APPENDIX

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Tillamook Bay National Estuary Project Action Plan Demonstration Project Report

Year Two Demonstration Projects:

Constructed Wetland: $17,850

Contractor: Oregon State University
Principal Investigator: Dr. James Moore
Start/End Date: 6-20-96/6-30-97
Matching Funding: $20,283; OSU X $10,880, Oregon DEQ X $9403
TBNEP account # 028-4283-210-096U

Synopsis:
Oregon State agricultural engineers built a constructed wetland on the local dairy farm of Dale Buck. The two-cell system captures runoff from an active, 15-acre dairy pasture and relies on wetland processes to reduce non-point source pollutants in surface water. The site will be equipped with a flood stage recorder to calculate flow into the wetland and automatic sampling equipment to measure water quality parameters including: biological oxygen demand, pH, total suspended solids, total nitrogen, ammonia and nitrate, total phosphorous, and fecal coliform. Sampling of water into and out of the wetland will begin with the fall rains and continue into the spring when cows go to pasture. Sampling will occur during storm events when most water enters the system. The project has great potential for showing other farmers the value of constructed wetlands as a pollution remediation technique and demonstrating how to construct a small-scale wetland. The project was continued for a second year. Contact: Dale Buck, farmer, 503-398-5191.

Lessons learned:
Discussion follows Year Two of this project, on Page K-6.

Patterson Creek Restoration Project: $5,000

Contractor: Pals of Patterson Creek
Principal Leader: Patrick Vining
Start/End Date: 7-1-95/7-1-97
Matching funding: $8160
TBNEP account # 028-4283-210-096I

Synopsis:
As a foundation consisting of local landowners and volunteers, the Pals of Patterson Creek (PPC) completed the first year of a stream restoration and monitoring project in Bay City, Oregon. Among other efforts to improve salmon habitat, volunteers planted trees, cleaned out fish blockages, trapped and identified fish, and tested water quality in two creeks draining into the main Bay. The project has been a success. Many community volunteers learned stream monitoring techniques and applied them to a highly visible creek. Moreover, the project has great potential to serve as a prototype for similar efforts called for

under the Governor's Salmon Restoration Program. Contact: Pat Vining, Treasurer, Pals of Patterson Creek, 503-377-2257.

Lessons learned:
In every sense of the word, this project has been an unqualified success. It has illustrated perfectly that private citizens who are committed to a common cause CAN make a difference. Over the course of four years, with 100% landowner cooperation and participation, more than 3,000 trees have been planted for riparian restoration. An ongoing educational program with elementary students continues as young children are taught both in the classroom and in the field about personal stewardship of the natural resources of their "backyard."
--Pat Vining

Assessment of Wetland Reconstruction Through Dike-Breach: $30,000

Contractor: University of Washington - $25,000
Secondary Contractor: Phillip Williams and Associates - $5000
Principal Investigator: Dr. Charles Simenstad
Start/End Date: 8-4-95/7/31/96 Extension to October 31, 1996 granted
Matching funding: $10,000; ODSL X $8334, PWA X $1,666
TBNEP Account # 028-4283-210-096K

Synopsis:
In cooperation with local landowners, wetland scientists from the University of Washington evaluated the landscape to assess the potential to restore tidal wetlands by removing dikes on farmland. The scientists used geographic information systems (GIS), image analysis tools, and site visits to identify areas most likely to increase salmon rearing habitats in tidal estuarine systems. Moreover, the team evaluates the patterns of landscape change in two existing, naturally-breached wetland systems to predict the probably of success and recognize characteristics of restored tidal wetland. Combined with appropriate economic data, TBNEP will use this information to recommend wetland restoration sites in specific reaches of the lower Watershed. A draft report was presented at the Restoration Workshop held by the TBNEP in August 1998. The document has been reviewed, final revisions are nearly complete. Contact: Dr. Charles Simenstad, University of Washington, 206-543-7185.

