Examples of Justification of Social or Economic Importance

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Example 1: Leavenworth National Fish Hatchery

Necessity of Leavenworth National Fish Hatchery

Grand Coulee Mitigation

The hatcheries of the Leavenworth National Fish Hatchery Complex, consisting of Leavenworth NFH, Entiat NFH and Winthrop NFH began operations in 1938, 1940 and 1940, respectively. Reclamation built the hatcheries, but the Bureau of Fisheries (now the USFWS) funded and operated them until 1993 when Reclamation began directly reimbursing the USFWS for their operation. The impetus for their construction was to perpetuate the anadromous fish runs that were displaced from the natural spawning areas above Grand Coulee Dam. The hatcheries were initially authorized under the Grand Coulee Dam Project, 49 Statute 1028, on August 30, 1935 as part of the Rivers and Harbors Act. The hatcheries were reauthorized under the Columbia Basin Project Act, 57 Statute 14, on March 10, 1943, and subsequently under the Fish and Wildlife Coordination Act, 60 Statute 1080, on August 14, 1946. The adult salmon and steelhead runs were first intercepted at Rock Island Dam beginning in 1939 and continuing through the returns in 1943 as part of the Grand Coulee Fish Maintenance Project (GCFMP). The initial program consisted of direct outplants of adult fish to specific stream areas and beginning in 1940, Hatchery production. Fish production has been continuous since 1940.

The mitigation objectives commonly associated with the GCFMP are:

1) "to bring by stream rehabilitation and supplemental planting the fish populations in the 677 miles of tributary streams below Grand Coulee and Rock Island Dam up to figures commensurate with the earlier undisturbed conditions and with the natural food supply in these streams."

2) "to produce in addition, by combination of artificial spawning, hatching, feeding, rearing and planting in these streams, a supplemental downstream migration equivalent to that normally produced by the 1,140 miles of streams and tributaries above Grand Coulee Dam."

Tribal Trust

Trust Responsibilities to Native American Tribes are described by the Indian Trust Doctrine, which was developed by the US Supreme Court. The doctrine articulates the trust responsibility that the Federal Government has in relation to Native Americans. The Federal Government has fiduciary obligations to the Tribes- in essence, a legal obligation to act in the Tribe's best interests, including duties to protect Tribal lands and cultural and natural resources.

Under the Secretarial Order 3206 (signed by both the Secretary of the Interior and the Secretary of Commerce), *American Indian Tribal Rights, Federal-Tribal Trust Responsibilities*, it is further recognized the USFWS (including Leavenworth NFH) has trust responsibilities with respect to tribes. The one tribe which Leavenworth NFH has the greatest interaction with is the Yakama Nation. Adult salmon returning to the Hatchery are an important component of the Yakama Nation's fisheries activities. Since 1987, the Yakama Nation has exercised its treaty right to fish

for spring Chinook salmon in Icicle Creek. The focus of the fishery is the large pool located below the Leavenworth NFH spillway; the character of the river here provides access to construct scaffolds, and fishing platforms. The fishery is important to tribal members as one of the few remaining places in Washington State that offers a productive fishing opportunity utilizing traditional methods. Salmon continue to be an important nutritional and symbolic commodity of the Yakama Nation.

The Yakama Nation is a member of an organization called the Columbia River Inter-Tribal Fish Commission (CRITFC) which also includes the Warm Springs, Umatilla, and Nez Perce tribes. CRITFC serves to manage and protect fisheries resources in the Columbia River basin and protect treaty fishing rights. CRITFC explains the importance of salmon to Tribes in the following way:

Salmon play an integral part of tribal religion, culture, and physical sustenance. Listed below is a short list of the many ways that the tribes consider the salmon to be sacred.

- *Salmon are part of our spiritual and cultural identity.*
- *Over a dozen longhouses and churches on the reservations and in ceded areas rely on salmon for their religious services.*
- *The annual salmon return and its celebration by our peoples assure the renewal and continuation of human and all other life.*
- *Historically, we were wealthy peoples because of a flourishing trade economy based on salmon.*
- *For many tribal members, fishing is still the preferred livelihood.*
- *Salmon and the rivers they use are part of our sense of place. The Creator put us here where the salmon return. We are obliged to remain and to protect this place.*
- *Salmon are indicator species: As water becomes degraded and fish populations decline, so too will the elk, deer, roots, berries and medicines that sustain us.*
- *As primary food source for thousands of years, salmon continue to be an essential aspect of our nutritional health.*
- *Because our tribal populations are growing (returning to pre-1855 levels), the needs for salmon are more important than ever.*
- *The annual return of the salmon allows the transfer of traditional values from generation to generation.*
- *Without salmon returning to our rivers and streams, we would cease to be Indian people.*

Icicle Creek lies entirely within the area ceded to the United States by the Yakama, Palouse, Pisquouse,Wenatshapam, Klickitat, Klinquit, Kow-was-sae-we, Li-Qy-was, Skinpah,Wash-ham, Shyikes, Ochechots, Kay-milt-pah, and So-hap-cat, a confederation of tribes considered as the Yakama Nation under the Treaty of June 9, 1855, 12 Stat. 951.
The Yakama Nation and the Colville Confederated Tribes have litigated fishing rights in U.S. v. Oregon, where the Court held that the Yakama Nation is the tribe with the right to exercise and regulate the fishing rights reserved under the 1855 Treaty in the area ceded by the Treaty. U.S. v. Oregon, 787 F.Supp. 1557 (D. Or. 1992), 29 F3d 481, 486 (9th Cir. 1994), and 43 F.3d 1284 (9th Cir. 1994), cert. denied, 515 U.S. 1102 (1995). The Yakama Nation's concern regarding Leavenworth NFH is based on its strong interest in treaty and non-treaty fishing activities on Icicle Creek, which are governed by the processes and agreements initiated under the Court's

continuing jurisdiction in U.S. v. Oregon. The Colville Confederated Tribes' concern regarding Leavenworth NFH is based on the historic ties of its Wenatchi members to the Icicle Creek area, and because the Colville Confederated Tribes receive surplus fish from Leavenworth NFH, which are an important subsistence food source for tribal members. As a signatory to the 1855 Treaty, the United States assumed a trust responsibility to protect the terms and conditions of the Treaty, and is bound by the rulings in U.S. v. Oregon interpreting the Treaty.

Overriding Public Interest

The activities of the Leavenworth NFH are in the overriding public interest. This determination properly considers the economic, social, and environmental benefits of the Hatchery's operations.

Leavenworth NFH creates significant economic benefits to north central Washington and greatly adds a boost to the tourism economy of the city of Leavenworth. The Hatchery has become a popular tourist destination point in the community with annual visitation of approximately 150,000 people. Visitors represent diverse cultures and backgrounds and are a mix of all ages. A 2007 Hatchery demographic analysis shows a significant number of the visiting public coming from other parts of the United States. Other visitors represent 33 countries from around the world.

Historically, Leavenworth NFH is very significant in furthering the development of Leavenworth and its resources. It was one of the largest employers in north central Washington in the 1930's and 40's during the construction period and provided the Civilian Conservation Corps with many projects throughout those struggling times. Major interest in archiving the historical contributions of the Hatchery is currently underway by the national D.C. Booth Hatchery Society in Spearfish, North Dakota and the Upper Valley Historical Museum located in Leavenworth.

The Hatchery provides full-time employment for 20 employees. Annual salary for these employees is approximately $1.2 million. The Mid-Columbia Fisheries Resource Office, which works in conjunction with the Hatchery and is also located on Hatchery property, adds an additional 11 full-time and 10 seasonal/term staff for a total salary base of $1.3 million. In addition to this direct employment, the Hatchery generates substantial economic activity in the community which results in many indirect jobs through contracts, equipment suppliers, other employment programs, non-profit organizations, youth and volunteer work. In addition to jobs and local economic activity, the Hatchery adds significantly to the Chelan County tax base in central Washington.

