Memorandum #2
Participation Incentives for Groundwater Recharge from Floodwater Diversion

Prepared by M.Cubed[1]

For Sustainable Conservation

March 2017

PARTICIPATION INCENTIVE METHODS

This memo focuses on ways of incentivizing growers to participate in an on-farm groundwater recharge program, given the financing mechanisms outlined in the previous section. The main factors to consider in creating an effective incentive program are participant selection, price setting, and payment method. These factors are described below. In Appendix A we use this framework to examine several existing incentive programs for fostering environmental benefits.

Selection method

Unlimited Participation—In some types of environmental markets, such as those in Emission Reduction Credits, there is no limit on who participates. Participants that meet specific requirements are eligible to participate. In the context of groundwater recharge, participation will be limited by several factors, including the amount of funding available to incentivize participation, and the amount of flood water available for recharge in a given year.

Lottery—In cases where program interest is greater than available funding, a lottery method is a simple and straightforward selection method. If project benefits do not vary across applicants or if for political reasons, program operators do not want to be seen as giving preference to one applicant over another, a lottery approach could be appropriate. In the case of The Nature Conservancy's demand management pilot program on the Colorado River, a lottery system was used in the first year, as a simple, low cost, and politically neutral selection method. In that case, participants were notified that in future program rounds, the selection method may be updated to a more complex, but economically efficient process.

First-come First-served / Queuing—In a first-come first-served selection system, participants are enrolled in the program in the order they apply until the funding or available water for recharge runs out. This type of enrollment is most appropriate when the benefits offered by different participants are uniform. For example, the USDA's Conservation Reserve Program follows this method. Eligibility is limited to specific practices with large environmental benefits,

[1] Richard McCann and Elizabeth Stryjewski. Address: 2655 Portage Bay Avenue, Suite 3, Davis, California 95616. Telephone: 530.757.6363. E-mail: mccann@mcubed-econ.com.

so the program foregoes the competitive application process. Advantages of this approach are that the administrative and information costs are low. In the context of a groundwater recharge program, if eligibility can be limited to areas with specific and uniform recharge properties (e.g. certain locations in the basin, soil types, crop types) first-come first-served enrollment could be appropriate

Scored Subsidy--If however, recharge potential varies across potential participants, it will be preferable to enroll those that provide greater recharge capacity first. A scored subsidy approach to enrollment takes into consideration differentiation in the benefit from particular parcels. Scored subsidy programs use indexes or other methods to assign scores for various attributes, with the goal of identifying participants that offer the greatest level of service. For example, in a groundwater recharge program, applicants may be scored on their location in the basin, soil type and crop type to determine which parcels will yield the greatest amount of recharge per acre-foot of flood water. This assumes that the program administrator has information on the relative recharge potential from different parcels, and so has greater information requirements than a first-come first-serve program. Relative to an auction-based mechanism, a scored subsidy program has lower administrative costs and is simpler to implement.

Auction-based—In an auction based enrollment program, enrollment is based not only on the relative value that a participant provides, as in scored subsidy enrollment, but also on the price that a participant is willing to accept to enroll in the program per unit of value they provide. The costs of an auction -based system are higher, but it does allow for the most cost-effective use of program dollars.

In a reverse auction, the sellers bid what they are willing to provide the service or product, and the buyer selects the lowest qualifying bids first. The Nature Conservancy's BirdReturns program to provide temporary wetland habitat for migrating birds in California is an example of a reverse-auction program.[2] The payment to participating farmers are determined by reverse auction, where farmers submit bids of how much they would be willing to accept on a per acre basis to flood their rice fields for a 4, 6 or 8-week period. Program administrators are then able to select participants based on which fields provide the best habitat for specific species as well as bid price.

Price determination

Uniform Price--Under a uniform payment system, participants in the recharge program receive a uniform price per unit of benefit provided. In habitat conservation programs this may be on a per-acre basis. In a groundwater recharge program, the price would more likely be based on the acre-feet of water placed on a field or the amount of water likely recharged to the aquifer as a result of on-farm recharge. The main benefit of this approach is that administrative costs are low. However, the price would need to be set to incentivize sufficient interest in the

[2] Robbins, Jim, 2014. "Paying Farmers to Welcome Birds," *The New York Times,* https://www.nytimes.com/2014/04/15/science/paying-farmers-to-welcome-birds.html, April 14.

program without overpaying participants. Because of this, a uniform price scheme is not likely to procure the maximum value per dollar spent.