Lessons learned:
There is a need and ability to (as demonstrated by this project) adopt an objective, systematic approach to assessing and setting priorities for estuarine wetland restoration.
Still need to incorporate a finite view of restoration end-point and constraints. We tried to do that by using historic structure, but lacked resolution in that data. (Historic structure is useful, but needs to be higher-resolution.)
This needs to be taken to the next step of developing data on infrastructure and constraints to implementation. We identified ecological priorities, but issues such as where house, roads can be moved to, etc., ran into social/economic/political hurdles.
--Dr. Charles Simenstad

Year 3 Demonstration Projects:

Biotechnical Barb Structure and Gravel Bar Stabilization: $25,183

Contractor: Tillamook County SWCD
Principal Investigator: Randy Stinson
Start/End Date: 3-1-97/3-1-98
Matching Funding: SWCD agrees to fund monitoring in Years 2B3
TBNEP Contract # PA500(5)

Synopsis:
Stream bank erosion, lack of structural stream diversity, and limited riparian vegetation have been identified as major concerns for the survival of salmon in Oregon streams and rivers. Biotechnical barb structures have been identified as a possible fish friendly, low-cost method to improve stream bank stabilization, stream channel diversity, and riparian vegetation. The concept of the barb is to divert the thalweg away from eroded streambanks and create slack water on the barb side of the stream. Sediment is collected on the barb side, creating a bar. Channel scouring occurs adjacent to the bar. After the bar is formed, willow plantings provide additional bar and stream bank stabilization. Surveys are being conducted at the initiation and completion of the project.

Topographic maps are being created from the survey data to analyze changes in the hydrology and morphology of the stream. A photographic log of the stream reach is being prepared and permanent photo points have been established. Pre-structure and annual post-structure (high and low flows) photographs will be included. Plant growth will be monitored annually. The barbs were constructed in September 1997 and planted in March 1998. First year monitoring has been completed. The planting was not completely successful, and will be replanted in the spring of 1999. The barb stabilization project was completed along with the primary survey.

Overall, the structures appear to be working well. Based on this project, SWCD obtained additional funds and landowner buy-off to install additional barbs throughout the County. NRCS has adopted barb construction and stabilization as strategy throughout the region. Contact: Randy Stinson, Tillamook County Soil and Water Conservation District, 503-842-2848.

Lessons learned:
For many years, various agencies have installed stream barbs (other designations include: river jetty, rock barb, finger jetty) with varying degrees of success. In some cases, the practice brought about results opposite those intended. Sometimes the effect was immeasurable, and in others, the positive benefits were dramatic.

In 1996, the TBNEP funded a demonstration project with the Tillamook County Soil & Water Conservation District to install state-of-the-art barbs on the Kilchis River at a point where the river channel was widening dramatically. Up stream from this point, a rural residential landowner was experiencing undesirable erosion.

Within one year after the installation of bio-technical stream barbs at these sites, the results were positive and dramatic. The landowner had been very skeptical of the practice, favoring conventional riprap over the bio-technical approach. The

same landowner is now a strong advocate of bio-technical streambarb design for erosion control and channel enhancement.

Stream barbs have been installed in other rivers within the Watershed under other programs since this demonstration project. As a result, there is a wide variety of project results from which to determine levels of success. Of these, several determinations have been made. These include:

- Bio-technical stream barbs can be useful in reversing the trend of a widening, shallowing river channel.
- The practice costs from 1/6 to 1/3 of traditional hard armour practices, yet yields similar results.
- The practice promotes gravel and sediment deposition and sediment can be planted with riparian species for riparian zone enhancement.
- The practice provides improved channel sinuosity (diversity).
- The practice provides improved velocity gradients (diversity).
- The practice provides improved salmon spawning and rearing habitat.
- The practice provides improved water temperature attenuation.
- Stream barbs trap or detain organic and woody debris.

