>

During the evaluation we found that the CBWTP network has assimilated considerable experience that can help with strategic planning. There were examples of one or more QLEs taking innovative approaches to address many of the limiting factors. We also found that CBWTP staff was supporting strategies to address some limiting factors. For example, CBWTP has played an important role in building capacity in areas where QLEs are weak.

In the future however, there is room for the program to increase the effectiveness with which it identifies, addresses and monitors limiting factors. We recommend that the program adopt a more systematic approach to monitor limiting factors such as that employed here, and that some portion of the QLE meetings be allocated to developing strategies for addressing those limiting factors of highest priority. Sharing of best practices, and capacity building, can form an important part of strategies to address limiting factors.

Ultimately all factors that are significantly limiting QLE activities should be addressed, but it may be desirable for the program to begin with the three limiting factors that had the highest median scores in the limiting factor analysis, and among the greatest number of individual QLEs with scores for these factors of them being a "serious impediment to work", or higher. These three factors are:

- Poor coordination of donor support, resulting in it being hard to finance some aspects of transactions.
- Too few sellers of water in targeted reaches, causing difficulties in achieving flow targets.
- High transaction costs.

Significantly, all of these limiting factors could be considered at least partially outside of the control of QLEs. This means that any strategy to address these limiting factors, at least in the short-term, requires the QLE and CBWTP program to adapt, rather than reducing the limiting factor itself. In the case of donor support, the most appropriate action might be for CBWTP to become more flexible in the components of the transactions that it will fund, and in particular, being willing to fund more deal development, and let other donors fund the water purchase. Over the longer term, CBWTP staff could educate other donors so that they fully understand the importance of the non-water costs, and ease their restrictions. How to resolve the problem of too few sellers is less clear. A first step perhaps would be to conduct more in-depth analysis of

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<sup>12</sup> Because the distinction between limiting factors that are within and outside the control of QLEs is blurred, we combine here what was a two-part question in the original evaluation questions.

why some landowners are unwilling to sell, even if culturally they and their communities accept water transactions (ways to overcome cultural resistance are discussed in Section 4.4). The underlying reason may be economic rather than cultural, and it may be possible to change the economic terms of the transactions to make them more attractive to landowners. The issue of high transaction costs is quite challenging to address. As explained in Section 4.2, there may be no easy way to reduce transaction costs, and it may be necessary for CBWTP (and BPA) to accept that achieving instream goals may be more expensive than was previously envisioned, and seek greater financial resources to support the activity of QLEs.

#### 4.2 Can water transactions achieve the scope and scale necessary to restore river habitat in specified geographic priority areas?

QLEs and their stakeholders generally feel that as long as the required financial resources are available, it should be possible to achieve the scope and scale of transactions necessary to restore flow in all priority reaches across the Basin. This sentiment is reinforced by the limiting factor analysis, which found that at the level of the portfolio, QLEs are effectively addressing the vast majority of the limiting factors, and there are no limiting factors that appear capable of creating an impasse if greater resources are brought to their resolution.

Rather than *if* QLEs can conduct a sufficient volume of transactions, uncertainty is associated with whether QLEs can increase the rate at which transactions are completed, and the closely related issue of whether they can achieve greater efficiencies in conducting transactions.

Factors that might *increase* the rate and *decrease* the cost of transactions in the future include:

- QLEs become more skilled in transactions;
- In sub-basins where water rights are not yet adjudicated, adjudication proceeds, reducing resources required to establish historic water rights, and to monitor transactions against junior users.
- Cultural acceptance and knowledge about water rights increases among landowners and communities, reducing the time required to negotiate transactions.

Factors that might *decrease* the rate at which transactions can be conducted (or at least prevent an increase), or *increase* costs, include:

- Instream flow restoration might be limited by the speed at which partners can address the other components of habitat restoration.
- Transactions may take longer and be more expensive because QLEs have done the easiest transactions first. Future transactions may involve landowners that need more time to accept a transaction, or that may require higher compensation, or may involve more junior users that will increase monitoring costs.
- A lack of a demonstrated biological response by anadromous fish to restoration initiatives may decrease the willingness of landowners to engage in transactions.
- As land values increase, and as the demand for water increases, water values may increase.

