Dollar Cove Surface Water Treatment Feasibility Study

For:

North Tahoe Public Utility District

Prepared By:
Stephen Twomey, P.E
C-054681

May 1, 2009

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May 26, 2009

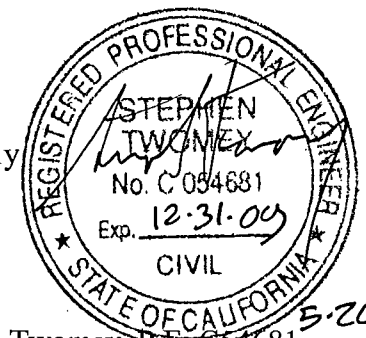
North Tahoe Public Utility District
875 National Ave.
P.O. Box 139
Tahoe Vista, CA 96148

RE: Dollar Cove Water Treatment Feasibility Study
NTPUD Project # 0927
STPE Project # 09-06

Dear Mr. Schegg

Following is the completed Dollar Cove Surface Water Treatment Feasibility Study

Sincerely



Stephen Twomey, ~~P.E. C54681~~ 5-26-09

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Feasibility Study
Surface Water Treatment Plant
For
Dollar Cove Water System

Table of Contents

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Feasibility Study
Surface Water Treatment Plant
For
Dollar Cove Water System

Section 1
Summary and Conclusions

Stephen Twomey, P.E. (Consulting Engineer) has been retained by the North Tahoe Public Utility District (NTPUD) to study the feasibility of re-commissioning the Dollar Cove Pump Station as a stand alone water treatment plant, or a supply for a remote treatment facility. The Dollar Cove water system is currently served through an interruptible water supply agreement with the Tahoe City Public Utility District (TCPUD). The treatment processes considered would meet the projected needs of the Dollar Cove system, with options for additional capacity available to supply TCPUD.

After review of water quality and regulatory standards, the feasibility of three treatment plant sites has been evaluated in Section 4. (See Figure 1, location map).

Site A – Existing Dollar Cove Pump Station
Site B - At existing 350,000 gallon NTPUD tank site.
Site C - North side of Highway 28, across from Dollar Drive.

The feasibility of installation of a complete treatment facility at Site A, within the existing pump station, is evaluated in Section 4 and Appendix D. It has been found that space constraints would require design concessions which would compromise effective operation of the facility. The conclusion of the Consulting Engineer is that modification of the existing pump station to accept a water treatment process is not feasible.

Sites B and C are considered Feasible as treatment plant locations (see section 4).
Capital and annualized costs for feasible options have been developed in Section 5 and are summarized here in Table 1.

Table 1, Capital and Annualized Costs:

	Location		0.40 MGD	0.70 MGD	1.4 MGD
Site A	Exist Dollar Cove Pump Station	Not considered feasible for treatment plant due to space constraints of existing building			
Site B	At 350,000 Gallon Tank	Capital Cost Total Annualized	$3,217,000 $344,000	$4,215,000 $480,000	$6,223,000 $739,000
Site C	At Hwy 28	Capital Cost Total Annualized	$2,838,000 $310,000	$3,890,000 $449,000	$5,898,000 $704,000

Based on the subjective review in section 4, and the marginally lower costs, Site C at Highway 28 is preferred and recommended by the Consulting Engineer.

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Feasibility Study
Surface Water Treatment Plant
For
Dollar Cove Water System

Section 2
Project Setting and Lake Tahoe Water Quality

Dollar Cove Water System:
Dollar Cove is a North Tahoe Public Utility District (NTPUD) water distribution system isolated from the remainder of NTPUD facilities. This system historically drafted water from Lake Tahoe, disinfected, and pumped to a storage tank on Dollar Hill. Since 1997 Dollar Cove has been supplied water from the Tahoe City Public Utility District's Highlands system through an interruptible water supply agreement. The service area includes the Chinquapin condominium development with approximately 190 units, and a portion of Old County Road and Highway 28 with approximately 71 single family service connections. All services are metered.

Projected system demand:
The various treatment process considered within this study have been sized to meet the 20 year projected demand of the Dollar Cove system. Please see appendix B for analysis. For this study, Dollar Cove water system peak day demand in 2030 is projected to be 255 gpm (0.37 MGD).

Budgetary estimates for off site treatment options in Section 5 include additional capacity for export to neighboring water systems such as the TCPUD Highlands system. Two added demand levels are considered:

0.7 MGD = 486 gpm:
Projected NTPUD need and capacity to replace TCPUD well (230 gpm).

1.4 MGD = 970 gpm:
Projected NTPUD need, capacity to replace TCPUD well, and 500 gpm available to wholesale to water systems in the vicinity.

Existing station description:
The existing Dollar Cove Pump Station was installed with the development of the Chinquapin condominiums around 1970. The station is a concrete block building, 26'-9"x12'-9" inside (341 sqft). The building is built into the backshore bluff with the finished floor 3.9' above high lake water level. The station includes an aging 16" steel lake inlet line which projects 300' into the lake to a depth of 19' at low water.

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Access to the pump station is difficult. The station is located at the end of a down sloping footpath. The path is paved 5' wide and runs 160' from a parking area within the Chinquapin Condominiums down to the pump station. This path runs to the uphill side of the station. The roof of the station has been improved into a sun deck by the Condominium owners. The floor level of the station, with entry door is then reached via exterior stairs down the North of the station. While construction could be conducted from barges off the Lake, maintenance and operations would require access from the subdivision side of the station. Vehicular access is limited to the roof level in summer months, and not practical in winter.

There is a sanitary sewer lift station immediately north of the water pump station. That sewer pump handles the wastewater flow from the Chinquapin Condominium development. Discharge is through a 6" pressure sewer approximately 360' to the Dollar Main lift station at Highway 28.

Expansion of the footprint of the pump station is not practical. Permitting would include TRPA, Lahontan, Fish and Game, Army Corps of Engineers, Placer County Building, Planning, and Public Works. The building is in a very sensitive location built into a steep bank within the wave run up area of Lake Tahoe. Any excavation greater than 3.9' below the finished floor is below the high water line of Lake Tahoe.