This table lists significant differences between bio-technical stream barbs and conventional riprap

Bio-technical rock barbs	Conventional riprap
Divert flows away from erosion areas	Scours along toe
Create scour pools away from erosion areas	Decreases diversity
Re-establish meander geometry by increasing sinuosity of thalweg	Straightens thalweg
Natural sediment recruitment provides substrate for planting riparian area	Moves sediments down system
Provide stream shading/cover/fish habitat, immediate and long-term	Sometimes provides long-term shade
Collect organic debris	Provides little organic recruitment
Absorb or dissipate hydraulic energy	Has little effect on kinetics of water

--Randy Stinson and Richard Felley

Nestucca Watershed Habitat Assessments: $1,444

Contractor: Nestucca Watershed Council
Principal Investigator: Mary Barczak
Start/End Date: 4-1-97/4-31-98
Matching Funding: BLM, ODFW, and DEQ committed to providing technical training and advice to volunteers.
TBNEP Contract # PA500(9)

Synopsis:

Anadromous fish populations along the Oregon Coast are declining. Freshwater habitat has been identified as one factor limiting these populations. Under the Coastal Salmon Restoration Initiative, government programs will provide regulatory and technical support, but local people will do the bulk of the work to conserve and restore watersheds. The objectives of this project were to gather data on habitat conditions of streams long private lands that are potentially good habitat for species of concern (coho salmon, chum salmon, and winter steelhead). The data gathered concerned the physical environment (following the ODFW

Aquatic Inventory Project protocol) as well as macroinvertebrate fauna (following the DEQ sampling protocol).
Data helped the Nestucca Watershed Council and Technical Advisory Committee assess the need for habitat enhancement/restoration projects, as well as prioritize among possible projects. Involving private citizens in watershed issues, and facilitating cooperation between private citizens and agency personnel were some of the beneficial outcomes of the project. Contact: Mary Barczak, Project Manager, Nestucca Watershed Council, 503-392-3161.

Lessons learned:
The volunteers were enthusiastic about stream assessment training and field work. We found that some volunteers needed encouragement and the support of being paired with an experienced volunteer before the new volunteer was comfortable about his/her abilities to do the field work.
--Mary Barczak

GIS Training/Public Access Site: $10,020

Contractor: Tillamook Community College
Principal Investigator: Paula Ascher
Start/End Date: 2-5-97/2-5-98
Matching Funding: TBCC will develop curriculum and maintain the equipment. $19,401
TBNEP Contract # 028-4285-210-370

Synopsis:
Currently in this region, GIS databases are being developed to manage watersheds, plan emergency scenarios, streamline community development permitting, and improve agency information sharing. TBCC and TBNEP have been working closely over the past year to develop the local capacity to use new technologies to protect the watershed. We have collaborated to train a TBCC faculty member to teach GIS technology. Funding from this project was used to purchase equipment to provide five PC-based workstations and webserver capacity. TBCC has developed a training curriculum that incorporates use of local issues and GIS databases into ArcInfo/ArcView training. Through training and public access, TBCC will develop its capabilities as a community learning center, teaching the community about the nature of the priority problems of the estuary and their ramifications. The project provided additional natural resource oriented vocational education as well as technical assistance to landowners and other affected groups. Contact: Paula Ascher, Director, Professional Technical Education, TBCC, 503-842-8222 X133.

Lessons learned:
The GIS training/public access site, housed at the Tillamook Coastal Watershed Resource Center, has been a good educational tool for the community. People have come in to access the database and get advice from the staff. We've seen a lot of one-on-one teaching. The center also serves as a home base for the Watershed Council, bringing people together. We have met all of our goals. The biggest complaint is that there has been no funding for TCWRC staff. Participating agencies have worked together to staff the center, but a dedicated staff person would have been good. Long-term funding and staffing for TCWRC

are addressed in Action Plan CIT-08.

This true partnership continues to exist because people want it to exist, and they continue to put resources into it. It shows that this kind of partnership can work, if you're clear up front about what you want and what resources you can put into it.