- A lack of appropriately qualified staff for QLEs may limit the ability of QLEs to increase their capacity to conduct transactions.
- Even though landowners support transactions, a slowness or deliberateness may prove intrinsic to the way many landowners make decisions concerning land use. This “cultural brake” may mean that it is difficult or impossible to speed up the pace of individual transactions, which may require years to negotiate.

A highly relevant point is whether it is possible to achieve economies of scale in conducting water transactions. Many QLEs are of the opinion that this is unlikely because the context of each transaction is unique, and so it is difficult or impossible to turn water for instream flow into a commodity. The particular hydrology, groundwater-surface water interactions, and landowner context varies from reach to reach, and as a result, requires a significant investment to understand and deal with. Information and experience gained in one reach may not be directly applicable to other reaches.

#### 4.3 To what extent are long-term trends (climate change, demographics, land use change) being incorporated into planning?

QLEs are generally aware of long-term trends that might affect the sustainability of their transactions, but do not seem to be managing the risks of these factors in a systematic way.

With respect to *climate change*, QLEs were generally aware that climate change might affect water temperature, the quantity and timing of precipitation, and the timing of runoff. However, QLEs were not aware of how climate change would affect the specific hydrology of the sub-basins in which they worked. This is partly understandable because the current state-of-the-art predictions are not sophisticated enough to predict future climate with a high degree of confidence. Notwithstanding, it was our impression that QLEs are not fully cognizant of the work that has been done to date.

Some examples of how QLEs are beginning to grapple with the problem of climate change include:

- Forming teams within their organizations/agencies to design strategies to manage climate change impacts.
- Structuring transactions to maintain a specific threshold flow of water instream, rather than purchasing a specific amount of water. In this way the risks that climate change will reduce instream flow are passed on to the landowner.

One QLE felt that fully restored reaches (i.e., not just flow) are more robust to the impacts of climate change than are reaches where other ecological factors are limiting. This is an interesting (but to our knowledge untested) hypothesis that merits further investigation. If true, it would be another strong argument for having QLEs tightly integrate their work with the work of agencies doing other types of fish habitat restoration.

The impacts of *demographic change*<sup>13</sup> and *land use change* do not appear to be well understood by QLEs, although QLEs are certainly aware that changes are taking place. It

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<sup>13</sup> The Independent Scientific Advisory Board for the Northwest Power and Conservation Council, Columbia River Basin Indian Tribes, and National Marine Fisheries Service, recently conducted an analysis of

was our impression that QLEs were not generally aware of the work that had been done in this area, even to the extent of being able to comment upon under what circumstances development would have a net negative or positive impact on local hydrology. One QLE said that they were increasingly looking to partner with land trusts so that development impacts could be managed in the areas that they were doing water transactions.

In short we found that QLEs were working flat out just to manage the transactions in which they were currently working on, with little time or resources to attempt to understand and manage long-term trends that might affect the sustainability of these transactions over the longer term. QLEs will require additional support if they are to improve their performance in this area.

#### 4.4 What practices have proven successful in generating cultural acceptance of water transactions? What have been the roles of QLEs in generating cultural acceptance? What have been the characteristics of first adopters among landowners?

The limiting factors analysis found that community/landowner support for transactions was a manageable problem for the majority of QLEs, though two of the seven QLEs found that it was a serious impediment to their work. As such, cultural acceptance is a "second tier" limiting factor, of less importance than limiting factors with higher median scores, and/or significantly impacting the work of more QLEs (see Figure 1.2). This finding contrasts with the perception of CBWTP staff and other stakeholders at the onset of the evaluation who felt that a lack of cultural acceptance was one of the most important, if not the most important, limiting factor for the program. This is a positive finding and is probably at least partially due to the hard work of QLEs in improving cultural acceptance over the years of the program.

The difference between the actual and anticipated impact of cultural acceptance as a factor limiting QLEs activities is also probably partially due to confusion between cultural resistance and resistance on the part of landowners to enter into transactions for economic reasons. Water is irreplaceable and determines land value. As such landowners may accept transactions as a legitimate transaction for themselves and other landowners to engage in, but may not actually wish to do so until water becomes available through changes in land use.