In addition, while it is assumed that NTPUD owns the building, it is beyond the scope of work to research and determine the extent and type of rights the District acquired regarding this building when it purchased the water system. Without rights or title to additional land outside the footprint of the building expansion of the building footprint is not possible. Given the location of the building and the exclusivity of the surrounding development, opposition from the Chinquapin property owners to expansion of the structure can be expected.

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Lake Water Quality Data as it Applies to Drinking Water Standards:

The following drinking water standards apply and must be considered in the evaluation of treatment options:

- Disinfection Byproducts Rules
- Long Term 2 Enhanced Surface Water Treatment Rule (LT2-ESWTR)
- Lead and Copper Rule
- Surface Water Treatment Rule (SWTR)

Local experience with area drinking water systems using Lake Tahoe water as a source has demonstrated that the Surface Water Treatment Rule will control the design as discussed here.

Disinfection Byproducts
(Ca Title 22, section 64530-64537)
The Total Organic Carbon (TOC) threshold for reduced monitoring and to avoid enhanced treatment is TOC <= 2.0 mg/L. Lake Tahoe water is significantly below this level. Records from an Agate Bay surface source is 0.4 mg/L.
Maximum Residual Disinfectant Level (MRDL) for Chlorine is 4.0 mg/L
Anticipated chlorine dosing rate at treatment plant would be as low as 0.2 mg/L to provide the best quality possible with minimum chlorine taste and odor.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2-ESWTR)
The LT2-ESWTR is a US EPA regulation intended to monitor for the presence of Cryptosporidium oocysts in source water, and then increase treatment requirements if found. For Schedule 4 systems (< 10,000 persons served) 12 months of monitoring for E.coli without exceeding the trigger level of 10 E.coli /100 ml. permits the system to avoid the more costly Cryptosporidium sampling.
Review of records from the Fulton Water Company's two Lake Tahoe sources show only one sample greater than 1 E.coli /100ml in three years. (3.1 E.coli/100ml, August '08).
In addition, the NTPUD National Avenue Intake has returned no positive Cryptosporidium oocyst samples since the UV disinfection system was put into service.

Lead and Copper
(Ca Title 22, section 64670-64710)
The "Action Levels" for Lead and Copper at the tap are 0.015 mg/l and 1.3 mg/l respectively. Exceeding these levels (by the 90th percentile sample) triggers a Corrosion Control Treatment requirement.
Local water purveyors using Lake Tahoe water, including NTPUD, have not exceeded the Action Levels for Lead and Copper.
Treatment trains which require lowered pH may increase corrosivity, such as Ozone disinfection or coagulation processes. These processes can then require corrosion inhibitors to control lead and copper levels. Membrane processes, with associated low chlorine requirements, will not reduce pH and compliance with the Lead and Copper rule would be expected.

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Surface Water Treatment Rule (SWTR):
(Ca Title 22, section 64650-64666)
The SWTR requires any surface water source be subject to multi barrier treatment to reliably protect users from the adverse health effects of microbiological contaminants. In lieu of maximum contaminant levels, the SWTR requires specific treatment techniques. Those techniques are credited with certain removal credits for Viruses and Giardia. The treatment system must result in minimum reduction of 99.99% for Viruses, and 99.9% for Giardia.

There are provisions in the rule to avoid filtration under certain conditions. which NTPUD has successfully implemented with the UV disinfection facility at the National Avenue Intake. Regardless of that success, the California Department of Public Health (CDPH) has directed that no further Filtration Avoidance waivers will be granted and that filtration will be required for any new Lake Tahoe water source. (Personal conversations since 1997 w/ Jess Morehouse, Robert Huldquist, Alex Custudio, Mike Burgess).

Having accepted that determination, the following filtration technologies are available for consideration, with their allowed Giardia and Virus log removal credits. The remaining required removal to make up the 3 log Giardia and 4 log Virus total inactivation would be through disinfection

Table 2: SWTR Filtration Technologies

	Filtration Credit		Rqd Disinfection	
Treatments Listed in Rule	Giardia	Virus	Giardia	Virus
Conventional Filtration	2.5	2.0	0.5	2.0
Direct Filtration	2.0	1.0	1.0	3.0
Diatomaceous Earth	2.0	1.0	1.0	3.0
Slow Sand	2.0	1.0	1.0	3.0
Alternative Filtration Technology[1]				
Membrane Ultrafiltration	4.0	4.0[2]	0.5[3]	2.0[3]
Membrane Microfiltration	4.0	0.5[2]	0.5[3]	3.5
Contact Clarification[2]	2.0	1.0	1.0	3.0
Pressure Filters, Inline	2.0	1.0	1.0	3.0

1) Partial list of alternative filtration technologies accepted by CDPH, with Log removal credits.
2) Varies depending on manufacturer.
3) Per CDPH guidelines, to provide multi barrier treatment, minimum 0.5 log giardia or 2.0 log virus inactivaiton with disinfection.

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Feasibility Study
Surface Water Treatment Plant
For
Dollar Cove Water System

Section 3
Available Treatment Technologies

Available Treatment Technologies:
The following commentary reviews the applicability of each of the filtration/ disinfection processes listed above, and the feasibility of installation at the existing Dollar Cove Pump Station.

Table 3 Available Treatment Technologies

	Applicability	Comment
Treatments Listed in Rule		
Conventional Filtration	Not Applicable	Size of equipment exceeds space available at existing building
Direct Filtration	Not Applicable	Size of equipment exceeds space available at existing building
Diatomaceous Earth	Limited Applicability	See Discussion Below
Slow Sand	Not Applicable	Size of equipment exceeds space available at existing building
Alternative Filtration		
Membrane Microfiltration	Applicable	Analyzed in Section 4
Contact Clarification[2]	Not Applicable	Size of equipment exceeds space available at existing building
Pressure Filters, Inline	Not Applicable	Size of equipment exceeds space available at existing building

Conventional Filtration:
Not applicable to this site. The size of treatment equipment would far exceed the footprint of the existing building.