--Paula Ascher

Constructed Wetland (Year 2): $21,897

Contractor: Oregon State University
Principal Investigator: Dr. James Moore
Start/End Date: 6-30-97/6-30-98
Matching funding: Oregon DEQ X $10,000; OSU X $12,141
TBNEP Contract # PA508B

Synopsis:

Oregon State agricultural engineers built a constructed a wetland on the local dairy farm of Dale Buck. The two cell system captures runoff from an active, 15-acre dairy pastures and relies on wetland processes to reduce non-point source pollutants in surface water. The site is equipped with a flood stage recorder to calculate flow into the wetland and automatic sampling equipment to measure water quality parameters including: BOD, pH, TSS, total N, ammonia, nitrate, total P, and fecal coliform. Storm event and quiescent conditions were evaluated. In the first year, before plants were fully established, some treatment was provided. Hourly sampling took place over 24 hours during a fall storm event, where runoff microbial levels were expected to be highest. Additional periodic grab sampling indicated that incoming runoff levels decreased significantly as the animal waste was washed away and no new application of manure occurred. Bacterial concentrations of the runoff were found to be significantly decreased when exposed to the wetland cells, in rough proportion to the cells' sizes. During winter 1996B97, flooding damaged the wetland dam. After the dam was repaired and stabilized, monitoring continued in the second year to evaluate wetland function as the plants become fully established. Two reports have been prepared, a technical report describing residence times and treatment efficiencies for the wetland, and an Extension Newsletter article describing the process in more general terms. Contact: Dale Buck, farmer, 503-398-5191 or Dr. James Moore, OSU, 541-737-2041.

Lessons learned:

Constructed wetland to treat non-point source runoff. Constructed wetlands located high in the watershed can provide significant treatment ot NPS runoff. The greatest treatment is provided during small runoff events. These commonly occur in the late fall and early winter. The early runoff events also carry the greatest concentration of potential pollutants.

The data from 4 winter storms indicate that fecal coliform bacteria concentration can be reduced 90B95% with as little as 24 hours detention in a constructed wetland. Typically the longer the detention time, the greater the removal.

Suspended solids and any pollutants that are attached to these solids are efficiently removed when passing through a constructed wetland. For example, phosphorus attached to soil particles is removed in a wetland; however, soluble phosphorus passes through with little treatment.

Constructed wetlands offer the landowners a simple, low-maintenance water treatment unit that can impro9ve water quality. They do require some land to be dedicated to this use.

--Jim Moore

Large Woody Debris Survey and Placement in Tillamook Bay: $15,000 ($13,000 monitoring option)

Contractor: Robert Rees, Citizen, Fisheries Biologist
Start/End Date: 7-1-97/7-1-98
TBNEP Contract # PAN500-13

Synopsis:
Juvenile salmonids depend on large woody debris to provide food and shelter them from many predators that pursue them in the Aopen≅ estuary. Recruitment sources of LWD in the Tillamook Watershed have been reduced by the Tillamook Burn fires and logging practices. In addition, LWD is often removed from the channels in estuary for navigational purposes and for firewood. This project surveyed, categorized, and placed large woody debris (LWD) in Tillamook Bay. Pertinent literature was reviewed and appropriate resource professionals contacted for opinions and anecdotal information. Placement of new LWD structures in the estuary is expected to enhance estuarine habitat for juvenile salmonids and sensitive life stages of other aquatic species. Based on the results of the estuary and literature surveys, six LWD sites were established in Tillamook Bay using three different structure materials, and two different anchoring strategies. Surveys were conducted seasonally to document retention/migration of LWD in the estuary. Some seasonal surveys of each structure and appropriate reference sites were conducted as part of a larger fish use of the estuary study to document use of the structures by target (salmonids) and non-target species. The LWD project was featured on several regional news programs, and was highlighted at the Governor=s Watershed Enhancement Board Conference in October 1998.
Contact: Robert Rees, fishing guide, fisheries biologist, 503-842-8249.

Lessons learned:
Large wood can be successfully retained in Oregon's estuaries with the help of anchoring strategies explored in this project. Stumps, unlimbed fir trees, and human-made structures were all placed in the estuary and anchored for fish habitat. Tillamook experienced an extremely wet and stormy winter, which proved stressful on the 6 structures placed in the Bay. Four of 6 structures are still intact as of the Spring of 1999. The only failed sites were the two rootwad placements. These high-density structures are less than ideal for retention because they are so buoyant. The structures are susceptible to wind and wave action, causing them to break free of their anchors.
--Bob Rees