In any event, generating cultural acceptance is an important part of the work of QLEs, and the resources QLE allocate to this activity depends on the overall approach that they take to their work. QLEs tended to take one of two broad approaches in identifying and negotiating transactions. Some QLEs are opportunistic, working over large areas to identify and conduct the transactions of least resistance, many of which are even initiated at the request of the landowner. It is still an open question as to whether the opportunistic approach will ultimately put a QLE in a position to become more strategic when there is less flexibility in transaction location. The other approach used by QLEs is more strategic, seeking to build the relationships and trust that allows them to do whichever transactions are needed to meet specific flow targets and habitat restoration for more localized areas. These QLEs are usually more closely integrated into multi-

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demographic changes in the Columbia Basin, *Human Population Impacts on Columbia River Basin Fish and Wildlife*, June 8, 2007 (ISAB 2007-3).

agency efforts at comprehensive habitat restoration, and have strong ties with local communities.

Strategic QLEs have gained much useful experience in how to build cultural acceptance. When beginning work in a new area, the key seems to be to engage community leaders as early participants in the program. Characteristics of these people are that they are respected in the community, they are skilled and willing to speak in public, and that they can be engaged to promote water transactions to the broader community.

Engaging such people may take years. A key issue is that relationships in small communities are built upon trust among individuals, rather than institutions. QLE staff seeking to conduct water transactions need to spend enough time in the community to demonstrate their integrity so that landowners will trust them. One agency representative – in charge of developing nine community partnerships – said that agencies or individuals beginning work in new communities should not have a work plan or hold a public meeting for at least the first two years. Rather, they should spend this time attending public meetings, meeting people and understanding their concerns and priorities. In the words of this Fish and Wildlife officer, “You have to make deposits to the community before you can make withdrawals for conservation”. Donors need to recognize the importance of (and be willing to fund) the significant investment in time required to develop landowner and community relationships before transactions can occur. One way to possibly accelerate this process is to have QLEs work in close partnership with individuals that have already gained the trust of communities.

Of the many issues that agencies and institutions can have with landowners, dealings with water can be one of the most problematic and threatening. “Water is even worse than wolves” in the words of one QLE, referring to the livestock-wolf conflicts that have arisen where wolves have been reintroduced. However, if landowners have prior involvement with other aspects of habitat restoration (e.g., riparian fencing, establishment of riparian cover, or installing fish screens), then landowners can become comfortable with these and are more likely to engage in a water transaction. This is yet another advantage of QLEs working in a broader partnership for comprehensive restoration.

That said, most QLEs also recognized some small portion of the community will never be interested in doing transactions. Several QLEs put this number at around 20% of landowners or reaches.

## 5 Program Administration

The final group of evaluation questions examines the suitability of the CBWTP for water transactions and other types of restoration initiatives, and whether it has been effectively administered.

### 5.1 Is CBWTP the appropriate model for implementing a water transactions program?

The CBWTP program performs at least four important functions in supporting the work of QLEs in implementing water transactions, including:



- *Facilitating the flow of BPA funding:* QLEs with experience in obtaining funding through the provincial review process found the water transaction proposal and reporting processes through the CBWTP much easier and less time consuming. The CBWTP helps streamline and coordinate the administrative proposal and reporting components for the QLEs.
- *Integrating regulators and implementers:* CBWTP plays a valuable role as strategic integrator of state regulatory agencies and organizations that conduct water transactions. By doing so both groups become more familiar and comfortable with the other, leading to more productive working relationships.
- *Building capacity:* CBWTP has offered a range of training courses to build the capacity of QLEs. There is likely a significant economy of scale achieved by having CBWTP offer training to all QLEs at once, compared to QLEs trying to achieve this training individually.
- *Establishing an informal learning network among QLEs:* the twice-yearly meetings have proven highly effective in allowing QLEs to establish relationships with their peers in order to share experience.

The characteristics/accomplishments to date of the CBWTP model suggest it can be highly effective in addressing some of the most important limiting factors faced in conducting water transactions. For example, the ability of CBWTP staff to interact with large donors, and manage large grants to ease the administrative burden of the many QLEs, raises the possibility that CBWTP can play a role in both educating donors to be more flexible in the aspects of transactions that they fund, and also to seek additional large donors in order to scale up the program. Furthermore, the fact that CBWTP has functioned well as a strategic integrator raises the possibility that it can help integrate the work of QLEs with that of other state and federal agencies that are responsible for other aspects of habitat restoration and monitoring, a key challenge if CBWTP is to translate increases in stream flow to demonstrable benefits for fish populations.