Pajaro Valley Water Management Agency's Net Recharge Metering program is an example of a uniform price recharge program. It offers participants a rebate on groundwater pumping fees per acre-foot of water captured as inflows from on-farm stormwater collection projects, net of the infiltration that would have occurred without the project. In a program using flood releases for on-farm recharge the price could be based on the amount of water diverted to farms. Program designers will also have to consider using a discount factor, discussed more below. In the Pajaro Valley's Net Recharge Metering program, they use a discount factor of 50% because not all water that infiltrates goes toward recharging the aquifer and not all recharge is recoverable.

Scored Subsidy—Scored subsidy-based price setting would allow some price differentiation based on recharge rates. For example, if location A results in more water recharged to aquifers compared to location B, given the same amount of water applied to fields, then it can receive a larger payment per unit of water diverted onto fields. Once again, scored subsidy programs, like uniform payment programs are likely to have lower administrative costs than auction-based mechanisms.

Reverse Auctions --Reverse auctions are an alternative to a uniform participation payment program, that promise to procure on-farm recharge opportunities at the highest return on investment. Rather than paying a uniform price to growers willing to participate in an on-farm recharge program, a reverse auction solicits bids for the lowest payment that farmers would require to participate in on-farm recharge. This gives interested participants an incentive to bid the lowest amount they are willing to accept in order to be chosen for the program, and allows program administrators to evaluate the price against the recharge benefit. This addresses the potential problem of a uniform price system setting the price too low or too high. A reverse auction can be particularly cost-effective if there is variation in benefits from different parcels. For instance, if recharge benefits vary by location in the basin, type of soil, or some other factor, program administrators can select participants based on a cost-benefit ranking or a more complex algorithm.

The Nature Conservancy's BirdReturns program is an example of a reverse auction in agri-environmental practices. In its first year, approximately 40 farmers participated, flooding approximately 10,000 acres of rise farmland. Participating in the program poses a risk for farmers, whose flooded fields may not dry out in time for planting for the following season. The reverse auction allows them to consider this risk in their bid decision and be compensated accordingly.

There is evidence that reverse-auction enrollment programs can be more cost-effective than other approaches. A modelling exercise looking at the Sun Valley Watershed in Los Angeles County found that conducting a reverse auction to implement stormwater capture Best Management Practices (BMPs), like porous pavement and infiltration pits, would be more cost

effective than investing in centralized, large-scale stormwater capture.[3] That study reveals a tradeoff between optimal placement and size of the BMPs and the lower program costs of enrolling BMPs by competitive bid. There is evidence that that tradeoff nearly always favors enrollment by competitive bidding to achieve optimal cost-effectiveness.[4]

Because reverse auctions are more complex mechanisms there are more considerations to account for when structuring a successful program. First, an auction mechanism can be administratively burdensome and more costly to operate than a more straightforward uniform payment program. Additionally, generating sufficient participation in an auction is a key requirement.

However, high transaction costs on the part of applicants can reduce participation in agri-environmental reverse auction programs and result in less cost-effective auction results. According to surveys from the Tiffin River Watershed auction,[5] which held reverse auctions for Best Management Practices on agricultural lands to improve water quality in the Tiffin River and Lake Erie, three key barriers to participation were lack of knowledge about the auction (30%), perceived ineligibility to submit a bid (26%), and a lack of interest in submitting a bid (44%). Among individuals who knew about the auction and felt eligible, participants were still deterred because the auction seemed complicated (38%), they did not want to adopt any of the three eligible practices (26%), land rental agreements complicated participation (28%), and they perceived a low probability of bid acceptance (18%). Lowering perceived transaction costs and increasing interest in a reverse auction requires familiarizing potential bidders with the auction process through straightforward advertising, information sessions, and working with leaders in the community to spread the word about the program. Steps like building awareness, educating and communicating with the eligible landowners, streamlining the bidding process and reducing the time and effort required to participate will reduce perceived transaction costs and increase participation in a reverse auction, resulting in more cost-effective programs.[6]

Discount Factor—Applying a discount factor (also known as an "offset ratio" or "trading ratio") to the amount of recharge credited to participants in a groundwater recharge program can strengthen the integrity of the program or give preference to certain participants. First, a discount factor can be used to offset the uncertainty associated with groundwater recharge. For example, Pajaro Valley Water Management Agency uses a discount factor of 50% to account for the fact that not all infiltration becomes recharge and not all recharge is recoverable. The exact percentage of recoverable recharge is not known, but applying the

[3] Baerenklau, K.A., et al. 2008. "Capturing Urban Stormwater Runoff: A Decentralized Market-Based Alternative." *Policy Matters*, Volume 2, Issue 3.