Primary Productivity Sampling in Tillamook Bay: $9,500

Contractor: Dennis Schweizer, Oyster Farmer
Start/End Date: 7-1-97/7-1-98
Match: ODA will conduct toxins analyses on samples from hangings. Staff from the Willapa Bay Alliance will travel to Tillamook to conduct a one-day training session.
TBNEP Contract # PAN500-14

Synopsis:
Direct volumetric sampling for primary and secondary productivity, taken in concert with other water quality parameters, is an effective method that can help

determine ecosystem responses to climatic change, specific weather events, impacts of introduced species, pollution, and changes in land use practices that affect nutrient availability. Volumetric sampling can be correlated to anticipate peak zooplankton productivity, a useful measure of available food for juvenile salmonids. These types of data have been used by hatcheries to optimize release times for greatest survival. Some species of plankton can, under stress conditions, produce toxins that can be bioaccumulated in shellfish, which may lead to illness in consumers. Following protocols established by the Willapa Bay Alliance, this project collected plankton tows, estimated biovolumes, and characterized community composition for plankton in Tillamook Bay. A local high school student has been trained to collect and analyze plankton, and will continue the project in Year 2 as part of the Citizen Monitoring Effort outlined in the CCMP. Contact: Dennis Schweizer, oyster farmer, 503-842-2684.

Lessons learned:

For a one-year period, we sampled phytoplankton and zooplantkton at four stations in Tillamook Bay. We found that primary production was at a very high level as compared with other Pacific Northwest estuaries. In addition, we found that there were distinct differences in total volume between the sampling stations near the mouth of the Bay and sampling stations in the Upper Bay. We learned much about calculating the volume of water sampled, fixing and archiving plankton samples, identifying plankton genera, and the variety of environmental factors affecting primary production and plankton abundance.

--Kerry Griffin

Review of the graphed data as well as field notes offer some insight. It would seem that the plankton bloom season coincides with the onset of Northwest winds bringing in plankton from ocean upwelling; a logical expectation then being that later tidal exchange would bring more material if it is available. Early blooms don't coincide with the change to daylight low tides, especially daylight minus low tides. Rather, the spike seems to follow the next week. In comparison, the month of May had two phytoplankton blooms that did not seem to coincide with substantial minus runs or with NW winds. Rather, they seemed to happen during relative calm and with a smaller tidal exchange. This was a period when zooplankton had a strong showing, at least in the lower Bay. This was also true during July, when increased numbers are seen during calm winds and fog, with and without minus tides. It seems possible that some plankton groups might stay resident in the Bay, particularly zooplankton. The lower Bay conditions are near the marine levels for salinity and temperature. My personal view was that the bulk of plankton activity was from oceanic upwelling, NW winds driving this. The expectation then was that larger tidal exchanges would bring more material into the Bay. I have lost some confidence in that theory.

--Dennis Schweizer

Organism Movement for Various Manure Handing Practices: $23,960

Contractor: Oregon State University
Principal Investigator: Dr. James Moore
Start/End Date: 6-30-97/6-30-98
Matching Funding: Oregon DEQ - $10,000; OSU $16,730
TBNEP Contract # PAN-500-15

Synopsis:

This project demonstrated and evaluated several manure management practices through a series of trials of spreading manure and monitoring organism movement. Field scale plots received different manure application frequencies and rates. Organism concentration was determined in the runoff from each of the field plots. Applications were evaluated three times during the year to assess the effect of soil saturation on the pathway and transfer of organisms in the runoff water. In addition, plots were selected to allow for the evaluation of the impact of buffer strip width on organism movement. Plots were selected with sufficient buffer strip width to allow for downslope sampling at multiple locations within the buffer. Sampling was performed in the fall, before the soil was saturated, and again in the winter, after the soil was hydraulically full. Proper manure management is a key element in the success of the dairy industry in the Tillamook basin. The Tillamook Bay Watershed and shellfish industry have been impacted by water quality limitations (elevated coliform concentrations) with the closure of harvest several times per year. Organism movement into Tillamook Bay and regulations to control this movement could limit the production capability of local dairy producers. This project will help develop BMPs that will limit organism movement into waters of the State. Contact: James Moore, Bioresource Engineering Department, Oregon State University, 541-737-2041.