## 5.2 Is it effectively administered?

QLEs generally gave the CBWTP very high marks for administration of the program. QLEs found CBWTP staff to be knowledgeable, helpful, accessible and responsive to their concerns. As is to be expected in any program, QLEs did have some specific suggestions as to how the administration could be improved. Some felt that the reporting requirements could be more streamlined, while others felt that requirements at present were reasonable, but they hoped that the trend for reporting burden to increase over time would not continue. Some QLEs wished that CBWTP reporting dates were better coordinated with their other reporting commitments. One QLE did not mind the reporting requirements, but wished for more feedback on the materials that they submitted. Overall though, the CBWTP staff received some of the highest marks these evaluators have seen.

5.3 Would the CBWTP model be appropriate for other river restoration initiatives?

Both the administrative success and programmatic accomplishments of the CBWTP suggest that the model can be scaled up to cover a broader geographic area in the U.S. West, *and* might be appropriate for other river restoration initiatives beyond water transactions. Certainly the strengths of the CBWTP – a demonstrated ability to strategically coordinate different stakeholder groups (e.g. government regulators and non-governmental organizations) working on common issues, the ability to act as an interface between small grantees and large donors, the ability to foster learning among grantees working on similar issues, and the ability to achieve economies of scale in capacity building – have broad applicability across the U.S. West, as well as in related conservation activities that complement water transactions.

## DISCUSSION AND RECOMMENDATIONS

The CBWTP is an ambitious venture – attempting to create a new market for in-stream water, sufficient to one day restore flow-limited reaches throughout the Columbia Basin. It is evident from the evaluation that the CBWTP has been successful in developing a market for instream water, and QLEs have been innovative in the use of a range of transaction mechanisms to do so. The CBWTP has also been responsive to the need to ensure that water transactions result in increased instream flow, and has established reliable monitoring systems to do so. Where CBWTP can improve is in ensuring that water transactions result in gains for anadromous and resident fish habitat. To date, the integration of water transactions with projects to address other ecological limiting factors has been weak. The result is that many reaches where flow is addressed continue to lack other key ecological attributes to serve as adequate fish habitat. Furthermore, the monitoring of changes in habitat quality is insufficient to make conclusive statements about the effectiveness of CBWTP in this regard.

It is important to note, however, that the CBWTP is a young program, initiated in just 2003. It has succeeded, in our view, in making strong progress towards achieving its first two objectives, creating a market for in-stream water, and increasing in-stream flow. Its third objective, restoring fish habitat, is ambitious and will require time, resources, and sophisticated coordination with myriad other organizations and government agencies.

It is our view that the CBWTP is an excellent program, with strong leadership at NFWF and a very constructive and collaborative community of grantees (QLEs). In our experience as evaluators, this program distinguishes itself. All involved should be commended, and none should take for granted the unusually strong program of which they are a part.

In this context, we make recommendations for further improving what is otherwise an excellent start for this young program.

### #1: Consider Additional Performance Metrics

At present, the performance of CBWTP is principally measured in terms of water returned to instream flow (cubic feet/second and acre-feet). This metric has the advantages of being easy to measure and appears to be readily understood by donors and the community at large. It does not, however, tell us much about the progress that is being made relative to biological flow targets, or the complete restoration of fish habitat.

We recommend that CBWTP consider some variation of two new performance metrics, to complement the program's reporting system.

- First, a performance metric is required that shows the *percentage improvement towards reaching biological flow targets*. This will provide a clearer picture of how each transaction contributes to restoring flow in the reaches where they are conducted, and how much more work remains to be done in each reach before flow is fully restored. This should create an incentive for QLEs to seek out transactions in reaches where they believe they can complete the flow restoration through the fewest number of transactions possible, and to see those transactions

through such that the flow target is ultimately reached. Related to this point, it should also encourage the establishment of flow targets where they currently are not available – something that CBWTP as a program should address as soon as possible for priority reaches.