Direct Filtration
Not applicable to this site. The size of treatment equipment would exceed the footprint of the existing building.

Diatomaceous Earth (DE) Filtration:
DE filtration is one of the listed technologies in the Surface Water Treatment Rule. It is credited by rule with 2 log Giardia and 1 log Virus removal. DE filtration is applicable to good quality feed waters such as Lake Tahoe.

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There are many configurations of DE filtration equipment. Two of the most promising are considered here. Please see Appendix C of this report for further detail of process size and material handling requirements.

Horizontal plate and frame (filter press) type
Size of equipment exceeds building capacity

Vertical leaves, Vacuum Filter
Vertical leaves, Vacuum DE filters have been successfully used at the neighboring Fulton Water Company. The required equipment footprint is small. A 400 gpm vacuum DE filter (Mermaid Filter) is 10' x 5' x 6' tall. Their complete system is installed in a 24'x16' building.

While vacuum DE filtration could be configured to work within the Dollar Cove pump station, the delivery of DE and subsequent disposal of spent slurry would be problematic. Approximately 6,000 lb of material would have to be moved in and out of the plant per month. With the restricted vehicular access, much of this would be moved by hand. In addition, any interruption of flow through the filter would require immediate operator attention to clean and re start the system.

If further consideration of a DE treatment option is desired, a plant layout, process flow diagram, unit sizing and cost estimates can be prepared.

Slow Sand Filtration:
Not applicable to this site. Typical filter loading rates of 0.1 gpm/sqft would require a 3,000 sqft filter bed, far exceeding the 318 sqft available.

Membrane Microfiltration:
There are a number of packaged membrane filtration systems manufactured for drinking water applications. Review of the footprint required and design flow shows that there are systems available which would fit within the existing Dollar Cove pump station. In order to thoroughly test the feasibility of these systems, a preliminary treatment plant design has been prepared and follows in Section 4 of this report.

Contact Clarification:
Not applicable to this site. The size of treatment equipment would far exceed the footprint of the existing building.

Pressure Filters, Inline
Not applicable to this site. The size of treatment equipment would exceed the footprint of the existing building.

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Feasibility Study
Surface Water Treatment Plant
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Dollar Cove Water System

Section 4
Scope of Work Goal C

Goal C of the scope of work for this study is "Determine Feasibility of modifying the existing lake intake structures and piping to accept a water treatment process or provide offsite water treatment."

Feasibility of Water Treatment Plant at existing Dollar Cove Pump Station (Site A).

Microfiltration/ UV Disinfection is the most promising treatment option identified in the previous sections of this report. In order to test the feasibility of this process a preliminary design has been prepared. The major system components have been identified and sized in Appendix D. Option A Site Plan (figure 2), plant floor plan (figure 3), plant sections (figure 4), Process Flow Diagram (figure 5) and Lake Inlet Rehabilitation Plan (figure 6) follow in this section.

Major System Components:
- Inlet line rehabilitated with 10" PE pipeline
- 5 Hp submersible system feed pump in inlet line
- Memcore XS-48 microfiltration system
- Memcore XP-3 microfiltration backwash concentration system
- 30 Hp booster pump
- 126 kW UV reactor
- Hypochlorinator.

Deficiencies of Treatment Plant Design:
- No space available for future expansion.
- No capability for future pretreatment
- Emergency power not provided. Backup power may be available from the Dollar Main sewer lift station located 360' North West of plant.
- No redundancy provided for any of the major process equipment. Due to space constraints, only one booster pump and UV reactor could be fit into layout. Failure of the filtrate pump, booster pump, UV reactor, or their controls would disable the plant.
- Maintenance access to process equipment not adequate. All process equipment is shown installed against building walls. Some equipment would have to be moved or removed to gain access to components.

- Prescreen is located below floor level in the presumed existing pump dry well. Cleaning and maintenance of screen would require entry of confined space.
- Limited vehicular access to treatment plant.

Summary:
It has been found that space constraints within the existing pump station would not allow redundancy of any of the primary process equipment. In addition, maintenance access would be restricted or not available for some components of the equipment. These design concessions would compromise effective operation of the facility to a degree that it would not meet standards of reliability, maintainability, or worker safety.

The conclusion of the Consulting Engineer is that modification of the existing pump station to accept a water treatment process is not feasible.

No capital cost estimate is provided for this option.