Lessons learned:
Organism movement from various liquired manure land applications. Buffer strips or vegetated filter strips are not very effective at reducing bacterial numbers in runoff. While removal efficiency is low, the greatest percent removals were seen with very high bacterial concentrations in the runoff.
Infiltration into the soil profile was the greatest factor in reducing bacterial numbers in runoff.
Rainfalls of low intensity transported fewer organisms than did events of high intensity. Transport increased with intensity of rainfall event.
Field slope is important, as it provides velocity for surface runoff. Flat surfaces allow greater infiltration opportunity when compared to fields with higher slopes.
Although the data from this study is mixed, it does suggest that frequent light manure applications will lose fewer organisms in runoff than infrequent heavy applications. This is a general statement and will be strongly influenced by filed slope, soil infiltration rate, intensity and duration of rainfall.
--Jim Moore

Year Four Demonstration Projects:

Remediation of Fecal Coliform Bacteria, Sediment, and Heat Contributions to an Upland Agricultural Subbasin of the Tillamook Bay Watershed: Storm Event Water Quality Monitoring: $33,000

Contractor: E&S Environmental Chemistry
Principal Investigator: Dr. Tim Sullivan
Start/End Date: 3-98/12-98
Matching Funding: $15,000; EPA X $25,000, Oregon DEQ X $30,000, TCCA X fencing, GWEB X $98,000
TBNEP account # 028-4285-210-370I

Synopsis:
The proposed remediation effort has been submitted to multiple agencies to demonstrate effective reduction of fecal coliform bacteria, temperature, and sediment loads contributed to surface waters from an upland agricultural subbasin of the Tillamook Bay Watershed. This will be accomplished by a combination of streamside fencing, riparian planting, construction of multiple small artificial wetlands, and water quality monitoring before and after implementation of remediation efforts. Four primary objectives will be achieved: (1) improve water quality in a subbasin of one of the major rivers that flow into Tillamook Bay; (2) improve aquatic habitat; (3) demonstrate the environmental benefits that can be achieved though implementing cost effective management practices and remediation efforts; and (4) quantify the effectiveness of these measures by implementing a long-term monitoring strategy. Additional funding was secured to implement the project. A subbasin was selected and landowner support has been gained. Pre-construction monitoring was initiated in fall 1998.

To support the design of a citizen-based water quality monitoring program in the rivers, E&S also demonstrated the relation ship between *E. coli* and fecal coliform and TSS and turbidity in each river over two storms. These data will provide additional storm classification for modeling efforts and loading estimates. Contact: Tim Sullivan, E&S Environmental Chemistry, 541-758-5777.

Lessons learned:
At this point, the project is still in the data collecting phase. Permitting issues for wetland enhancement take a considerable amount of time, especially now given the concerns about salmonid habitat. Also, negotiating work on private land is a time-consuming process.
--Tim Sullivan

Zooplankton Monitoring in Tillamook Bay, Oregon: $3,474

Principal Investigator: Kerry Griffin
Start/End Date: 3-98/12-98
Matching Funding: volunteer time of 2 high school students
TBNEP account # 028-4285-210-370G

Synopsis:
Because of their vital role in the estuarine food web and carbon cycle, plankton can be used as an indicator of an estuary=s health. However, data sets must be collected for several years to provide enough information to be used as an effective management tool. While plankton are by one of many possible indicators, they are easily collected and identified, providing an excellent opportunity for a community-based monitoring program that can collect and compile an accurate, long-term data set. This project demonstrated the tools necessary for citizens to identify the major zooplankton groups in Tillamook Bay. A citizen monitoring guide has been prepared and reviewed. Three high school students participated in project. Continued plankton sampling has been identified as on ongoing need in the CCMP and presented to the Tillamook Bay Watershed Council as a potential activity for council members. Contact: Kerry Griffin, 503-624-7042