- Second, CBWTP should measure *progress towards the complete ecological restoration of reaches* where QLEs are conducting transactions. A performance metric, such as “miles of stream fully restored,” that considers all ecological limiting factors, will provide the program with a far better idea of its progress towards improving fish habitat in the Columbia Basin. It will also create an incentive for better QLE coordination with the entities performing *and* monitoring restoration of complementary ecological limiting factors (see next recommendation).

### #2: Integrate Efforts to Resolve All Ecological Limiting Factors

Building on the previous recommendation, the data show that about two ecological limiting factors remain for each reach where QLEs have conducted water transactions, indicating that fish habitat in these reaches is not fully restored even if target flow is. Leaving ecological limiting factors unaddressed can reduce or even negate the benefits of a water transaction (e.g. absence of riparian vegetation can result in water temperatures that exceed habitat requirements of anadromous fish).

From the perspective of the evaluators, it is not clear how water transactions can be justified without meaningful coordination with the efforts of other relevant agencies. Unless water transactions are part of a larger comprehensive effort, there is no way to ensure that other ecological limiting factors will ever be addressed, and that the water transaction will lead to intended benefits for fish populations.

As CBWTP matures, it should better integrate with the many other ongoing efforts in the Columbia Basin to restore the full suite of ecological limiting factors affecting fish habitat. Flow restoration should probably *not* be conducted in areas where there has not been an assessment of all ecological factors that may be limiting fish habitat, and where a convincing plan to address remaining ecological limiting factors does not exist.

### #3: Develop Guidelines or Standards for Habitat Monitoring

As CBWTP becomes more integrated with other efforts to restore fish habitat, it will also need to become better integrated with efforts to monitor the performance of habitat restoration. CBWTP should request from the Northwest Power and Conservation Council and BPA either guidelines for monitoring, or direct assistance in monitoring, to ensure that the information generated is consistent across restoration programs in the Columbia River Basin.

#### #4: Maintain support for the full array of temporary and permanent transaction tools

Within CBWTP there is an active debate about the current balance between short-term and long-term or permanent transfers. On one side of the debate, QLEs argue that temporary tools provide a palatable entry-point for landowners into a relatively young and unproven marketplace. Eventually, once water transactions are more fully understood, these and other landowners will be more willing to sign on to long-term leases or permanent transfers of water rights. On the other side of the debate, donors and program administrators are interested in seeing greater permanent gains made by CBWTP, by moving away from temporary tools in favor of outright purchase or other permanent transfer of water rights.

It is our opinion that temporary transaction tools are an important part of the program, and that both short- and long-term temporary transaction tools can be employed effectively as a part of the portfolio of mechanisms for achieving permanent gains by the program. We base our opinion on the following points:

- The water market is incipient and there is uncertainty among landowners about the long-term implications of selling water. Short-term transactions may be the only way to get some landowners into the market initially. As the picture becomes clearer, they may be inclined to move towards longer-term arrangements, such as long-term leases or permanent transfers.
- Some argue that temporary transactions are a form of “welfare payment” for landowners. In our view, if transactions are priced properly, the *net present value* (NPV) of a perpetual stream of temporary payments should be equivalent to the sale price of water in a permanent transfer<sup>14</sup>. In both cases the landowner receives the same amount of money, only paid out over a different schedule. Therefore, the argument seems to lack financial logic.
- Many temporary transactions are renewed, and often for longer and longer terms. Effectively, a temporary transaction that continuously renews has the same impact on flow restoration as a permanent transfer. The downside for CBWTP is that there may be greater uncertainty about the long-term cost as the rental price may change with each renewal.
- Offsetting uncertainty of future lease prices, however, is the flexibility that temporary transactions provide to CBWTP to re-orient its geographic concentration of transactions over time as demographic trends and climate change may require. Some of today’s transactions may occur in reaches that may be deemed undesirable for fish habitat in the future. The option *not* to renew those leases, and re-allocate financial resources to transactions elsewhere in the Columbia Basin may have great value.

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<sup>14</sup> NPV = sale price for permanent transfer = annual lease payment / discount rate. Various factors may affect this equivalency, resulting in the NPV of leasing being either slightly more or less expensive, but in general terms, the relationship should hold true if water rights are priced efficiently.

In short, we recommend keeping the full range of short- and long-term transaction tools in the CBWTP portfolio. Abandoning them on the basis that “permanent is better” may turn out to be short sighted.