[4] Cutter, W.B., et al. 2008. "Costs and benefits of capturing urban runoff with competitive bidding for decentralized best management practices." *Water Resources Research.* http://onlinelibrary.wiley.com/doi/10.1029/2007WR006343/full

[5] Palm-Forster, L.H., et al. Too Burdensome to Bid: Transaction Costs and Pay-for-Performance Conservation. American Journal of Agricultural Economics. 98(5): 1314–1333.

[6] Whitten, S.M., A. Reeson, J. Windle, and J. Rolfe. 2013. Designing Conservation Tenders to Support Landholder Participation: A Framework and Case Study Assessment. Ecosystem Services 6: 82–92.

discount factor assures that the program makes a conservative estimate of its impact on groundwater levels. This may be particularly important if payment is made in the form of groundwater rights rather than cash or a rebate. Similar discount factors are used in groundwater banking, where a discount factor is applied to account for water losses. In criteria pollutant offset markets, a discount factor can safeguard against risk and uncertainties associated with measurement, non-additionality, and other factors, and strengthen environmental integrity. Under the Federal New Source Review, discount ratios apply to Emission Reduction Credit use in some Air Quality Management Districts and applications. For instance, in the South Coast Air Quality Management District an offset ratio of 1.2-to-1.0 applies to Emission Reduction Credit offsets.[7] Among water-based pollution abatement programs, offset and trading ratios are often greater than 1-to-1, ranging from 1.1-to-1 in Pennsylvania's Nutrient Credit Trading Program to 4-to-1 in the South Nation River Watershed Trading Program.[8]

Settlement and Payment

Cash—the most straight-forward payment method is a cash payment to farmers. This requires that the cash to support the program is already available. This kind of program may be most popular with farmers to offset the costs participating in on-farm recharge.

Fee rebate—Rather than paying cash, a recharge program could offer in cooperation with the local GSA a rebate on groundwater pumping fees, assuming that such fees are already in place. This is the approach used by the Pajaro Valley Water Management Agency in its Net Groundwater Metering program. The benefit of a rebate is that it does not require funding to be in place prior to the program, since the rebate applies to pumping fees in the following year. However, this approach may be less popular with farmers who incur real costs associated with an on-farm recharge program.

Pumping allocations or other tradeable credits—An alternative to monetary compensation for participating in a groundwater recharge program is compensating participants with additional groundwater allocations or rights. This assumes that a system of groundwater rights has already been implemented by the local GSA. On the plus side, it does not require cash on hand to fund the program, however it does require particular attention to the discount factor applied to infiltration amounts to ensure that the program maintains a net benefit to groundwater levels. Compensation in water rights will be most appropriate if there are established institutions for selling or banking these rights.

[7] SCAQMD, "Emission Reduction Credits," http://www.aqmd.gov/home/permits/emission-reduction-credits, retrieved January 2017.

[8] Fisher-Vanden, K., S. Olmstead. 2013. Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis. Journal of Economic Perspectives—Volume 27, Number 1, Winter 2013.

Other considerations in designing incentive payments for GW recharge

Two-stage enrollment—Since a groundwater recharge program using floodwater releases would only operate in wet years, a two-stage enrollment program may be appropriate. Under a two-stage process, program operators would first elicit offers and pay landowners for the option to recharge groundwater in a given timeframe. In a dry year where no floodwater releases are made, the program loses only a small amount of money. Full recharge payments only take place in the case of a wet year.