Fish and wildlife-associated recreation, including sport fishing, makes large contributions to the rural areas of Washington state, such as Leavenworth. Washington State ranks first in the Pacific Northwest, and eighth in the nation, in spending by sport fishers, which totaled nearly $854 million in 2005. The Columbia River spring Chinook salmon fishery is estimated to generate a $15.4 million annual economic impact, according to the Northwest Sportfishing Association. Salmon produced from Leavenworth NFH which are harvested in Icicle Creek provide one, if not the only, consistent tributary sport fisheries in the upper Columbia River. Based on information collected during the 2007 creel survey on Icicle Creek, a total of 1,058 anglers fished 7,754 hours catching 115 spring Chinook salmon produced by Leavenworth NFH (Viola

2007). In 2007, this fishery alone has a contribution value of more than $402,000 to the local economy (Viola 2007).

During the years 1999-2003, sport anglers in Icicle Creek harvested an average of 1,252 spring Chinook salmon produced at Leavenworth NFH (Table 8). Additionally, 732 of Leavenworth NFH produced spring Chinook salmon are harvested by sport anglers in the Columbia River annually (Table 8). Only a small number of Leavenworth NFH's fish are captured in Pacific Ocean fisheries (Figure 11 and Table 8).

Figure 11.

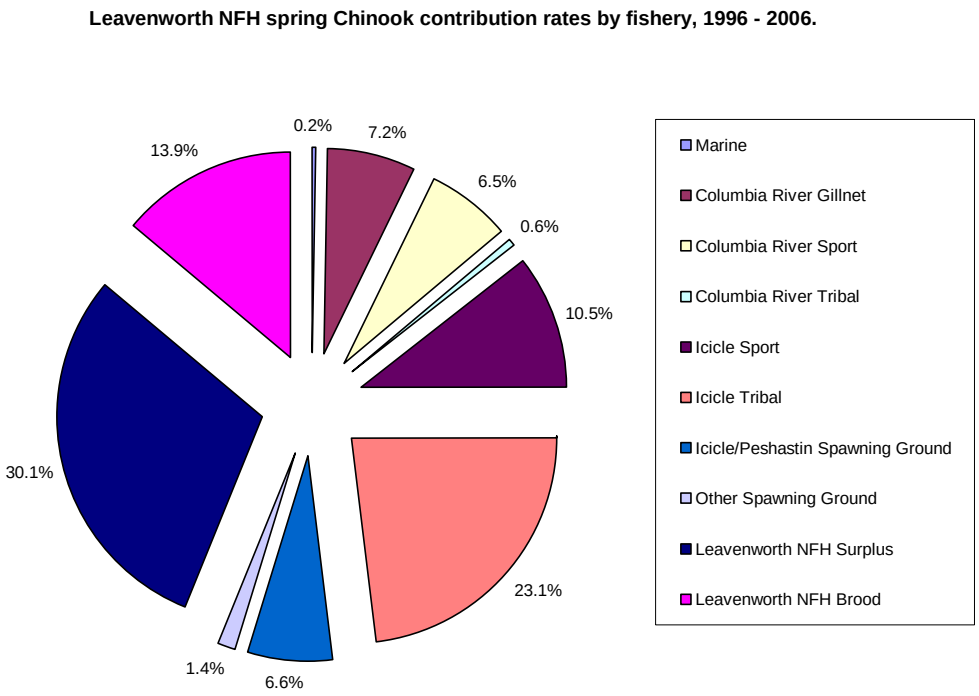

Table 8. Cumulative summary of returning adult spring Chinook salmon deposition for the Leavenworth Complex, 1999-2003 (Cooper 2006).

Recovery / Fishery Location	Leavenworth NFH		Entiat NFH		Winthrop NFH	
	#	%	#	%	#	%
Hatchery Brood	6,323	11.2%	1,973	20.9%	2,498	26.8%
Hatchery Donated Surplus	17,505	30.9%	6,174	65.3%	0	0.0%
Treaty Ceremonial	14,526	25.6%	78	0.8%	40	0.4%
Freshwater Sport	6,262	11.0%	9	0.1%	19	0.2%
Columbia River Gill Net	4,175	7.4%	512	5.4%	651	7.0%
Spawning Ground	4,053	7.1%	211	2.2%	5,426	58.2%
Columbia River Sport	3,686	6.5%	469	5.0%	659	7.1%
Test Fishery Net	0	0.0%	0	0.0%	1	0.0%
Freshwater Net	0	0.0%	2	0.0%	4	0.0%
Estuary Sport	0	0.0%	1	0.0%	0	0.0%
Ocean Troll	148	0.3%	19	0.2%	18	0.2%
Ocean Trawl	9	0.0%	0	0.0%	0	0.0%
Commercial Seine	0	0.0%	4	0.0%	0	0.0%
Above Rock Island	48,122	84.9%	8,464	89.5%	7,921	85.0%
Grand Total	56,685	100.0%	9,452	100.0%	9,316	100.0%

Local Native American Tribes also benefit from the adult spring Chinook salmon produced by Leavenworth NFH. In the years 1999 through 2003, the average annual number of adult spring Chinook salmon adults captured in Icicle Creek by tribal anglers was approximately 2,905 fish (Table 8) and approximately 835 are captured by Native Americans in the Lower Columbia River (Table 8). An economic value cannot be placed on a salmon caught by a tribal member because they consider the fish sacred.

If the number of salmon entering the adult holding ponds exceeds the number needed for production, the excess salmon are "surplused" to Native American tribes. The surplused fish are essential to local Native American tribes for subsistence and ceremonial purposes, and the economic value of the fish cannot be assessed. The Tribes who have received surplus salmon include the Yakama Nation, Colville Confederated Tribes, Spokane Tribe, Kalispell Tribe, Cour d'Alene Tribe. If tribes decline the surplus fish, then they are given to Trout Unlimited through a formalized agreement. Trout Unlimited uses profits generated from the sale of those fish for environmental education and aquatic habitat projects which benefit the Leavenworth NFH. Approximately 3,501 spring Chinook salmon produced at, and return to, Leavenworth NFH are surplused annually (Table 8).

The Leavenworth NFH is home to one of the largest comprehensive Environmental Education and Visitor Services programs in the National Fish Hatchery System. Alone, the annual Wenatchee River Salmon Festival hosts 10,000 people at the Hatchery each fall. Visitors and participants come from around the Pacific Northwest, with 40% staying more than one day in the Leavenworth area. The Leavenworth Chamber of Commerce has determined that, with an average expenditure of $300 by each visitor for lodging, meals, transportation, and shopping costs plus a volunteer value reaching $63,250, the festival generates $903,250 to the economic base of the community.

A unique program at the Hatchery involves recreational special uses. Year-round uses include horse and sleigh ride concessions, Leavenworth Summer Theater outdoor musical productions, and a 10 kilometer cross-country ski and snow shoe trail system managed by the Leavenworth Winter Sports Club (LWSC) and used by thousands of people throughout the winter. During the 2007-2008 season, the LWSC carried an annual payroll expenditure of $174, 842, employing 30 seasonal staff. With 107 days of cross-country trail operation, receipts for ski trail passes and memberships reached $179,299. One day to multi-day special weekend events also permitted on Hatchery grounds include birding and wildlife nature walks, marathons, Eagle Scout programs, Colville Tribal Pow Wow, Washington State Special Olympics cross country ski competition, Arbor Day, National Fishing Week events, handicapped fishing, Volksmarch, river tubing and rafting, snowshoe walks, weddings, trainings and teacher workshops. The economic value associated with public use at the Hatchery is over seven million dollars annually (Table 9).

Table 9. Estimated current economic value of permitted public uses on Leavenworth NFH land:

Event/Activity	Estimated Economic Value ($)
Leavenworth Summer Theater	1,720,000
Icicle Outfitters Horse and Sleigh Rides	93,180
Icicle River Ski Trail	4,665,600
Other Uses – general one day and multi-day use	1,250,000
Total	$ 7,479,030

Located on Leavenworth NFH grounds is the Cascade School District's Cascade Discovery Alternative High School which includes a classroom building, greenhouse, garden, storage sheds and parking. One full- time educator and one full- time para-educator manage the education program for approximately 25 students through the entire school year. This unique school is state accredited and has graduated more than 150 students since it began in 1993. Hatchery staff provides mentoring and vocational training and resources for these students. Additionally, two scholarships are made available to surrounding school districts, offering substantial funding for graduating high school seniors in pursuit of a higher education in a natural resource related field. One comes from the Salmon Festival and once comes from the American Fisheries Society Hutton Scholarship program.