#### #5: Accept Transaction Costs as a Necessary Part of Instream Deals

NFWF and BPA have indicated an interest in reducing the proportion of costs that is not direct payment for water. QLEs, however, indicate that those costs are necessary to develop water transactions, and are largely weighted towards the personal contact with landowners required to develop trust, clearly explain the transactions and their implications, negotiate a transaction, and see that transaction through the requisite government processes. In addition, QLEs must spend a fair amount of time determining which water rights they would like to acquire, based on flow needs, enforceability, presence of other ecological limiting factors, and a potential list of other considerations.

We observed that personal contact with landowners appears to be a fundamental requirement at this early stage of the instream water market's evolution. But perhaps most important is our second observation that water rights are heterogeneous in their characteristics, requiring a fair amount of information collection and analysis on the part of QLEs before transactions can be made. At this point in time, it is hard to image that instream water rights will become a commodity, as technically defined<sup>15</sup>, and will therefore always have associated costs in transaction development that would otherwise not be present in a commodity market.

For purposes of this discussion, we lump these costs into a broader category called “transaction costs,” which also includes legal and other costs associated with closing a deal. We believe that over time QLEs will discover efficiencies in their work, and therefore lower transaction costs. But at the same time, some transaction costs will be unavoidable, and some may even increase – for example as QLEs go after more challenging or scarce transactions in priority reaches over time.

We also observe some confusion over the role of certain market mechanisms, such as auctions, as a means of lowering transaction costs. The strength of auctions is as a method for revealing price, not necessarily lowering transaction costs. With an auction, QLEs will still need to evaluate potentially numerous water rights and their heterogeneous characteristics before they can determine whether prices represent a good value for restoring instream flow. An exception to this point is within an irrigation district in which the rights are essentially the same; auctions may be effective at lowering transactions costs within large irrigation districts.

Our recommendation is that CBWTP should not aggressively seek to lower transaction costs of QLEs until such time that it understands where those gains in efficiency can come. Simply lowering the funding available for transaction costs may result in only reducing the number of transactions QLEs can afford to conduct. Further to this point, raising money for transaction costs is a major limiting factor for QLEs. CBWTP might

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<sup>15</sup> In economic parlance, a *commodity* is a good or service that is undifferentiated across its supply base. In other words, that good or service provided by one supplier is for all intents and purposes no different than that provided by another. Instream water rights have multiple characteristics that vary across suppliers, such as the location and timing of flow they affect, preventing them from fitting this definition of “commodity.”

even reverse its current thinking and make more money available for transaction costs and rely more heavily on cost-sharing arrangements to pay for the direct acquisition of water. Finally, clear, objective guidelines must be given to QLEs for transaction cost reporting in order to understand the trends and opportunities as the program matures. There is also scope for considering a study of “lessons learned” among QLEs in lowering transaction costs.

#### #6: Continue to Develop Integrated Land-Water Transactions

It is evident that instream flow restoration and land conservation are linked in a number of ways, including the restoration and conservation of riparian habitat and water demands related to land use. Integrating water transactions with land conservation deals may offer important ecological benefits. In addition, there could be financial benefits as well, since the value of land in the Columbia Basin is often a function of its associated water rights – acquiring both in a single transaction rather than two separate transactions could lower the overall cost.

Thus far there are seven integrated land-water deals in the CBWTP portfolio, and there is interest among some QLEs to do more. Other QLEs have offered a number of reasons why integrated transactions are difficult to conduct, however, with the preponderance of commentary relating to difficulties in working in partnership with land conservation organizations.

We recommend that CBWTP focus on this topic and attempt to resolve those difficulties. In our view, opportunities may be lost by not engaging the land conservation market. CBWTP might even consider structural changes so that either it gets into the land conservation market itself or that it negotiates formal institutional partnerships with land conservancies in order to provide them with the expertise on water transactions that is necessary to ensure better integration. CBWTP is currently doing this to a limited extent with its riparian easement program.

Building on the strong foundation that CBWTP has built to date, we believe that the program can continue to expand in its reach and sophistication. We hope that the information and recommendations presented in this report will help it in doing so. We are also confident that CBWTP’s collaborative, thoughtful, and inspired community of partners will continue to find ways to improve the program as they go forward towards achieving their objectives for the Columbia Basin.