Lessons learned:
The goal of this project was to develop a zooplankton monitoring guide suitable for volunteers, high school students, and scientists, As I researched zooplankton functioning in estuarine systems, I decided to expand the scope of the project to include phytoplankton monitoring because algal blooms are closely linked with zooplankton blooms.
I worked with two local high school students who followed the protocols in the guide and provided constructive criticism on how to make the guide more user-friendly. In addition, I trained other local citizens, including a group of adults taking a community college course on watershed assessment.
We learned that estuarine plankton communities are closely linked with a variety of environmental factors such as water quality, nutrient availability, and grazing. These factors are influenced by human activities in and around the estuary. Farming, industry, municipal waste, runoff, and logging all affect the estuarine environment and therefore primary and secondary production..
--Kerry Griffin

Environmental Education and Restoration of Coon Creek, $3,210

Contractor: South Prairie School
Principal Investigator: Suzanne Kutsch
Start/End Date: 3-98/12-98
Matching Funding: hundreds of hours of citizen volunteer time
TBNEP account # 028-4285-210-370H

Synopsis:
South Prairie Elementary School is developing an outdoor environmental classroom centered on the restoration of Coon Creek, a small seasonal creek just north of the school. The project includes volunteers from the school, parents, community, local resource agencies, and other schools. The goals of the project include restoration of the stream to a more functional riparian ecosystem which supports native species, and education of students and the community in ecosystem processes. This project provided tools to support the effort. Significant progress had been made on the project; vegetation has been cleared and hundreds of trees planted, the fence and bridge has been installed, and many of the outdoor classroom sites have been established. Contact: Cecilia Dwigans, 503-842-8401.

Lessons learned:
In pursuing this project we have involved teachers, community members, students and agencies. We have drawn on all available expertise to guide our efforts and hope to produce a first-rate learning environment for district students. We hold meetings about twice a month and at least one Saturday workday per month. We have found that with teachers working hand-in-hand with parents, community members and agencies, we are establishing a project that will meet a multitude of needs. By working closely with the volunteers, we have avoided making mistakes and have gotten some things done that would have been difficult otherwise. The time, dollars, and equipment donated have demonstrated a fine cooperation of teachers, parents, community members, and agency representatives. We look forward to the continued success of this project. By learning to work together, we are overcoming obstacles and producing a project the whole community is proud

of.

--Jim Coon, committee chair

Two practical lessons can be added to Mr. Coon's list:

1. Fence-building takes considerable skill and labor and, if there's a lot of fence to built, dedication. As such, it's impractical as a purely volunteer effort. Wonderful support and many, many hours of hard work from well-trained supervised workers from the high school's alternative program and local juvenile corrections programs built the needed fence over several months.
2. Exotic species removal and suppression (without use of herbicides) is another nasty job requiring training, equipment, and much hard work and long-term effort. While volunteers cheerfully cut blackberries and scotch broom the first time, it was the alternative high school students and youth camp workers who kept after these invaders and give newly planted and uncovered native vegetation a chance. The young workers were very proud of their accomplishment, and received enthusiastic thanks from the schoolchildren.

--JoAnne Booth, committee member

Classroom Chinook Salmon Incubation and Hatching, $1,000

Contractor: Garibaldi Grade School
Principal Investigator: Diane Griffin
Start/End Date: 3-98/12-98
Matching Funding: ODFW donated eggs and biologist time, Pals of Patterson Creek Volunteer time
TBNEP account # 028-4285-210-370F

Synopsis:

The project demonstrated fisheries science principles and salmonid life history requirements to elementary school students. The project involves a number of community partners, in-class activities, field trips, and a laboratory science component. The TBNEP priority problems are presented to students in relation to salmonid survival and a program with the Pals of Patterson Creek on the importance of clean, cold water. Monies were used to purchase a chiller and support field activities. A second year of classroom activity was initiated in Winter of 1999. Contact: Diane Griffin, 503-322-0311.

Lessons learned:

It was very enlightening for both students and staff to discover how crucial temperature and cleanliness of the water is to the survival of salmon. The students became quite attached to their subjects and, when they released them into the stream, had a powerful lesson in the realities of a life cycle: some live, some die. Also, as a result of the students' personal attachment to the fish, many have developed a stronger sense of their responsibility toward keeping the waters clean. They now have their own convictions against polluting.