The Hatchery maintains widespread public support among residents of the local community and beyond. The non-profit Friends of Northwest Hatcheries is based on the Hatchery compound, and its mission is to provide volunteer support and funding for quality natural resource conservation education and interpretation. Connecting people with nature is at the heart of the Hatchery's outreach program. In fiscal year 2007, volunteers donated 13,250 hours of time working on habitat and wildlife projects, environmental education, maintenance, cultural resources and recreation programs. The value of volunteer contributions for this past year reached $159,000.

In addition to the Hatchery's substantial economic and community benefits, the Hatchery furthers the public's interest in the environment. The Hatchery takes important measures to be environmentally sensitive in managing its facilities, water, and land base. It has been recognized by the USFWS with a national Environmental Leadership award. The quality of the salmon raised at the Hatchery is high and considered one of highest valued natural resources in the state.

Example 2: Buckhorn Mountain Project

3.0 NECESSARY

3.1 Evaluation of Site, Structural and Managerial Alternatives

The best combination of site, structural and managerial approaches that can be feasibly implemented to minimize the lowering of water quality was evaluated in an all known, available and reasonable methods of prevention, control and treatment (AKART study (Appendix H in Golder, 2007a). The AKART study evaluated ten alternatives for reducing water quality impacts.

The alternatives were evaluated on the basis of effectiveness, implementability and cost. The effectiveness evaluation included consideration for degree of target constituent removal (effluent concentrations and reliability. The implementability evaluation was based on the ease of construction, ease of operation, and the availability of equipment, personnel and other resources, and other factors affecting the ability to construct and operate the alternative. The estimated costs include capital, operation and maintenance costs for the duration of operation on a net present value basis.

The following alternatives were evaluated:

Oil and Grease

- Mine Water Surge Pond: Temporary storage of mine water will enable the water treatment system to operate at a more even flow rate rather than responding to short-term flow changes. In addition to flow equalization, the surge pond (and desiltation basin) will also serve to remove oil and grease and total suspended soles (TS) that settle readily.

Metals

- Precipitation with line: Active treatment of stockpile drainage and groundwater inflow to the mine using lime as a precipitating reagent.
- Precipitation with sodium hydroxide: Active treatment of stockpile drainage and groundwater inflow to the mine with sodium hydroxide (NaOH) and microfiltration to remove the fine floc formed in the precipitation process.
- Ion exchange: Active treatment of metals by chemical adsorption onto an exchange media. Some natural materials are used for ion exchange, but for selective removal of target ions a synthetic resin is typically preferred.
- Reverse osmosis: Active treatment of metals using a selective membrane to concentrate dissolved constituents.

Nitrate

- Source Reduction: Establishing a blast management program to implement best management practices (BMPs) that minimize residual water quality impacts form the mine rock associated with explosive handling, storage and use.
- Active biological treatment (fixed-film and stirred reactors): Active treatment using a porous solid media within the reactor to contact bacteria which grow on the media.
- Reverse osmosis: Active treatment using a selective membrane to concentrate dissolved constituents.
- Ion exchange: Active treatment that removes nitrate ions by chemical adsorption onto an exchange media.
- Passive treatment: Nitrate would be removed by reduction to nitrogen (N2). Following nitrate removal, sulfate would be reduced to sulfide, resulting in metals removal by precipitation of metal sulfide.

Metals and Nitrate

- Active biological treatment: A two-step biological process in which the first "nitrification" step, ammonia is oxidized to nitrate, and then in the "denitrification" step the nitrate is reduced to harmless nitrogen gas (N2), which is released to the atmosphere.

A comparison of effectiveness, implementability and cost of each alternative is provided in Table 3-1. Reverse osmosis treatment would remove metals and nitrate but has the highest cost. Ion exchange to treat metals and nitrate has the second highest cost (a total of $8.8 million for the two systems), but would result in increased concentrations of chloride in the effluent. However, ion exchange would result in lower metals concentrations in the effluent than the other treatment alternatives, except for reverse osmosis. Reverse osmosis was not recommended because of poor reliability, poor implementability and higher costs than ion exchange.

Therefore, based on the evaluations in the AKART study, the following alternative represents the best combination of site, structural and managerial approaches that can be feasibly implemented for the Buckhorn Mountain Project during operations:

- Source reduction (blast management program) to reduce nitrate concentrations in the mine water;
- Surge pone (and up-gradient desiltation basin) for flow equalization stormwater storage, and removal of oil and grease and TSS;
- Ion exchange to remove metals and Ion exchange to remove nitrate

The treated water will be infiltrated to groundwater or discharged to surface water. The treated water will meet the stringent discharge criteria set out in the NPDES permit. However, even with the selected alternative, there will still be changes to surface and groundwater quality.

3.2 Water Quality after Treatment

3.2.1. Wastewater Treatment Discharge Quantities

The predicted maximum monthly inflow rate to the underground mine (mine dewatering) during mining of the Southwest Zone is about 60 gpm in an average year and about 110 gpm in a wet year. During later years of mining, discharge could be up to 165 gpm. These discharge quantities assume no grouting of the underground mine to reduce inflows; with the planned grouting program to be implemented by Kinross discharge quantities are expected to be in the range of 50 to 100 gpm.

An aquatic resources mitigation plan has been developed to mitigate the impacts of mine dewatering (Golder, 2007b). One element of the plan involves the discharge of treated mine water at up to four outfall locations depending on the amount of water and time of the year as follows:

- First, up to 6 gpm will be discharged at Outfall 003, Headwaters of South Fork Nicholson Creek (within Roosevelt Adit0 in the months of July, August and September to provide mitigation for reduced adit discharge. Additional water may be discharged to this outfall during snowmelt if capacity is limited at the other outfalls.
- Up to 1 gpm will be discharged to Outfall 004 at the Headwaters of Marias Creek in July, August and September to mitigate for reduced groundwater discharge to the headwaters of Marias Creek. Additional water may be discharged to this outfall during snowmelt if capacity is limited at the other outfalls.
- Then, if additional water is being treated up to 20 gpm will be discharged to the infiltration site.
- Finally, any remaining treated water will be discharged to Outfall 002 at the Lower Portal, and in April through June to Outfall 003 or 004, as needed.

3.2.2. Mass Balance Model

The minewater treatment and discharge process is presented schematically in Figure 202

A mass balance model was used to track the movement of contaminants from the mine water system to the environment during three stages of the mine life (Year 0, Year 4 and Year 8) under three potential precipitation regimes (14-inch, 20-inch and 30 inch precipitation years0> The mass balance model incorporates the results of the pre-development water budget, background water quality, NPDES permit discharge limitations, and expected effluent water quality and flow.

A pre-development water budget was developed for the drainages that would receive discharge from the mine dewatering operations. The water budget breaks out the amount of surface water runoff, groundwater recharge and evapotranspiration in a drainage basin on a monthly basis. Water budgets for the South Frok Nicholson Creek (SW-7), Marias Creek (SW-8), Gold Bowl Creek (SW-9) and Roosevelt Adit (GW-2) are represented in Appendix B of Golder (20071). Background water quality is presented in Table 3-2. Background water quality represents the average of the total dissolved values from 1992 through 2003, except for barium, beryllium and aluminum which represent values through 2005. These values were used in the mass balance calculations in Golder (2007a).

The first step in the mass balance model described in Golder (2007a) included calculating the total expected chemical loading from the treatment plant effluent and then separating the loading among the four outfall locations from the treated effluent (Tables 3-2 through 3-6). The expected water quality at SW-7 was then estimated under the assumption that groundwater and surface water from the mine and upgradient area mix and discharge to South Fork Nicholson Creek above gauging station SW-7. The expected groundwater quality at MW-4 was also estimated. Additional assumptions used in the model are described in Golder (2007a).