The benefit of using a two-stage enrollment structure is that potential enrollees are already lined up and ready to participate well before floodwater releases take place, smoothing the administrative process. An example of this type of program is the 1994 State Water Bank. After experimenting with water banking during statewide drought in 1991 and 1992, the California Department of Water Resources used a two-stage enrollment program in preparing for the 1994 banking program. Interested participants could purchase an option at $3.50 per AF to be exercised in March if necessary. The full offer price of $40 would then be paid only if the water purchase actually took place. In the case of the 1994 water bank, above average year runoff meant that the water bank was never implemented. In 2003, MWDSC set up a similar option program with Glenn-Colusa Irrigation District, in which a subset of the options was exercised to purchase water for transfer. Such a two-stage enrollment structure remains a promising way to secure early program participation.

Transaction costs—Transaction costs arise from the several steps involved in consummating any kind of economic transaction. This begins with the "search" process in which potential partners look scan for others who are willing to transact. Even in what appears to be one-way transactions, the parties will have costs in finding funding or developing responses to a proposed incentive. The "negotiation" process ranges from accepting a list price to participating in an auction to bargaining. The "monitoring and implementation" step can be the most costly and last for the life of good or service transacted. Transaction costs are often hidden, not showing up in the revealed price or tax for the transaction.

Transaction costs may be higher for auction programs than for simpler selection methods, but the list in Table 1 provides an example of incremental costs that accrue. For the Washington Water Trust 2015 Dungeness Dry-Year Leasing Program and Reverse Auction, described in Appendix A, it identified 14 tasks falling under three categories of transaction costs, Search, Negotiation, and Monitoring and Implementation.[9] Although the Dungeness Dry-Year Leasing Program is a reverse auction program to procure forbearance agreements from river rights holders, the transaction cost tasks are likely to be similar for a program to enroll landowners in an on-farm recharge program.

[9] Alex Bennett, Lillian Burns, Adriel Leon, Martin Merz, Patricia Song. "Factors Influencing the Expansion of Environmental Water Markets." Bren School of Environmental Science and Management. http://www.esm.ucsb.edu/research/2016Group_Projects/documents/BrenProject_EnvMarkets_FinalReport.pdf. March, 2016.

Table 1. Example Breakdown of Transaction Costs

Transaction Cost Category	Transaction Cost Category Task	% of Total time (Washington Water Trust)
Search	Fundraising and Grand Writing	6.0%
Search	Planning and strategizing for auction	7.2%
Search	Marketing Campaign	7.2%
Search	Sent out offer forms	10.8%
Search	Landowner Outreach	10.8%
Negotiation	Process Offers Received	14.5%
Negotiation	Due diligence	10.8%
Negotiation	Draft and sign contracts	14.5%
Negotiation	Mapping for contracts	8.4%
Monitoring and Implementation	Fill out lease applications	0%
Monitoring and Implementation	Get signature on lease application	0%
Monitoring and Implementation	Visual Monitoring 3 times	8.4%
Monitoring and Implementation	Prepare invoice, issue checks	2.4%
Monitoring and Implementation	Phone call and follow-up survey to participants	2.4%

Monitoring requirements—Monitoring requirements will depend on how the program and program payments are structured, with different payment structures requiring different monitoring practices. For example, payments based on acres of fields enrolled may require on-site inspection to confirm that participants are meeting all requirements of the program. Payments linked to the amount of water diverted onto fields or the amount of water recharged may require other monitoring equipment. When designing how payments will be calculated, program operators should consider potential monitoring requirements.

Market requirements—A well-functioning market in groundwater rights or a system of banking groundwater rights may be a pre-requisite for compensating participants with payment in additional groundwater water rights. Otherwise farmers run the risk of being stranded with additional water rights that they cannot use in a given year. An outline of how to evaluate these programs is in Appendix B.

Land rental complications—Land rental complications have been cited as a reason for reduced participation in agri-environmental best practices auctions. If the decision to participate in a recharge program depends on first identifying the appropriate decision maker, and then the decision-maker coordinating with another manager, this may increase the transaction costs of participation and deter some operators from applying. Program operators should be mindful of how many parcels in the basin are rented and how this might impact participation.

APPENDIX A: EXAMPLE PROGRAMS

This section outlines several example programs that use enrollment incentives to encourage practices that result in environmental benefits. We use the framework established in the previous section to understand these programs. Table A-1 summarizes the selection, price, and payment approach used in each program.