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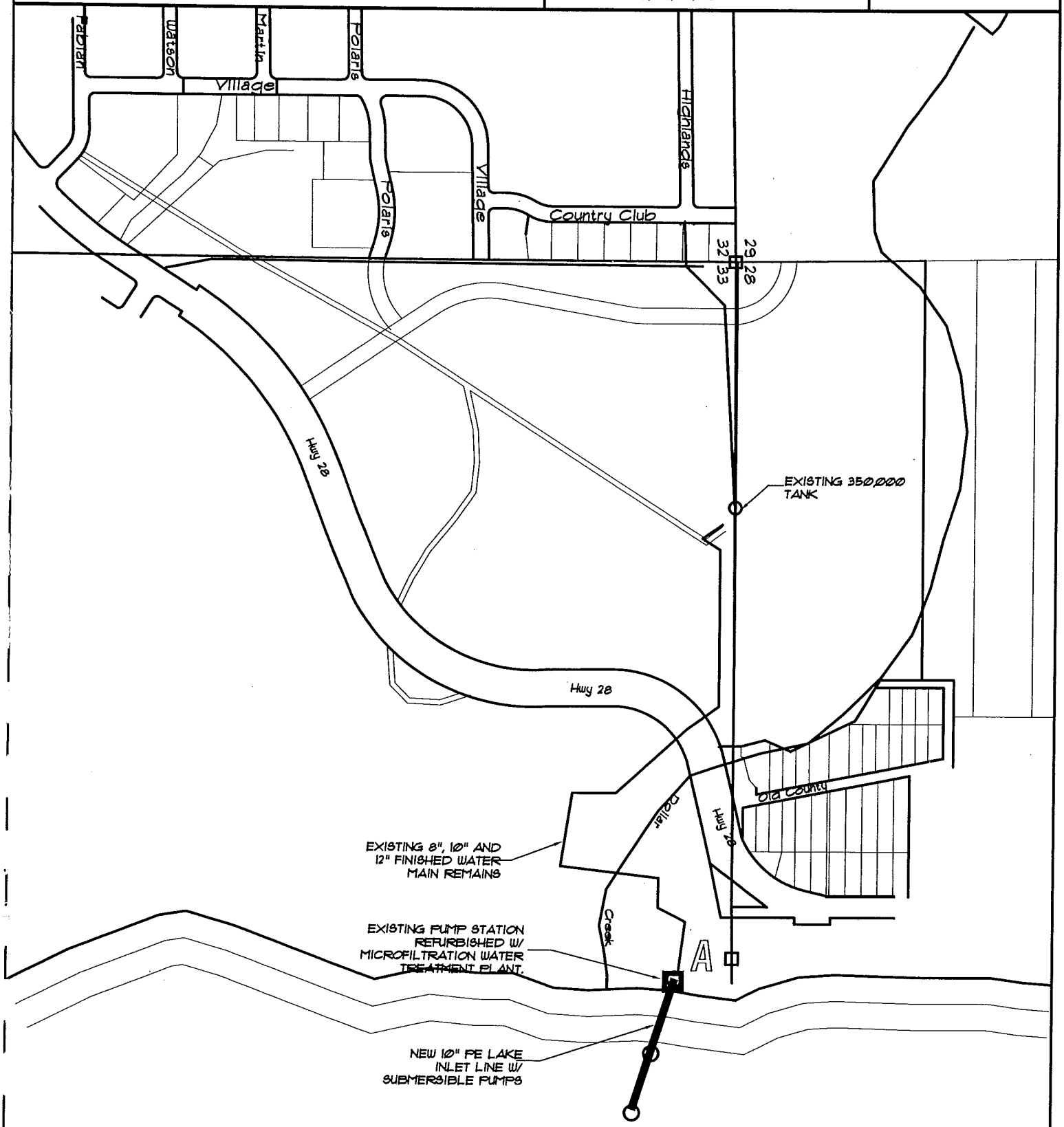
09-06 NTPUD DC



Site Option A
Existing Pump Station

N

NO SCALE

Figure 2

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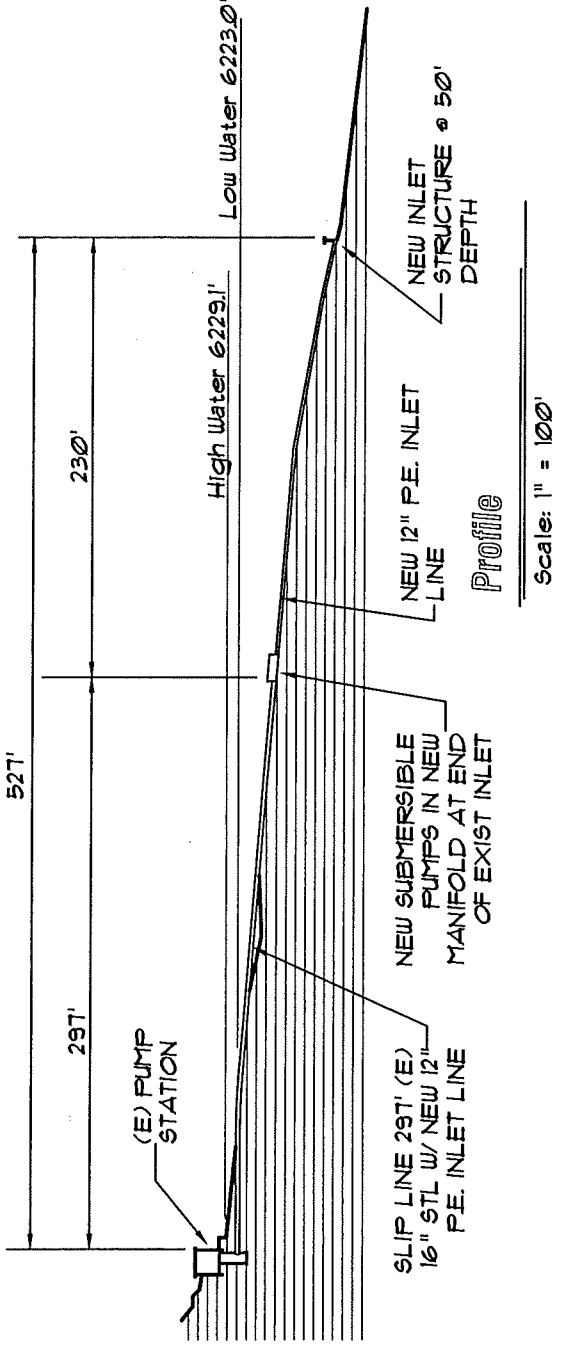