The model results for a 14-inch, 20-inch and 30-inch precipitation year at Year 8 are provided in Tables 3-7 and 3-8. The water quality concentrations in Year 8 represent a worst case scenario because the maximum discharge rate from the mine dewatering and the highest chloride concentration in the effluent will occur toward the end of mining. These results are based on the mine inflow rates as determined from the groundwater flow model and assume that the concentration in the mine water is independent of inflow rate (i.e. the higher the inflow, the greater the mass of constituents in the mine water). Lower mine inflow rates as a result of grouting will result in less mass entering the treatment system and thus less mass in the treated water (Golder, 2007a).

A comparison of expected surface and groundwater quality with the operation of the Buckhorn Mine project with background water quality and stat water quality standards indicates:

Surface Water

- Concentrations of ammonia, nitrate, antimony, arsenic, chromium copper, fluoride, selenium thallium iron, manganese, nickel, zinc, chloride, sulfate and total dissolved solids would be slightly higher than background water quality with the operation fo the Buckhorn Mountain Project.
  Concentrations of cadmium, lead, mercury, and silver would be at or slightly lower than background water quality the operation of the Buckhorn Mountain Project.
- Surface water quality at SW-7 would meet surface water quality standards with the exception of the chronic standards for cadmium and mercury. This is because background concentrations for cadmium and mercury are greater than the chronic surface water standard. The treated effluent would meet the chronic surface water standard for both cadmium and mercury.

Groundwater

- Concentrations of ammonia, nitrate, chromium nickel, zinc, chloride, sulfate, and total dissolved solids would be slightly higher than background water quality with the operation of the Buckhorn Mountain Project.
- Concentrations of antimony, arsenic, cadmium, copper, fluoride, lead, mercury, manganese, selenium, silver, thallium and iron would be at or lower than background water quality with the operation of the Buckhorn Mountain Project.
- Groundwater quality down gradient tof the mine would meet groundwater quality standards, with the exception of manganese and arsenic. This is because background manganese and arsenic concentrations exceed the groundwater standards. The treated

effluent would meet the groundwater standard for manganese. The arsenic concentration in the effluent would be less than 0.001 mg/L.

There would be water quality changes immediately below the outfalls. Seasonal water quality changes would occur form effluent discharges at Roosevelt Adit (Outfall 3) and the headwater of Maris Creek (Outfall 004). The change in water quality at monitoring locations GW-2 (Roosevelt Adit) and SW-8 was evaluated for the months of July, August and September based on the assumption that there would be instantaneous and complete mixing of the effluent at the monitoring location.

Table 3-9 shows that the mixed Outfall 003 and GW-2 water would meet surface water quality standards with the exception of cadmium, lead, and mercury which already exceed standards in background water quality.

The ion exchange treatment system will return water to the environment that is in better-than-background condition for some parameters including cadmium, lead, mercury and silver. State surface and groundwater quality standards will be met at SW-7 and MW-4 for the parameters regulated under the NPDES permit, except in cases where the background water quality is higher than the standard. In these cases, water quality at SW-7 and MW-4 will improve compared to current conditions with the operation of the treatment system. The changes in water quality from the treatment plan effluent would be minor and meet the state water quality standards that are set based on the needs of aquatic life. Operation of the treatment system may also decrease the impacts on aquatic life because of background water quality exceedances by adding water of better-than-background quality.

An analysis of the water temperature in the mine water surge pond and the temperature increase in the surface water downgradient of the Roosevelt Adit indicated that the temperature criteria in the receiving water as established in WAC 173-201a would not be exceeded under expected operating conditions (Appendix P in Golder, 2007a).

Changes to water quality are necessary even with the operation of the treatment system. The mine water will be treated using ion exchange technology which is an advanced technology that essentially provides a higher level of treatment than typical mine-water treatment systems such as lime precipitation.

4.0 OVERRIDING PUBLIC INTEREST

The second element of the Tier II Analysis prescribed by WAC 173-201A-320 is a determination that the activity expected to result a measurable lowering water quality is in the "overriding public interest." Under Ecology's regulations and guidance, the determination of overriding public interest properly considers both the economic and environmental benefits of the proposed activity.

The Buckhorn Mountain Project is in the overriding public interest. Although the Project may result in a measurable change in water quality, the change would be minor and temporary, and would not have material adverse consequences for fish, wildlife or other elements of the environment. On the other hand, the Project will result in substantial public benefits that will

more than outweigh these minor impacts on water quality. The Buckhorn Mountain Project will create significant economic benefits for an economically distressed area of Washington, generating jobs, economic activity and tax revenue. The Project also presents environmental advantages, incorporating state-of-the-art water treatment technology and a variety of mitigation and reclamation measures that will benefit the surrounding environment.

4.1 Economic Benefits

The Buckhorn Mountain Project will create significant economic benefits for Washington State, and the economically depressed Okanogan and Ferry counties. The Supplemental Environmental Impact Statement (SEIS) for the Buckhorn Mountain Project describes the economic benefits of the Mine project to Okanogan and Ferry counties in Section 3.15 (DOE, 2006).

Construction of the mine and related facilities is expected to create 80 jobs. The mine is expected to employ approximately 194 people during seven or eight years of operation. Thereafter, mine reclamation will continue to employ approximately 15 people for another two years (DOE, 2006). The Project is also crucial to continued operation of Kinross' existing Kettle River mill, which is one of the largest private sector employers in Ferry County. The Buckhorn Mountain Project will allow for the continued operation of the Kettle River mill. Without the project, the mill would likely cease to operate because of the existing K2 mine, which currently supplies the mill with ore, is scheduled to stop ore production in late 2007.

In addition to this direct employment, the Project is expected to generate substantial economic activity in the area and result in 26 indirect jobs during the construction phase, 171 indirect jobs during the operation phase and 11 indirect jobs during the reclamation phase (DOE, 2006). These regional economic benefits are already being realized. In 2005 alone, Crown Resources paid in excess of $7.6 million to Washington state vendors and suppliers of goods and services related to the Mine, as well as to charitable groups and local royalty holders. The majority of these payments (more than $6.3 million) were paid to companies located in Ferry, Okanogan and Stevens Counties. To date Crown Resources has spend over $36 million in developing the Buckhorn Mine and has additional commitments totaling more than $21 million directly associated with the permitting, equipment purchases, and construction of the Mine.

In addition to jobs and local economic activity, the Buckhorn Mountain Project will generate substantial local tax revenues and improve the tax base in one of Washington's economically distressed areas. Tax revenues will result in a net fiscal gain for state and local governments and tax districts of over $1.4 million during the construction phase (DOE, 2006). Multi-year direct and indirect public fiscal impacts estimated for the construction, operations, and reclamation phases include combined multi-year revenues of $12.2 million and multi-year expenditures of $6.6 million for a multi-year net fiscal gain of over $5.5 million.

Washington's Office of Regulatory Assistance recognized the substantial economic benefits of the Project by designating it as an Economic Development Project pursuant to RCW 43.21L (Appendix A). A letter from U.S. Senator Patty Murray to Kinross Gold Corporation (Appendix B) also recognized the relationship of the Project to the public interest:

This project is a great example of businesses and community members working together to create opportunities that take advantage of our state's natural resources and provide jobs to local

workers. The Buckhorn Mountain Project will improve the quality of life for dozens of local residents by providing family wage jobs for residents of both Ferry and Okanogan Counties.

The Mayor of Republic has similarly stated:

> The Kettle River Operations employs a large number of people; the impact of not having them would be catastrophic to our City and County. Both the City and the County governments are barely surviving with the small tax base that we have, and the loss of another large employer would finally finish off what economy we do have at this time.
>
> We cannot emphasize strongly enough the fact that this project is extremely important to the economic survival of the City of Republic, Ferry County, but also to Okanogan County and the State of Washington. With these economic factors and the fact that this is an environmentally responsible project, we ask [the Forest Service] to issue the permits for the Buckhorn Mountain Project as soon as possible (Appendix C).