Table A-1. Summary of enrollment programs

	Selection					Price					Payment		
	Unlimited	Lottery	First-come first-served	Scored	Auction	Uniform	Scored	Reverse Auction	Market-determined	Discount Factor	Cash / reimbursement	Fee Rebate	Water rights / tradeable credit
PVWD Net Recharge Metering				X*		X				X		X	
TNC BirdReturns					X			X			X		
Tiffin Watershed BMP Reverse Auction					X			X			X		
Washington Water Trust Reverse Auction					X			X			X		
Department of Energy and Environment Stormwater Retention Credit Trading Program	X					X			X				X
TNC Colorado River demand management program		X				X					X		
Verde River Exchange Water Offset Program	X								X		X		
Emission Reduction Credits	X					X			X				X
USDA Conservation Reserve Program--Continuous Enrollment			X				X**			X	X		

	Selection					Price					Payment		
	Unlimited	Lottery	First-come first-served	Scored	Auction	Uniform	Scored	Reverse Auction	Market-determined	Discount Factor	Cash / reimbursement	Fee Rebate	Water rights / tradeable credit
USDA Conservation Reserve Program--General Enrollment				X			X**			X	X		
Wildfire Mitigation Programs			X	X		X					X		
** For the initial pilot program, participants will be identified on an individual basis. Though not an established scoring system, this likely involves weighting a range of factors, similar to a scored subsidy.*													
***rental payments do vary so they are not uniform, but they vary by county rental rates*													

Pajaro Valley Net Recharge Metering Program

Pajaro Valley Water Management Agency's Net Recharge Metering[10] program is one of the few examples of a program to incentivize groundwater recharge. The program offers agricultural landowners in the valley incentives to collect stormwater runoff to recharge depleted aquifers. This kind of distributed stormwater collection is parallel to distributed generation in electricity markets. The program is starting on a pilot basis to 8 to 10 project sites that can collect at least 100 acre-feet of water per year and implementing one or two sites per year. Larger ranches have the most potential to capture large amounts of rainwater and so are being targeted for the first round of projects. Incentives are provided in the form of rebates on the participant's pumping fees in the following year (PVWMA is a special acts district formed to reduce groundwater overdraft. They charge an augmentation charge to all well users). The rebate is calculated as 50% of the augmentation charge per acre-foot of stormwater recharged on a property. They use 50% to account for the fact that not all water that infiltrates as stormwater becomes recharge and not all recharge is recoverable. The rebate provides an incentive to participate in the program even though there may be operations and maintenance costs associated with projects. A third-party certifier will assist PVWMA in identifying sites, raising funds, designing stormwater capture systems, permitting, and construction, as well as monitoring and evaluation. The rebate will apply only to additional water recharged from the project (i.e. total recharge less incidental recharge that would have

[10] http://pvwater.org/media-room/news-releases/2016/Release1601-PV%20Water%20Launches%20Landmark%20Groundwater%20Rebate%20.pdf

occurred without the project). PVWMA will publicize the program and make an annual call for statements of interest, which will be evaluated by the third-party certifier. Funding for project installation will be raised externally through grants and other means.

TNC BirdReturns Program

The Nature Conservancy's BirdReturns program uses reverse auctions to identify California farmers willing to create temporary wetland habitat by flooding their fields during February and March—the peak of bird migrations.[11] The program uses crowd-source data from birdwatchers to identify and prioritize networks of habitat needed by bird species. Participation and price are determined by reverse auction, where farmers submit bids of how much they would be willing to accept on a per acre basis to flood their rice fields for a 4, 6 or 8-week period. Program administrators were then able to select participants based on which fields provided the best habitat for specific species as well as bid price. In its first year, approximately 40 farmers participated, flooding approximately 10,000 acres of rise farmland. Participating in the program poses a risk for farmers, whose flood may not dry out in time for planting for the following season. The reverse auction allows them to consider this risk in their bid decision. Migratory bird protection can be likened to another 'crop' income, with payments to farmers made in cash.