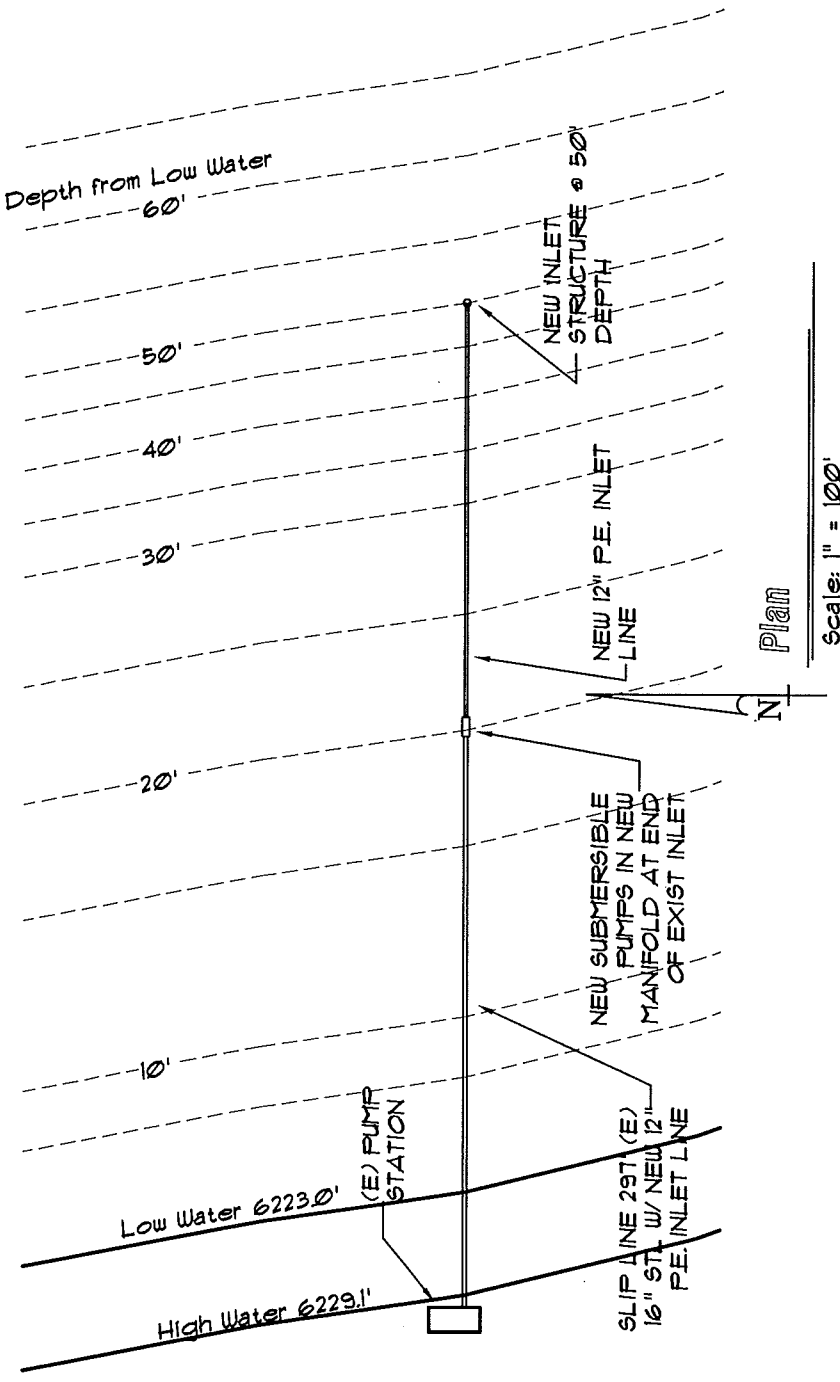

Lake Inlet Rehabilitation

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Feasibility of Off Site Water Treatment:

Off Site Water Treatment would use the existing pump station as a supply pump only. A transmission main would then be required from the Dollar Cove pump station to any proposed treatment plant site. The treatment plant could then be sited and sized to optimize operation efficiency. The NTPUD's Dollar Hill properties encompass 87 acres, which would allow construction of a treatment plant without significant space constraints.

A number of Off Site treatment plant locations have been considered in the Dollar Hill area. After consulting with NTPUD staff, and reviewing relative proximity of existing utilities, access, neighboring land uses, hydraulics, soil capability, and property title, two sites were selected for further review.

Site B - At existing 350,000 gallon NTPUD tank site.
Site C - North side of Highway 28, across from Dollar Drive.

Table 4, Site Alternatives Characteristics:

	Ownersihp	New Access Roadway	Soil Class (Bailey)	New Raw Water Main	New Finished Water Main	New Sewer Extension	New Electric Power Service
Site B	NTPUD	1,840'	Class 6 TbD	2,770'	50'	2,200'	2,200'
Site C	NTPUD	100'	Class 5 FuD	4,760'	2,200'	50'	100'

Discussion of site characteristics:

Site B – On NTPUD's Dollar Hill property at existing 350,000 gallon tank site.
This option would be for construction of a new treatment plant at the site of the existing 350,000 gallon water tank on NTPUD's Dollar Hill property. This site would consolidate facilities at one location (tank and treatment plant). The existing TCPUD transmission main from Country Club Ln. could be used for export of water to the TCPUD system. Construction of a new raw water transmission main from the Dollar Cove pump station would be required, including boring under Highway 28. Electric power, sewer service for residuals disposal, and a new access roadway would all need to be extended 2,000' from Highway 28 to the site. The road would need to be maintained year round to allow daily and emergency access to the treatment plant.

This location is near the center of NTPUD's Dollar Hill lots. The required access road would bisect the property which could impact future recreational uses. In addition, there is an active Osprey nest 400' north of the tank site which may result in construction or operational restrictions.

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Site C – On NTPUD's Dollar Hill property at Highway 28.
This site would be on the West side of Highway 28, at the South West "corner" of the NTPUD Dollar Hill property. The site is directly across from Dollar Drive, diagonal from the 7-Eleven convenience store on Dollar Hill. Access would be immediately off the Highway, minimizing road construction and associated snow removal. An existing 6" sewer lateral w/ manhole (TCPUD) is at the site which could be available for residuals disposal. Sierra Pacific Power's overhead high voltage lines cross Highway 28 at this location making power available. A new export line to the TCPUD system at Fabian would be required, but that would enter a lower pressure zone of the TCPUD system, reducing pumping costs for export water. The raw water transmission main from the Dollar Cove pump station would be 2,000' longer to reach this site, and a parallel finished water main returning to the existing tank would be required. Controls would be more complex with this site in order to match pumping rates between the supply, booster to TCPUD and gravity demand to the NTPUD system.

Either Site B or Site C is feasible as a Water Treatment Facility supplied from a refurbished Dollar Cove pump station. Cost estimates follow in Section 5 of this report.