The Tri-County Economic Development District has also emphasized the substantial public economic benefits from the Project:

> The economic viability of Ferry County depends greatly on the successful opening of this mine. Our unemployment rate is the highest in Washington State at 8.6% (Workforce Explorer June 2006), and Kinross Gold will be our county's largest employer, employing approximately 190 workers. The jobs that will result in the successful opening of the Buckhorn Mountain Mine are critical to our area, as are all of the supporting businesses that will also be positively affected by the opening of the mine (Appendix D).

The Project enjoys widespread public support amongst residents of the local community. In connection with their review under the National and State Environmental Policy Acts, both the U.S. Forest Service and the DOE have received dozens of letters in support of the Project. This support is also reflected in a recent advertisement printed in the Republic News Miner, listing 283 individuals and businesses endorsing the Project as an economically sound and environmentally safe project (Appendix E).

4.2 Environmental Issues

In addition to the Project's substantial economic benefits, the Project has also been designed to further the public interest in the environment. The Project incorporates state-of-the-art ion exchange water treatment technology, and includes numerous mitigation and reclamation measures that will not only compensate for the Project's environmental impact but will result in environmental benefits.

The Buckhorn Mountain Project will utilize state-of-the-art water treatment technology. This technology will remove some contaminants found naturally in area surface waters and result in discharges that will have a better-than-background water quality with respect to some parameters (see Section 3.2). The use of this technology will also demonstrate its feasibility and help to set a new standard for future project in Washington, a factor that Ecology's guidance recognizes as a substantial public benefit.

The Project also includes a variety of mitigation and reclamation measures that will more than compensate for expected impacts to water resources, wetlands and aquatic resources, and result in net environmental benefits. These measures are summarized below and discussed in greater detail in Sections 3.7.4, 3.9.4, 3.10.4 of the SEIS (DOE, 2006).

For example, the Aquatic Resources Mitigation Plan (Golder, 2007c) for the Project provides for increased streamflow in Toroda Creek and Myers Creeks during the summer months when flows are low; a stream and riparian enhancement project on the lowermost ¼ mile of Marias Creek above its confluence with Toroda Creek; augmentation water for Roosevelt Adit that supports significant wetlands on Buckhorn Mountain; riparian habitat protection and improvements on the 97-acre Thorp parcel adjacent to Myers Creek at the international border and the 29-acre Pine Chee property; and aquatic-life passage improvements in Nicholson and Marias Creeks. In Nicholson Creek, the removal of a blocking culvert near the mouth of Nicholson Creek and Toroda Creek that has not occurred in many years. Direct impacts to wetlands have been avoided and minimized to the greatest extent possible.

Potential wetland impacts will be more than compensated for by the enhancement and restoration of the Pine Chee wetlands and wetlands on the Thorp site on lower Meyers Creek. This will be accomplished by excluding cattle from the areas, controlling existing noxious weeks, planting native wetland plants, and performing some minor hydrology manipulations to correct previous changes that decreased water input to certain areas. The aquatic and riparian habitat and wetland enhancements on Myers Creek, Marias Creek, and Pine Chee wetlands will also be dedicated in perpetuity in ensure permanent protection of habitat.

Extensive reclamation following mining operations will reclaim and restore disturbed areas to a stabilized and productive condition and protect long-term land, water, and air resources in the Project area. A reclamation plan will be prepared setting forth procedures to restore the site to conditions similar to those that existed prior to mining, including surface water drainage patterns. The Buckhorn Mountain Project SEIS sets forth reclamation mitigation measures for wetlands including re-contouring the project sites, seeding native grasses and broad-leaved herbs, and planting trees and shrubs.

Mitigation and enhancement activities will also increase recreational opportunities in the Project area following reclamation. Some fishing occurs along Toroda Creek. The ¼ mile habitat stream and riparian habitat enhancement project near the Toroda and Marias Creek confluence will improve the hydraulic connection between the two creeks, enhancing fish passage and therefore fishing opportunities.

The Buckhorn Mountain Project is located in the Myers Creek Mining District, where gold, copper, magnetite, and other mining operations have taken place periodically since 1896. Given the long-term use of this area for mining operations, and the extensive mitigation and reclamation proposed in connection with the Buckhorn Mountain Project, the Project will ultimately create a net environmental benefit for water and terrestrial quality in the area.

Example 3: Proposed Friant Ranch WWTF Wastewater Discharge to the San Joaquin River and Wastewater Reclamation for Friant Ranch Specific Plan Area Landscaping and Irrigation at Lost Lake Park, Friant, CA

ASSESSMENT OF SOCIO-ECONOMIC CONSIDERATIONS

The public benefit derived from the new discharge that is necessary to accommodate growth in the Friant area is an important consideration as part of the antidegradation analysis. In accordance with APU 90-004, guidance for a 'complete' antidegradation analysis, the following factors are considered in determining whether the projected lowering of water quality that is anticipated with the proposed surface discharge is necessary to accommodate economic or social development and is consistent with maximum public benefit:

- A consideration of alternative control measures that might reduce, eliminate, or compensate for the negative impacts of the proposed capacity increase;
- An evaluation of each alternative for costs, impacts on water quality, and compliance with applicable laws, regulations, and policies;
- An assessment of the socio-economic impacts of each alternative; and
- A balancing of the alternatives based on environmental and socio-economic considerations.

The Friant Ranch WWTF will produce recycled water suitable for unrestricted use. Because the Millerton Lake source water is of high quality and low in salinity, the recycled water used for irrigation is not expected to unfavorably impact the groundwater underlying the Friant Ranch Specific Plan area, Lost Lake Park, or similarly situated properties such as the Beck Property. However, the irrigation demand for the recycled water is not sufficient for year-round disposal, and a surface water discharge or storage is necessary for the majority of the time period from October 1 to April 30 of each year. The new discharge is projected to result in limited water quality impacts due to the nominal increment in water quality parameters typically observed through domestic use. In the alternative, if surface water discharge is determined to be unviable, seasonal storage would be required.

Costs and Benefits of Alternatives for Maintaining Existing Water Quality

Part I of the antidegradation analysis, the assessment of projected water quality impacts, identified constituents that, to varying degrees, may potentially lower water quality in the San Joaquin River.

Part II of the antidegradation analysis provided here is an assessment of the costs and benefits of maintaining existing water quality in all receiving waters. Alternatives considered for the disposal of treated effluent from the Friant Ranch WWTP include (1) year-round discharge to the San Joaquin River, (2) reuse as irrigation water with seasonal discharge to the San Joaquin River, and (3) reuse as irrigation water with seasonal storage. Reuse of recycled water is a beneficial use of water, and each alternative involving the reuse of recycled water is preferred over discharge to the San Joaquin River. Because demand for recycled water is generally seasonal, the

year-round discharge is not considered further in the analysis.[1] Alternatives to maintain water quality by eliminating any incremental increase in receiving water concentrations include: (1) an expanded recycled water program, (2) seasonal storage, and (3) additional wastewater treatment through the implementation of microfiltration and reverse osmosis (RO). All of these alternatives possess unique abilities to address water quality constituents of concern, and each has distinct implementation benefits, liabilities, and costs. As a practical matter, however, the demand for recycled water is seasonal. It is unlikely that there would be sufficient recycled water demand in the winter at a level necessary to negate the need for other disposal alternatives. Because the proposed project already incorporates the use of recycled water to the extent feasible in during the irrigation season, the expanded recycled program alternative is not feasible and will not be considered further.