Tiffin Watershed Water Quality BMP Program

Another example is a 2014 reverse auction in two Ohio Counties to allocate payments for applying best management practices (BMPs) to reduce agricultural phosphorus runoff in the Tiffin River Watershed. Agricultural phosphorus runoff has been identified as a primary cause of harmful algal blooms in Lake Erie. There were three eligible BMPs allowed in the auction—using cover crop, filter strips, and subsurface drainage control structures. Of approximately 1000 landowners targeted, 36 submitted bids. Bids were ranked based on the cost per pound of reducing bioavailable phosphorus. With only a small portion of farmers in the watershed submitting bits the auction did not result in the most cost-effective procurement of phosphorus reduction. Surveys conducted after the auction identified some of the primary reasons for low participation as a lack of knowledge about the BMP auction, perceived ineligibility to submit a bit, and lack of interest in submitting a bid. Among those that knew about the auction and believed they were eligible, the primary barriers were that the auction seemed complicated, they did not want to adopt any of the eligible practices, land rental agreements complicated participation, and they perceived a low probability of bid acceptance. Analyses of this program suggest that when transaction costs or perceived transaction costs of a reverse

[11] http://blog.nature.org/science/2014/08/06/birds-birdreturns-innovative-lands-conservation-science/

auction are high, a well-targeted uniform payment program may perform better in terms of cost-effectiveness.[12]

Washington Water Trust Dungeness Dry-Year Leasing Program Reverse Auction

In critically dry years, the Washington Water Trust holds a reverse auction to lease agricultural water rights to supplement instream flows in the Dungeness River. Bid invitations are sent to senior water rights holders with 10 or more acres of irrigation. Bidders must demonstrate beneficial water use in the past 5 years, and be willing to fallow at least 5 acres of irrigated land through the season. To evaluate the bids, auction managers look at the value of flow to instream habitat, seniority of rights, distance upstream from the confluence, as well as price. Bid invitations are sent out in late March, and bidders are notified of the outcome by late April. Lease payments are made at the end of the irrigation season. Program managers may hold multiple rounds open only to first-round bidders if the budget is not spent in the first round. Washington Water trust sets a reserve price that may also be adjusted in subsequent rounds.

Department of Energy and Environment (DOEE) Stormwater Retention Credit Trading Program

The District of Columbia's Stormwater Retention Credit Trading program provides incentives to install rain gardens, green roofs, and other stormwater retention infrastructure to local participants. Participants typically complete a DOEE-approved Stormwater Management Plan, and must install infrastructure following the Department's Stormwater Management Guidebook. By doing so, participants in the program generate Stormwater Retention Credits (SRC) that can be sold in an open market. Developers can purchase SRCs to meet their stormwater retention requirements. An online clearinghouse provides information on available SRCs, asking prices, final sale prices from recent transactions, and interested buyers.

The Nature Conservancy Colorado River demand management programs

The Nature Conservancy has worked in irrigation districts on the upper Colorado River and Grand Valley to implement two pilot demand management programs. The programs were implemented through local irrigation districts and designed according to local conditions. In the Grand Valley, TNC supported the Grand Valley Water Users Association to pilot a water bank program. Participants were selected by a lottery system, which was simple to implement and politically preferable for the local districts and paid a fixed price established by GCWUA early in the process. On the upper Colorado River, the program had $2 million of funding and received $7 million worth of project applications. Participants were hand-selected by the Upper Colorado River Commission to meet the first-year goal of ensuring a diversity of project types as well as

[12] https://www.econ.iastate.edu/files/events/files/palm-forsteretal-tooburdensometobid-ajae2016inpress.pdf

geographic diversity. In future program rounds the selection method may move toward a reverse auction or other selection method.

Verde River Exchange Water Offset Program

Friends of Verde River Greenway, in the Verde Valley of Arizona have initiated a pilot program to connect willing buyers and sellers of Water Offset Credits in the Verde Valley project area. Offsets can be created on an annual basis by fallowing agricultural land. Other local water users can purchase the Water Offset Credits to "offset" their own water use in the valley. Offset buyers are not entitled to additional water use as the offset credits do not represent actual water use rights. Credits are aimed at local businesses, farms, or families that are interested in supporting the effort to reduce overdraft and create more instream flows in the Verde River. Friends of Verde River Greenway is working with the Bonneville Environmental Foundation to register and track offset credits. In 2016, the program had two participants in its pilot program as buyers of offset credits.