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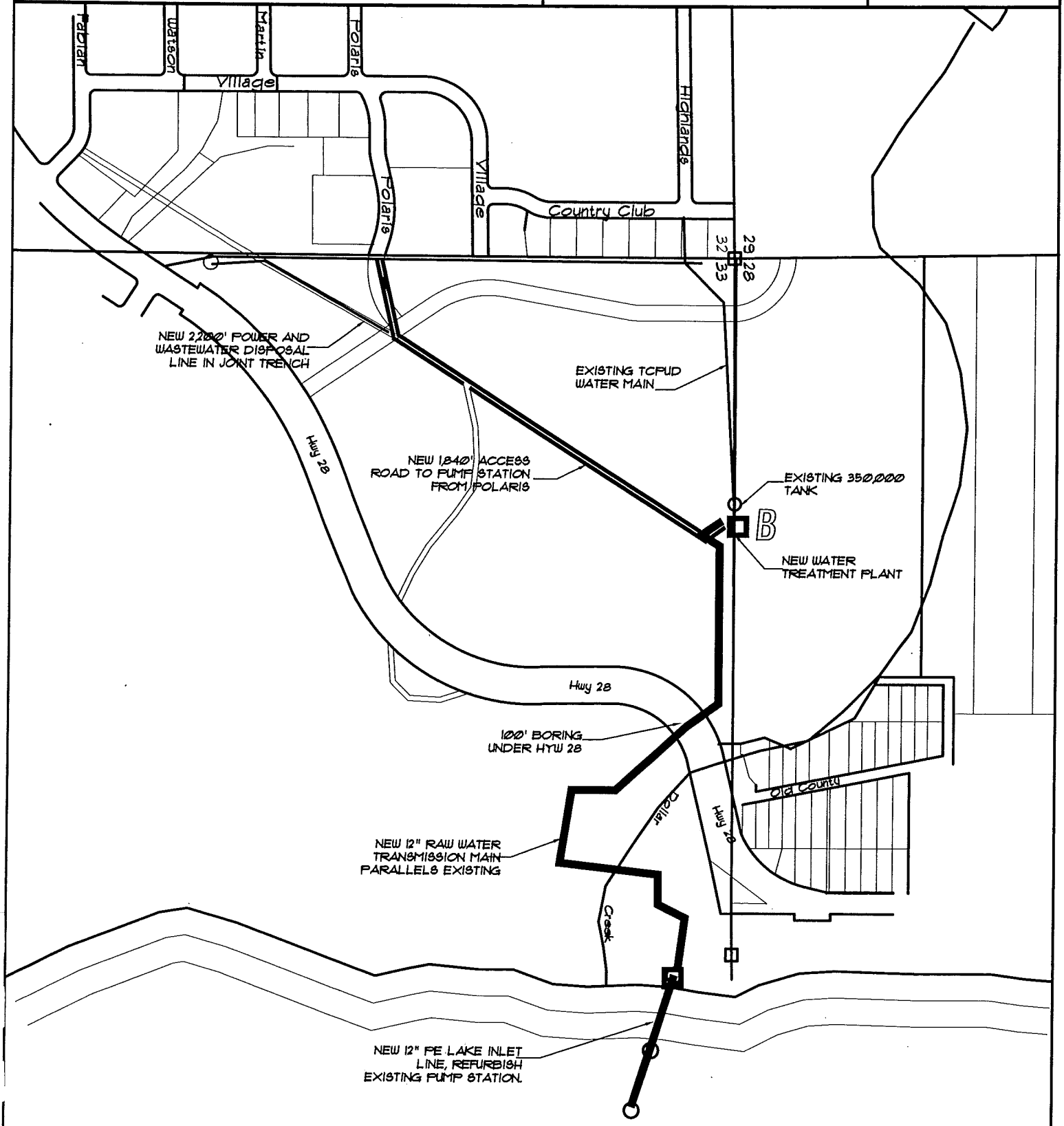
09-06 NTPUD DC	



Site Option B
New Plant @ Exist Tank

N

NO SCALE

Figure 7

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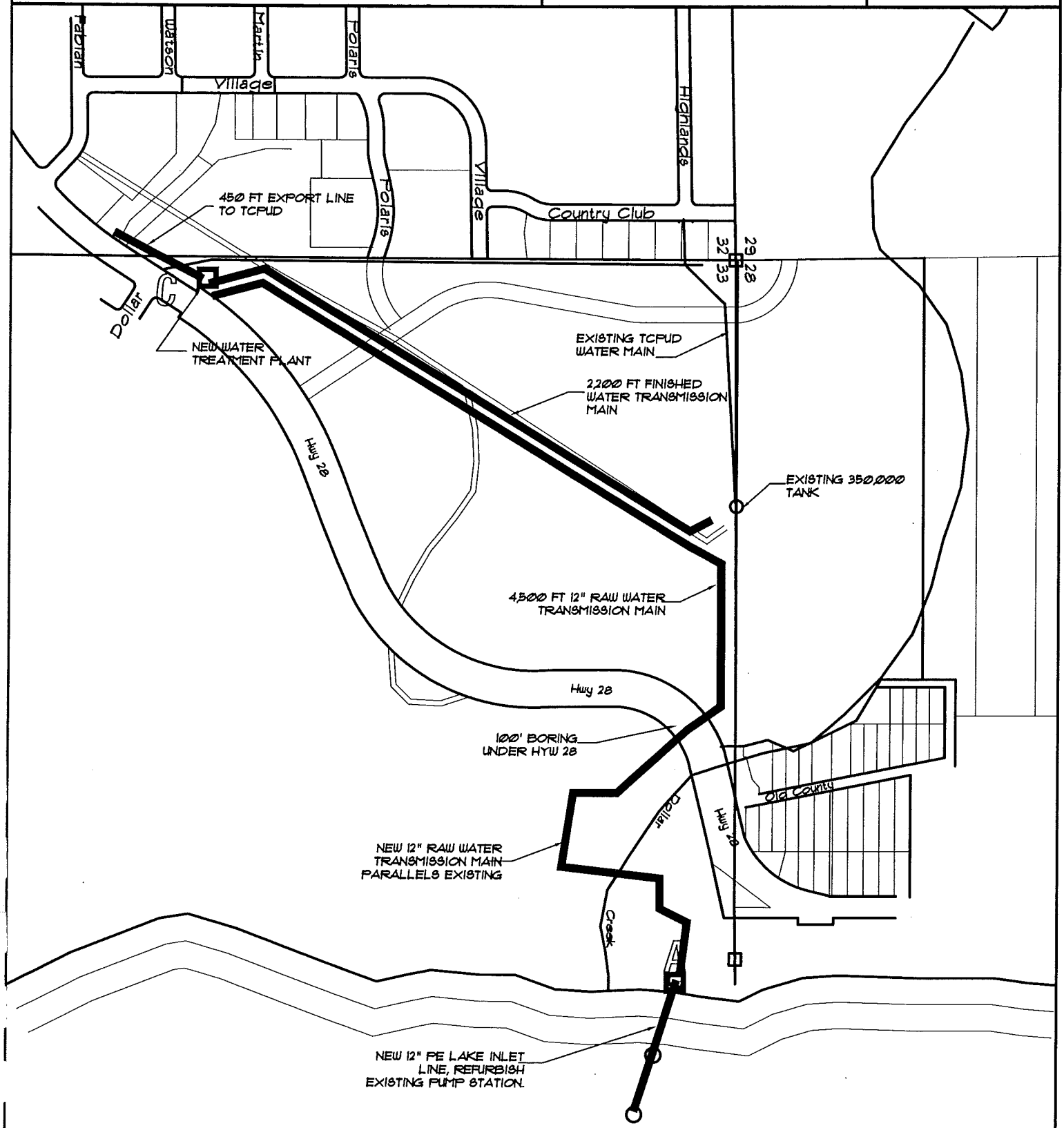
09-06 NTPUD DC	