As the service area for the Friant Ranch WWTF is the Friant Ranch Specific Plan area and the existing uses and future build-out of the Friant Community Plan area, the costs of maintaining existing water quality in the San Joaquin River will be assessed by increasing connection fees and/or increasing sewer service fees. The Friant Ranch Specific Plan consists of approximately 3,000 residential units at full build-out. For purposes of the analysis, commercial connections will be considered as equivalent dwelling units and costs will be amortized over 20-years and divided equally between the residential units

Seasonal Storage with Irrigation

Because irrigation demand is seasonal, recycled water produced during the winter, when demand is negligible, must be stored for future use or disposed of in some manner. Seasonal storage of wintertime flows for subsequent irrigation requires physical space for the storage facility. For example, a preliminary water balance reveals that a storage pond would need to provide approximately 370 acre-ft of storage and would occupy an area of approximately 42 acres. Storage area within the development is not available because the open space in the development is either protected for environmental habitat purposes or used for parks and parkways, and cannot be used for constructed storage basins. Storage within Lost Lake Park is not available due to potential impacts on the flood plain. Other properties in the vicinity of the FRWWTP and Lost Lake Park, with the exception of Beck Property, are either unsuitable or unavailable for locating the storage pond.

The Beck Property site is a potentially viable alternative for seasonal storage and irrigation because the site is sufficiently large (approximately 150 acres). It is anticipated that the Beck Property would provide an adequate area for irrigation of all water generated by development of the Friant Ranch Specific Plan, and potentially all of the Friant Ranch WWTP recycled water could be utilized seasonally for irrigation with additional seasonal land or river disposal.

Cost

Planning level estimated costs for constructing a storage pond sufficient to provide seasonal storage of the FRWWTP product water on the Beck Property are provided in Table 3.

[1]Should it become necessary to consider year-round discharge in the future, this anti-degradation analysis will be updated and revised accordingly.

Annualized costs are based on a 20-year period and a 6 percent discount rate (annualization factor = 0.08718). Capitol costs include securing the land, modifying the existing pond, pumps to bring the water from the Friant Ranch WWTP to the pond, pumps to deliver the water from the storage pond to irrigation, and the piping necessary to transport the product water. To develop the costs it was assumed that the pond would be located at the north end of the Beck Property in the existing pond excavation created by the gravel operation. The O&M costs are based on supplying power to the pumps delivering water to the ponds for 12 months of the year and to the pumps delivering water to the irrigation use for 8-9 months of the year, and the maintenance for the pond, pumps, and pipes.

Table 3: Storage Pond Cost Estimate for Seasonal 0.8 MGD Treatment Capacity.

Process	Capital Cost(1,2)	Annualized Capital Cost	Annual Operation and Maintenance Cost(1)	Total Annual Cost
Storage Pond	$7,000,000	$610,000	$360,000(3)	$970,000

(1) Estimated July 2007 costs at ENRCCI 8515 provided in LWA, 2007.
(2) Project costs include engineering, administrative, legal, and contingency costs.
(3) Power costs to convey water to and from the storage pond set $0.12/kW-hr

The estimated costs would depend on the ultimate location of the storage pond and relation to the Friant Ranch WWTP and the Beck Property. Additionally, any site selected on the north side of the San Joaquin River would require the added expense of crossing the river with the conveyance pipe.

Benefits
The storage of product water and subsequent use for irrigation would effectively eliminate the discharge of recycled water to the San Joaquin River. Additionally, the seasonal storage alternative would maximize the reuse of the recycled water. As the Friant Specific Plan area expands, additional Friant Ranch WWTP product water would be available for irrigation, thereby potentially reducing the demand of surface water for crop irrigation.

Potential Impacts
The additional power consumption to pump the water from the storage pond to the adjacent irrigated lands and the associated green-house gasses are the primary impacts of the storage pond alternative.

Compliance with Laws and Regulations
The recycled water is generally of better quality than the underlying groundwater, and so the irrigation use will not lower the water quality. Furthermore, the proposed treatment facility will produce water conforming to unrestricted use as per Title 22. No direct discharge to the San Joaquin River would occur in the seasonal storage alternative.

Reverse Osmosis
The proposed wastewater treatment plant for the Project is a state-of-the-art system including nitrification/denitrification, microfiltration (MF), and ultraviolet (UV) disinfection. The remaining advanced wastewater treatment option available to the Project is reverse osmosis (RO). RO is a membrane separation process that is used for the removal of dissolved constituents from wastewater remaining after advanced treatment with tertiary filtration or microfiltration. (Metcalf and Eddy, 2003). RO treatment relies on applied pressure to force water through a

semi-permeable membrane while restraining the passage of particulate and high molecular weight constituents. Membranes exclude ions, but require high operating pressures to produce the de-ionized water. (Metcalf and Eddy, 2003). Passage of water through the membrane produces a relatively ion-free high quality effluent stream and a concentrated waste stream of brine. MF should occur prior to RO to remove larger organic and inorganic particles membrane service life. The proposed treatment plant has MF. RO is a very energy intensive process and the waste brine concentrate poses its own disposal issues. In regard to pollutants of concern contained in the effluent, application of RO would reduce concentrations of TDS, metals, ammonia, and organic compounds, resulting in lower EC levels in the product water. To minimize the concentrations of copper and zinc in the discharge, the entire effluent stream would require treatment by RO. RO treatment of 0.8 MGD will produce approximately 0.16 MGD of liquid brine that would undergo concentration and crystallization prior to disposal in a local landfill based on a 75-80% efficiency and 550 µmhos/cm effluent and a 0.64 conversion factor into TDS. (Metcalf and Eddy, 2003). It is estimated that 0.16 MGD of liquid brine will produce about 440 tons/year of crystallized brine requiring disposal in a suitable landfill. At present, it cannot be determined whether the salts would constitute a hazardous waste under California and Federal law, but the cost analysis assumes that disposal in a hazardous waste landfill would be necessary. The 0.64 MGD of product water would be disinfected with ultraviolet disinfection and discharged to the San Joaquin River.

Costs

The RO costs provided in **Table 4** are *planning level estimates* for only the added costs of RO treatment, and do not include the cost of the proposed treatment plant. RO cost estimates assumed 75 percent recovery for the treatment process. The estimates include the on-site cost of controlled thermal evaporation or crystallization of brine and its ultimate disposal of the resulting salts in the Waste Management landfill in Kettleman City. The nature of the brine and residuals produced by RO treatment of the effluent is assumed to limit disposal options of residuals to a hazardous waste landfill and are reflected in the estimated costs. **Table 4** presents various costs associated with the construction and operation of RO facilities having a treatment capacity of 0.8 MGD. Total costs include capital and operations and maintenance costs, and all cost estimates are presented as *planning level estimates* provided in present worth dollars as of July 2007. Annualized total costs are based on a 20-year period and a 6 percent discount rate (annualization factor = 0.08718).

Table 4: Reverse Osmosis Cost Estimate for 0.8 MGD Treatment Capacity.

Process	Capital Cost(1,2)	Annualized Capital Cost	Annual Operation and Maintenance Cost(1)	Total Annual Cost
RO	$6,500,000	$600,000	$250,000(3)	$850,000

(1) Estimated July 2007 costs at ENRCCI 8515 provided in LWA, 2007.
(2) Project costs include engineering, administrative, legal, and contingency costs.
(3) Based on 7 month seasonal operation (October – April, during River discharge only)

Benefits

The addition of RO treatment to the effluent would reduce the EC to levels lower than the existing conditions of the San Joaquin River below Friant Dam and significantly reduced effluent copper and zinc concentrations. However, it should be noted that RO treatment would not significantly affect the downstream water quality in the San Joaquin River.

Potential Impacts
Advanced wastewater treatment employing RO generates a significant level of concern due to energy demand and "cross media impacts" referring to the interrelated impacts caused by removal of a pollutant from one medium and its transfer to one or more other media. In the case of RO, the process removes a pollutant at a certain concentration from wastewater and partitions it to a significantly higher concentration brine. The brine is then directly disposed or further concentrated, typically by evaporation/crystallization into residuals. Pollutants, such as metals, are not destroyed, but transferred from one medium to another. Organic pollutants can be destroyed or converted to other toxic or non-toxic forms and can also be transferred from one medium to another. It should be noted that in transferring from one medium to another, the bioavailability of the pollutant may be changed significantly. RO treatment results in the transfer of pollutants from wastewater into biosolids, air, and/or concentrated waste streams. Depending on regulatory limits, additional treatment of the biosolids, air, or waste streams may be required. (Carollo, 2005).