Emissions Reductions Credits

Emissions Reduction Credits (ERCs) are issued when a source of air pollution shuts down or decreases emissions, and can be traded and banked to meet New Source Review requirements under the California Clean Air Act. New sources of emissions must offset their emissions based on set offset rations. Offset ratios range from 1.0 to 1.2, meaning that new sources must purchase 1.2 times the emission amount in ERCs. To qualify as an ERC, offsets must be surplus to any federal, state or local laws or regulations, and must be real, enforceable, quantifiable and permanent. However, since compensation for reducing emissions is in the form of a tradeable offset, there is no limit on participation, as long as the reductions meet established criteria. The price of an ERC is set by the owner and varies depending on location and pollutant. New sources of emissions may be required to obtain offsets in the form of ERCs to mitigate emissions that result after applying the best available control technology. The incentive to reduce emissions depends on the existence of healthy market and banking systems so that ERCs can be sold if not needed directly and immediately by the participant.

USDA Conservation Reserve Program—Continuous Enrollment

The USDA's Conservation Reserve Program (CRP) is a voluntary program that contracts with farmers to implement practices that yield conservation benefits. CRP contracts range from 10 to 15 years to take land out of production and establish vegetative species to control soil erosion, improve water quality and provide habitat in exchange for rental payments and cost-share assistance. Under continuous enrollment, offers to participate are automatically accepted on a first-come first-served basis as long as they meet certain eligibility requirements. Eligibility requirements include a minimum 12-month land tenure, land must be working cropland in four of the previous 6 crop years, and the land must be suitable for any of the eligible conservation practices, which include riparian

buffers, filter strips, pollinator habitat, and salt tolerant vegetation, among others. The Farm Service Agency offers rental payments and cost-share assistance to participants. Rental payments are variable, based on relative productivity of the soils in each county and the average dry-land cash rent. Cost-share is also available for 50% of the cost of establishing the practice.

USDA Conservation Reserve Program—General Enrollment

Unlike continuous enrollment, general enrollment in the CRP is a competitive application process. General CRP sign-ups are not held on a fixed schedule but are announced periodically by the Secretary of Agriculture. Applicants are scored according to an Environmental Benefit Index (EBI), which takes account of soil erosion prevention, water quality improvement, wildlife benefits, air quality benefits, and cost. The FSA ranks all applicants across the country by the EBI, determines an EBI threshold and offers enrollment to all offers that scored above the threshold. Incentive payments include both rent and cost-share payments.

Wildfire mitigation incentive programs

Programs to encourage individuals to mitigate their private risk of wildfire are typically undertaken at the state, county or local level and can vary significantly. However, considering this category of incentive programs in general may be instructive to creating an incentive program for groundwater recharge. In general, these programs reimburse residents for a percentage of expenditures made to reduce their wildfire risk, up to a maximum value, typically ranging from several hundred to a couple thousand dollars. They often also provide advisory services, information, and inspections to participating residents. Interest in these programs is usually greater than available funding, so participants are selected on a first-com, first-served, or scored basis.

APPENDIX B: EVALUATING INCENTIVE MECHANISM PERFORMANCE

Different incentive mechanisms might be evaluated across a range of criteria for effectiveness and equity. Incentive goals represent what regulators, participants and interested third parties wish to achieve by adopting these mechanisms. Measures of success are the objectives an analyst can use to communicate to policymakers the goals attained by an incentive-based program. Institutional proficiency are the traits most likely to lead to a successful incentive program. This analytic framework can serve as a roadmap for an analyst in assessing these incentive proposals.

The Organisation for Economic Co-ordination and Development (OECD) proposed one set of criteria for evaluating incentive programs, such as tradeable permits or rights, in that they should achieve economic efficiency, provide effective environmental protection, be politically acceptable and supportable, provide administrative ease for the regulatory agency, and achieve equity goals.[13] The measure of an incentive program's success depends on the relationship of price or tax to marginal value of product from the resource or environmental factor measured as an input being traded, the volume of transactions, the relative price stability and spread within the program, the distributional impacts from markets' actions, and whether the stated goals by the regulatory agency were achieved. An "efficient" market achieves all beneficial transactions while reflecting all social values by internalizing the benefits and costs associated with using a resource.

[13] OECD, "Recommendation of the Council on the Use of Economic Instruments in Environmental Policy," http://acts.oecd.org/Instruments/ShowInstrumentView.aspx?InstrumentID=41&InstrumentPID=38&Lang=en, January 31, 1991.