Site Option C

New Plant @ Hwy 28/ Dollar

N

NO SCALE

Figure 8

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Feasibility Study
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Dollar Cove Water System

Section 5
Scope of Work Goal D

Budgetary Allowance for Feasible Treatment Plant Options

Table 5, Total Capital and Annualized Costs:

	Description		0.40 MGD	0.70 MGD	1.4 MGD
Site A	Exist Dollar Cove Pump Station		Not Feasible per Section 4		
Site B	At 350,000 Gallon Tank	Capital Cost	$3,217,000	$4,215,000	$6,223,000
		Annual O&M	$88,000	$145,000	$244,000
		Total Annualized	$344,000	$480,000	$739,000
Site C	At Hwy 28	Capital Cost	$2,838,000	$3,890,000	$5,898,000
		Annual O&M	$84,000	$140,000	$235,000
		Total Annualized	$310,000	$449,000	$704,000

Table 6, For 50% utilization of plant capacity, cost per thousand gallons produced:

	Description		0.40 MGD	0.70 MGD	1.4 MGD
Site A	Exist Dollar Cove Pump Station	O&M	N/A	N/A	N/A
		O&M w/ Capital			
Site B	At 350,000 Gallon Tank	O&M	$1.21	$1.14	$0.95
		O&M w/ Capital	$4.72	$3.76	$2.89
Site C	At Hwy 28	O&M	$1.15	$1.09	$0.92
		O&M w/ Capital	$4.24	$3.51	$2.76

Following are site diagrams and cost estimates for these two locations.
Capital cost for each location were estimated for three design capacities.

0.4 MGD Meets 20 year projected NTPUD need only.
0.7 MGD Projected NTPUD need and capacity to replace TCPUD well.
1.4 MGD Projected NTPUD need, capacity to replace TCPUD well, and 500 gpm available to wholesale to water systems in the vicinity.

Process designs and itemized estimates have not been prepared for these options. Where possible, Unit Cost Models have been used to estimate complete plant costs. The major cost

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components are taken from the USEPA 2003 Drinking Water Infrastructure Needs Survey, Modeling the Cost of Infrastructure (June 2006). Those cost items are identified as "from EPA" on following cost estimates.

Other items have been priced as noted in the estimate.
Project overhead (engineering, permitting, administration, etc.) has not been added to these costs as the estimates from EPA are for complete project, including overhead.

Estimated Project Costs
Dollar Cove Water Treatment

Plant location option B
At existing 350,000 NTPUD tank on NTPUD property

Project Costs for Plant Option B
Located at site of existing 350,000 gallon tank on NTPUD property.

This option would require a new raw water transmission main from the Dollar Cove inlet station to the new treatment plant. This main would run 1,400' in Chinquapin Homeowners Association roadways, cross Dollar Creek on the existing bridge. The transmission main would be bored under Hwy 28 within the exisitng filled roadway, crossing under the NTPUD sewer force mains. The remaining 970 feet is across open ground up a wooded slope to the existing tank site.

The new treatment plant would require a new all wheather access road, electrical power, and wastewater disposal line to sewer.

Booster pumps to TCPUD would be included in the treatment plant. The existing TCPUD water main would be used for export.

The Treatment plant and access roadway would be located on Bailey Soil Class 6, TbD.
Transmission main in Baily Soil Class 3, UmE and Class 6, TbD. Crosses Dollar Creed on existing bridge.