In addition to these cross media pollutant transfer impacts, operation of RO processes can generate additional pollutants and greatly elevate local power demand as described by the potential RO environmental impacts provided in **Table 5**. Increased power consumption would lead to increases in greenhouse gas emissions that would significantly expand the carbon footprint of the Project. Additionally, the transport of residuals to a landfill will result in additional greenhouse gas and other air pollution emissions, directly contrary to Assembly Bill 32 (AB 32) – the California Global Warming Solutions Act of 2006 – that seeks to establish a statewide greenhouse gases emission cap for 2020 based on California's 1990 emission levels. Finally, temporary, construction-related impacts associated with the building of RO treatment facilities would be anticipated as part of implementing the alternative control measure. However, these temporary, construction-related impacts would be mitigated to the greatest extent practicable.

Table 5: Potential Environmental Impacts associated with Reverse Osmosis Treatment of Wastewater

Potential RO Environmental Impacts[1]
Substantial power requirements of RO treatment and associated increases in greenhouse gas emissions from the power plants providing the electricity.
Potential need for additional treatment of brine waste to remove heavy metals and other contaminants from the aqueous phase prior to crystallization and disposal of waste.
Ultimate disposal of brine and residuals requiring the energy intensive processes of evaporation, crystallization, and off-site transport.
Increases in greenhouse gas emissions from transport needed to dispose of crystallized brine waste.

(1) Metcalf and Eddy, 2003.

Compliance with Laws and Regulations
State and federal water quality laws require that discharges not result in an exceedance of water quality standards. The effluent prior to RO treatment is expected to meet all relevant water quality objectives and standards outside of the proposed mixing zones. Thus, although RO would further lower the levels of pollutants in the effluent, it is unnecessary to ensure that the effluent complies with applicable water quality standards.

SOCIO-ECONOMIC IMPACTS OF ALTERNATIVES FOR MAINTAINING EXISTING

WATER QUALITY

By applying RO, the EC in the San Joaquin River would be improved and the total copper and total zinc levels would be minimized. The RO alternative control measure would result in a substantial increase in monthly sewer fees paid by the future ratepayers. Furthermore, the annual cost of the alternative, and the associated monthly sewer rate increase, can be translated into a loss of disposable personal income (DPI) to households in the new development area as a means of estimating the overall socio-economic cost of implementing and operating RO treatment of the effluent. **Table 6** shows the annual debt service estimated for future residential and future non-residential ratepayers to fund implementation of the RO treatment alternative.

Table 6: Estimated Annual Debt Service Assessed to Ratepayers in Friant Ranch.

Ratepayer Group	Annual Debt Service[1] for Alternative	Debt Service Revenue Source
Seasonal Storage	$970,000	Increased sewer fees
Land Disposal	$590,000	Increased sewer fees
Future Residential	$850,000	Increased sewer fees

(1) Debt amortized over a 20-year period with an annualization factor of 0.08718. RO assumed to operate 7 months per year

Socio-economic impacts to Friant residents as a result of implementing RO treatment in addition to the tertiary treated, disinfected effluent are assessed as impacts on individual households due to sewer fee increases. Median income for a household in the County was $34,725 as of the census of 2000. Utilizing the consumer price index3 the 2000 household income is equivalent to $42,100 in 2007 dollars. Household income levels, the corresponding DPI and the relation to the levels of treatment are listed in **Table 7**. Poverty line household information is included in **Table 7**, because as of the 2000 census, 12.5% of the current population in the existing town of Friant is at or below the poverty line. The annual financial burden on lower income households of financing the cost of an alternative wastewater treatment control measure would result in proportionately less DPI available to these households as compared to middle and upper income classes.

Table 7: Percent of Annual Disposable Personal Income Required to Fund Reverse Osmosis

Treatment of the Friant Ranch Effluent by Household Income Class

Annual Household Income & Description	Household Disposable Personal Income[1]	Annual Residential Sewer Fee by Treatment Level as Percentage of Annual Disposable Personal Income % of DPI		
		Seasonal Storage[6]	Land Disposal	RO Treatment
$20,650 Poverty Line Household[2]	$17,036	1.9	1.2	1.7
$34,200 Low Income Household[3]	$28,215	1.2	0.7	1.0
$42,100 Median Household Income[4]	$35,269	0.9	0.6	0.8
$64,125 150% Median Household Income[5]	$52,903	0.6	0.4	0.5

(1) Calculated as 82.5% of household income.
(2) 2007 U.S. Dept. of Health and Human Services poverty guideline income level for a four person household.
(3) Low income is defined as 80% of the median household income for an area (U.S. Dept. of Housing and Urban

Development).
(4) Median household income for Fresno County from 2000 Census adjusted to 2007 dollars.
(5) 150% of Median income.
(6) Does not include cost to convey water to and from the storage pond

Reductions in DPI in the local economy due to the financing of the RO alternative would result in fewer dollars being spent on non-essential goods and services by those ratepayers required to fund RO treatment. Decreased spending within an economy ultimately leads to decreases in labor demand, which further impacts household spending due to losses in employment. Furthermore, the actual, realized economic impact of the RO treatment alternative would increase if (1) the brine produced by the process requires additional treatment to remove heavy metals and other contaminants, and/or (2) crystallized residuals require specialized disposal in some type of hazardous materials containment site. Contingencies of specific ultimate disposal of the brine were not and cannot be considered in the economic costs provided for the alternative at the current stage, but certainly would generate additional direct and indirect economic and environmental impacts to be borne by all future ratepayers required to pay for the RO treatment of wastewater generated in Friant.

BALANCE OF ENVIRONMENTAL BENEFITS AND SOCIO-ECONOMIC CONSIDERATIONS

State Water Resources Control Board ("State Water Board") guidance requires that a complete antidegradation analysis include a balancing of the proposed action against the public interest. (APU 90-004 at p. 4) The approach utilized here for compliance with State's requirement is to compare the environmental impacts of the proposed Project (new NPDES-permitted discharge of 0.8 MGD tertiary treated, disinfected effluent) with the environmental and socio-economic impacts of an additional RO treatment process integrated with the proposed project as a means of essentially eliminating the incremental water quality impacts of the proposed tertiary discharge. The socio-economic impacts of the proposed project need not be estimated in the analysis because they form a baseline common to the proposed project and the RO treatment alternative. The current comparison focuses on the socio-economic impacts and environmental benefits and impacts of the RO treatment alternative relative to the water quality impacts of the proposed project. Additionally, the no project alternative is also considered. Based on these comparisons, a project deemed to be consistent with best practicable treatment or control consistent with maximum benefit to the people of the State is identified.

The socio-economic and water quality impacts of the proposed Project and the RO treatment alternative considered as part of the analysis are compared in **Table 8**. The proposed 0.8 MGD tertiary treated, UV disinfected discharge is projected to have both minor favorable and unfavorable effects on San Joaquin River water quality, depending on the parameter. The proposed tertiary discharge is projected to have a slight increase in the San Joaquin River flow, and a slight increase in EC, total copper, and total zinc.

The implementation of RO as an additional treatment process for tertiary filtered, disinfected effluent is also projected to have both favorable and unfavorable environmental impacts. The favorable impacts are the concentration reductions in EC, metals, and other constituents discharged to the San Joaquin River. While the RO process would be operated to maintain EC concentrations at pre-project levels, it would have a favorable indirect impact on downstream water quality through the further reduction of metals and nutrients from the tertiary treated

effluent that undergoes RO. This ancillary reduction in tertiary effluent pollutant loading would likewise act to maintain downstream receiving water quality and mass loading to pre-project levels. Unfavorable impacts of RO treatment stem from the concentration of brine, its potential toxic contaminants, the energy required to transport crystallized residuals to the ultimate disposal, and the substantial energy requirements inherent in RO treatment process. The increased energy consumption to power the RO system and transport residuals to disposal would lead to increases in greenhouse gas emissions that would significantly expand the carbon footprint of the Project. Apart from these direct and more obvious effects, RO treatment brings with it the potential to transfer environmental impacts outside of the project area if off-site transport and disposal of residuals create new environmental impacts in other areas of the State.