--Lori Dilbeck, 4/5 teacher, Garibaldi Grade School

Classroom Chinook Salmon Incubation and Hatching, $1,000

Contractor: Tillamook High School
Principal Investigator: Dennis Silvey
Start/End Date: 3-98/12-98
Matching Funding: ODFW donated eggs and biologist time

TBNEP account # 028-4285-210-370

Synopsis:
The project will demonstrate fisheries science principles and salmonid life history requirements to high school students. The project involves a number of community partners, in-class activities, field trips, and a laboratory science component. The TBNEP priority problems are presented to students in relation to salmonid survival. Monies were used to purchase a chiller and support field activities. Contact: Dennis Silvey, 503-842-2566.
Lessons learned:
Students developed a deep appreciation for the importance of water quality: its parameters such as temperature, dissolved oxygen, and cleanliness. The hands-on component made all the difference as students began to comprehend complex scientific principles by being out in the field and using the tools they'd been taught to apply.
--Dennis Silvey

Managing Animal Waste in Dairies to Improve Efficiency of Nutrient Utilization, Enhance Economics, and Reduce Environmental Impacts, $17,213

Contractor: Kilchis Dairy herd Services
Principal Investigator: Mark Wustenburg
Start/End Date: 3-98/12-98
Matching Funding: $4,375, OSU Extension $3,750, NRCS $3,750
TBNEP account # 028-4285-210-370

Synopsis:
Dairy farmers have relied heavily on pastures for both grazing and silage production. As managers, they should be tracking nutrients supplied in the form of manure to their forage crops to maximize productivity without over-applying any particular nutrient or causing environmental impacts. Several studies have shown the timing of manure application is important in the uptake of nutrients from the soil. More frequent applications increase nutrient removal and total crop yield. This project is tracking nutrient flows from cows, through soils, and back through harvested forage over a one-year period. Values will be generated for waste generated, the loss of nutrients in the system, and crop removal rates to complete the total nutrient monitoring cycle. Currently, agronomic rates based on literature values from outside the County are being used. Providing farmers with Tillamook data will help them maximize forage production with minimal environmental impacts. Sampling began in Summer 1998 and will continue through Summer 1999. Contact: Dr. Mark Wustenburg: 503-377-2250

Lessons learned:
The project is ongoing. The most significant finding from the data compiled so far is that it appears that soil testing can be used to indicate how evenly nutrients are being distributed across a dairy. Also, some early indications are that it seems likely that the amounts of nitrogen and phosphorus being recycled have been underestimated. Further data collection is forthcoming.
--Mark Wustenberg

Citizen-Based Water Quality Monitoring; $8,678

Principal Investigator: Don Reynolds
Start/End Date: 3-98/12-98
Matching Funding: Citizen volunteer labor, DEQ labor
TBNEP account # 028-4285-210-370

Weekly sampling and analysis has occurred on four rivers using the Colilert system to gather baseline data to answer the monitoring question AHow often and for what length of time is each of the five rivers in violation of DEQ=s water quality criteria for *E. coli* bacteria? Are there trends in the frequency and/or duration of those water quality standard violations over time scales of years to decades?≅ A presentation was made to the Tillamook Bay Watershed Council to continue monitoring.

Lessons learned:
The Tillamook River is consistently out of compliance with E coli bacteria standards. This is consistent during periods of rain and dry and has not varied over the course of this study.
Three other rivers X the Miami, Kilchis, Trask X and the small stream Patterson Creek, which runs through Bay City, exceed the standards periodically. These events are not specifically tied to large rain events, though some have close associations, but seem rather to be associated with emptying of storage facilities for manure and other wastewater from farm operations. The longer storage is made on the farms, the greater the likelihood of a peak in the coliform count as the tanks are emptied.
Patterson Creek is not affected by farm runoff as no dairy operations are in the area. This leaves the main culprit to be either non-dairy animals, such as horses and emus; wild animals, such as deer; or failed septic tanks in the area which have not yet been identified. Work is ongoing to identify the source of the problem.
A specific lesson that we have learned is that one must take repeated samples to identify when and where the problems exist. Too few samples let the problems go undiagnosed and leave you to believe that no problems exist. Repeated samples let you identify causes that may be contributing factors to the reading.
--Don Reynolds