## REFERENCES

Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other authors. 2004. Instream flows for riverine resource stewardship, revised edition. Instream Flow Council, Cheyenne, WY.

Bradshaw, S. Undated. A buyer's guide to Montana water rights. Trout Unlimited.

Clifford, P., C. J. Landry, A. Larsen-Hayden. 2004. Analysis of Water Banks in the Western States. Washington State Dept. of Ecology.

Independent Scientific Advisory Board. 2007. Climate Change Impacts on Columbia River Basin Fish and Wildlife. Northwest Power and Conservation Council, Portland, OR.

Independent Scientific Advisory Board. 2007. Human Population Impacts on Columbia River Basin Fish and Wildlife. Northwest Power and Conservation Council, Portland, OR.

Independent Scientific Review Panel. 2007. 2006 Retrospective Report. Northwest Power and Conservation Council, Portland, OR.

Hartwell, R., B. Aylward. 2007. Auctions and the reallocation of water rights in Central Oregon. Deschutes River Conservancy.

Horne, A. A. Purkey & T. McMahon. 2007. Purchasing water for the environment in unregulated systems – what can we learn from the Columbia Basin. Unpublished draft manuscript. 9 pp.

Kendy, E. 2005. Water-balance considerations for instream flow restoration design: understanding irrigation return flow. Prepared for Trout Unlimited.

Landry, C. J. 1998. Saving Our Streams Through Water Markets: A Practical Guide. Political Economy Research Center.

Lovrich, N. et al. 2004. Of Water and Trust: A review of the Washington Water Acquisition Program. Policy Consensus Center, Pullman and Seattle, WA.

Malloch, S. 2005. Liquid Assets: protecting and restoring the West's rivers and wetlands through environmental water transactions. Trout Unlimited.

Molle, F. and J. Berkoff. 2006. Cities Versus Agriculture: Revisiting Intersectoral Water Transfers, Potential Gains, and Conflicts. International Water Management Institute, Colombo, Sri Lanka.



National Research Council. 2004. Managing the Columbia River: instream flows, water withdrawals, and salmon survival. The National Academies Press, Washington DC.

Neuman, J. 2005. The good, the bad, and the ugly: the first ten years of the Oregon Water Trust. *Nebraska Law Review*, 11:29, 432-84.

Oregon Water Resources Department. 2006. Water Rights in Oregon.

Resource Dimensions LLP. 2006. Economic Analysis of the Columbia River Basin Water Mitigation Program, Gig Harbor, WA.

Roegner, C., H. Diefenderfer, A. Whiting, A. Borde, R. Thom, E. Dawley. 2006. Monitoring Protocols for Salmon Habitat Restoration Projects in the Lower Columbia River and Estuary. Draft Report for US Army Corp of Engineers, Portland.

Roni, P., T. J. Beechie, R. E. Bilby, F. E. Leonetti, M. M. Pollock, and G. R. Pess. 2002. A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific Northwest Watersheds. *North American Journal of Fisheries Management* 22:1-20.

The Blackfoot Challenge, Big Blackfoot Chapter of Trout Unlimited, Montana Fish Wildlife & Parks, and others. 2005. A Basin-Wide Restoration Action Plan for the Blackfoot Watershed. Prepared for Montana Department of Natural Resources and Conservation *and* The Blackfoot Watershed Restoration and Monitoring Partners. 63 pages plus appendices.

Trout Unlimited. 2005. Liquid Assets: Protecting and restoring the West's rivers and wetlands through environmental water transactions.

Trout Unlimited's Western Water Project. 2007. Gone to the well once too often. Trout Unlimited.

Upper Salmon Basin Watershed Project Technical Team. 2005. Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin (SHIPUSS). Prepared for the Upper Salmon Basin Watershed Project and Custer *and* Lemhi Soil and Water Conservation Districts. 67 pp.

Westwater Research LLC. 2007. Columbia Basin Water Transaction Program: Annual Economic Report 2006.

Westwater Research LLC. 2006. Columbia Basin Water Transaction Program: Annual Economic Report 2005.

Westwater Research LLC. 2003. Review of Western US Environmental Water Leasing Programs.

Westwater Research LLC. Saving streams through the US tax code: providing tax incentive for the permanent and temporary donations of water rights to enhance stream flow.