As directed by the State Water Board's guidelines, the costs of offsetting a proposed project's potential impacts must be estimated and compared to the expected environmental benefits to be gained by maintaining water quality. Within the context of this comparison, it is also appropriate to consider the environmental and socio-economic implications of not going forward with the proposed project; a scenario commonly referred to as the no project alternative. Four scenarios emerge from the current analysis that warrant evaluation: the no project alternative, the seasonal storage with irrigation alternative, the RO treatment alternative, and the proposed Project. As part of this analysis, the balance of economic considerations and environmental benefits under each scenario are evaluated here.

Table 8: Comparison of the Socio-Economic Impacts and Environmental Benefits and Impacts of the Proposed Project and RO Treatment

Treatment Level	Economic Impact to Future Ratepayers	Environmental Impacts of Treatment Process
Tertiary Filtration, Irrigation with Seasonal Storage(1, 3)	Capital Cost: **$7.0 Million** Annual O&M Cost: **$0.36 Million** Total Annual Cost: **$0.97 Million**	**Favorable Impact** • No direct discharge to the San Joaquin River • Full use of recycled water • Decommissioning of existing Town of Friant WWTP and adsorption of existing service area into FRWWTP. • Reduces riparian water demand. **Unfavorable Impact** • Site selection for pond could affect ultimate cost.
Irrigation with River Discharge (*proposed project*(1))	Not estimated(2)	**Favorable Impact** • Slight increase in river flow. **Unfavorable Impact** • Slight increase in downstream concentration for the following parameters: EC, total copper, and total zinc.
Reverse Osmosis (*in addition to proposed project*)	Capital Cost: **$6.5 Million** Annual O&M Cost: **$0.23 Million** Total Annual Cost: **$0.83 Million**	**Favorable Impact** • No net annual change in downstream EC (TDS) concentration. • Reduction in mass loadings of metals and nutrients discharged to the San Joaquin River. **Unfavorable Impact** • Increases in energy consumption and greenhouse gas emissions due to power requirements of RO treatment. • Disposal of brine and contaminated media resulting from the separation of unwanted pollutants from wastewater. • Potential need for additional treatment of brine waste to remove heavy metals and other contaminants from the aqueous phase prior to crystallization and disposal of residuals. • Off-site disposal of crystallized residuals. • Increases in energy consumption and greenhouse gas emissions from hauling to dispose of crystallized residuals.

(1) Treatment process sufficient for unrestricted use recycled water
(2) While the proposed project will result in monthly residential sewer fees and socio-economic impacts as a result of financing and operating/maintaining the proposed project, these costs represent a baseline effect common to the alternatives, and therefore do not require quantification as a means of assessing the incremental socio-economic effects.
(3) Costs could be affected by ultimate site selection. Alternative dependant on ability to irrigate Beck Property or other similar irrigation demand.
(4) Alternative contingent on agreement by gravel mine owners to accept the recycled water for disposal/irrigation.

No Project Alternative

Disallowing a surface discharge, or in the alternative seasonal storage with irrigation, would effectively terminate the Project and produce unfavorable socio-economic impacts both locally and regionally. The Project is needed to accommodate continued growth in Fresno County. Fresno County is one of the ten most populous counties in the State, and continues to grow at a relatively high rate compared to the state average[4]. For these reasons, not seeking the surface water discharge, or in the alternative seasonal storage with irrigation runs contrary to the enhancement of economic health and need for housing in the local community and the county.

Seasonal Storage with Irrigation Alternative

The seasonal storage and use of recycled water for agricultural irrigation would result in beneficial use of recycled water to the maximal extent feasible. Use of the Friant Ranch WWTP product water for agricultural irrigation may result in a reduction in the amount of surface water needed for irrigation of the Beck Property. This may result in a slight increase in San Joaquin River water available to other uses. (Flow will not increase, as release from the dam is regulated to meet riparian and other demands with a residual measured at Gravelly Ford below Highway 99.) Furthermore, while there is a slight possibility that a minimal amount of product water may find its way from the storage pond to the San Joaquin River, it is the opinion of a professional hydrogeologist (Kirk, 2009) that any such transport would be minimal, and in any case would be through over 1,300 lateral feet of sand and gravel, which would provide a filtering effect assuring the quality of the water reaching the river would be better than that considered in the Phase I Water Quality Analysis.

Reverse Osmosis Treatment Alternative

The environmental benefits of RO treatment are proportional to the incremental changes in water quality of the San Joaquin River. As stated earlier, the RO treatment alternative would not improve downstream receiving water quality, but merely maintain it at pre-project levels or minimize the impact. Projected increases in downstream receiving water concentrations for a small number of parameters (EC, total copper and total zinc) attributable to the proposed 0.8 MGD discharge are estimated to be minor, thus resulting in RO treatment acting to offset only exceedingly small reductions in downstream receiving water quality. The more striking effects of RO treatment are found in the unfavorable environmental impacts inherent in the process resulting from brine concentration, potential need for removal of toxic contaminants, crossmedia contamination, crystallized residuals disposal, and the substantial energy requirements of the RO process and conveyance of residuals to disposal. These sizeable energy demands would lead to increases in greenhouse gas emissions that would significantly expand the carbon footprint of the proposed Friant Ranch WWTP and run contrary to the intent and stated goals of AB 32.

From a socio-economic impact perspective, RO treatment is estimated to result in residential sewer fee increases that show a range of socio-economic impacts depending on household income class. Additionally, the actual economic impact of RO treatment could increase above that estimated in this analysis if (1) the brine produced by the process requires additional treatment to remove heavy metals and other contaminants, and/or (2) crystallized residuals require specialized disposal in some type of hazardous materials containment site. To this end, the environmental and socio-economic costs associated with RO treatment are unduly high

compared to the water quality benefits that would be achieved through the implementation of this alternative as a means of offsetting the incremental water quality changes projected for the proposed project. For these reasons, it is not in the public interest to require implementation of RO treatment of the effluent to avoid insignificant changes in water quality in the San Joaquin River.

Proposed Project

The water quality impacts analysis conducted earlier in this report shows that the recycled water undergoing nitrification-denitrification, microfiltration, and UV disinfection will generally result in water of very high quality being discharged by the Project into the San Joaquin River during the wet season. Additionally, the proposed project will be operated to ensure compliance with the NPDES regulatory program (i.e., future effluent limitations) which will make sure that water quality objectives in the receiving water are met. Furthermore, the reduction in water quality that would result from the proposed project will not unreasonably affect actual or potential beneficial uses. The proposed project will include source control and pollution prevention activities to minimize the levels of salts (EC), copper, and zinc being discharged to the treatment plant.

PROPOSED DISCHARGE IDENTIFIED AS PROVIDING MAXIMUM BENEFIT TO THE STATE

Both the seasonal storage with irrigation alternative and the proposed project for seasonal surface water discharge would have negligible impacts on the San Joaquin River and/or underlying groundwater. In particular, as compared to effluent undergoing additional RO treatment, the differences are essentially *de minimis* for most constituents once discharged effluent and receiving water are either well-mixed, or filtered through 1,300 feet of sand and gravel. Therefore, the critical comparison to be made between alternatives is a balancing of the exceedingly small and likely immeasurable changes in downstream receiving water quality or groundwater quality of a small number of parameters attributable to the seasonal 0.8 MGD tertiary treated, disinfected effluent discharge; the environmental impacts of RO treatment and associated residual disposal, and the socio-economic impacts of the alternative control measure due to loss of household DPI and its anticipated inhibitory effect on demand for goods and services, and employment prospects in Fresno County. Based on the balancing of environmental and socio-economic impacts associated with the four scenarios described above, either the proposed seasonal surface water discharge or seasonal storage with irrigation provides the best practicable treatment or control consistent with maximum benefit to the people of the State.