Capital Costs Analysis

Item	Size/ Notes			
Plant design flow, Q [MGD]		0.40	0.70	1.40
Inflation markup from 2003 to present				
ENR Construction Cost Index (2003-2009)		1.30	1.30	1.30
Water Treatment Plant				
Complete Direct Filtration, Pressure Plant	from EPA	$ 1,294,679	$ 1,932,757	$ 3,174,788
Plant cost w/ Inflation		$ 1,683,082	$ 2,512,584	$ 4,127,224
Access Roadway	1,840' @ $170/ft	$ 312,800	$ 312,800	$ 312,800
Land Acquisition		$ -	$ -	$ -
Subtotal		$ 1,995,882	$ 2,825,384	$ 4,440,024
Raw Water Supply/ Pumping				
10" PE inlet to 50' depth		$ 50,000	$ 50,000	$ 50,000
Pumps	from EPA	$ 82,038	$ 122,265	$ 200,418
Enter exist pump station, rehab		$ 20,000	$ 20,000	$ 20,000
New 12" water main, Chinquapin roadways	1700' @ 125/ft	$ 212,500	$ 212,500	$ 212,500
New 24" bored casing/ 12" main at Hwy 28	100' @ $1,000/ft	$ 100,000	$ 100,000	$ 100,000
New 12" main, open ground	970' @ 100/ft	$ 97,000	$ 97,000	$ 97,000
Emergency Power(40 kw, 65 kw, 140 kw)	from EPA	$ 41,859	$ 62,662	$ 118,551
Subtotal		$ 603,397	$ 664,427	$ 798,468

Finished Water Transmission				
Station Discharge Pressure		Atmospheric	Atmospheric	Atmospheric
Booster Pump Station	Included in plant	$ -	$ -	$ -
New 12" water main		$ -	$ -	$ -
Flow available to TCPUD, MGD		0.00	0.30	1.00
New Main to TCPUD		$ -	$ -	$ -
Booster station to TCPUD at tank site	Included in plant	$ -	$ -	$ -
Subtotal		$ -	$ -	$ -
Electrical Power:				
Sierra Pacific Power connection fee		$ 50,000	$ 50,000	$ 50,000
Power Transmission (joint trench)	2,200' @ 50/ft	$ 110,000	$ 110,000	$ 110,000
Emergency Power(40 kw, 65 kw, 140 kw)	from EPA	$ 41,859	$ 62,662	$ 118,551
Subtotal		$ 201,859	$ 222,662	$ 278,551
Residuals Disposal (sewer)				
Wastewater flow, at 1% of production (gpd)		4000	7000	14000
TTSA fee (200 gpd/EDU, $5,000/EDU)		$ 100,000	$ 175,000	$ 350,000
TCPUD fee (250 gpd/EDU, $1,000/EDU)		$ 16,000	$ 28,000	$ 56,000
Wastewater disposal line to sewer	2000' @ $150/ft	$ 300,000	$ 300,000	$ 300,000
Subtotal		$ 416,000	$ 503,000	$ 706,000
Total Project Costs:		**$ 3,217,137**	**$ 4,215,472**	**$ 6,223,043**
Capital Cost per GPM produced		$ 11,614	$ 8,674	$ 6,402

Annual Costs Analysis

Capital Cost amortized over 20 year life of plant

Project Captial Cost from above:			$	3,217,137	$	4,215,472	$ 6,223,043
For annual interest rate				4.90%		4.90%	4.90%
(20 year, AA tax free muni revenue bonds)							
Depreciation Life of Project [year]				20		20	20
Annual Capital Cost				$255,967		$335,398	$495,128

Annual O&M Costs for Treatment Plant:

Plant design flow, Q [MGD]				0.40		0.70	1.40
Water Treatment Plant Operation							
Operator Labor for Complete System	Labor Hours			1000	$	1,600	$ 2,500
	Skilled Operator Rate		$	65.00	$	65.00	$ 65.00
	Labor Cost		$	65,000	$	104,000	$ 162,500
Access Roadway Snow Removal	1,840' @ $3.00/ ft		$	5,520	$	5,520	$ 5,520
Facility Operation Subtotal			$	70,520	$	109,520	$ 168,020

Electrical Power:
for power consumption, assume 50% utilization
and 70% pump and motor efficiency

Station Elevation =	6435	ft
NTPUD tank full =	6465	ft
TCPUD Upper (grey) tank =	6756	ft
TCPUD Lower (green) tank =	6662	ft
Lake Low Water =	6223	ft

Raw Water Supply Pumping	Flow mgd			0.20		0.35	0.70
	Head, ft			212		212	212
	Kw-hr/ year			69,409		121,465	242,931
Finished Water To NTPUD	Flow mgd			0.20		0.20	0.20
to NTPUD tank	Head			30		30	30
	Kw-hr/ year			9,822		9,822	9,822
Finished Water Export	Flow mgd			0.00		0.15	0.50
to TCPUD Upper (grey)	Head			291		291	291
	Kw-hr/ year			-		71,455	238,184
Building Power (lights, controls, etc)	Bldg Sqft		$	1,000	$	1,500	$ 2,000
	Kw-hr/ year/ sqft		$	30	$	30	$ 30
	Kw-hr/ year		$	30,000	$	45,000	$ 60,000
Total Power Consumption	Kw-hr/ year			109,231		247,742	550,936
For Electric Rate	$/ Kw-hr		$	0.08	$	0.08	$ 0.08
Total Power Cost			$	8,738	$	19,819	$ 44,075

Residuals Disposal (sewer)			
Wastewater flow, at 1% of peak (gpd)	4000	7000	14000
TTSA fee (200 gpd/EDU, $144/6mo/EDU)	$ 5,760	$ 10,080	$ 20,160
TCPUD fee (250 gpd/EDU, $201.76/EDU)	$ 3,228	$ 5,649	$ 11,299
Annual Sewer Fees	$ 8,988	$ 15,729	$ 31,459
Annual Cost Totals:			
Annual Production, MG (@ 50% of capacity)	73.0	127.8	255.5
Annual O&M Costs:	$ 88,247	$ 145,069	$ 243,553
O&M cost per 1,000 gallons	**$ 1.21**	**$ 1.14**	**$ 0.95**
Amortized annual captial cost	$ 255,967	$ 335,398	$ 495,128
Total annual cost:	$ 344,214	$ 480,467	$ 738,681
Total cost per 1,000 gallons produced including Captial and O&M	**$ 4.72**	**$ 3.76**	**$ 2.89**

Estimated Project Costs
Dollar Cove Water Treatment

Plant location option C
Off Hwy 28 at crest of Dollar Hill, across from Dollar Drive

Project Costs for Plant Option C
Located off of Hwy 28 near the old Watermelon Patch. This site has gravity sewer, high voltage power and easy access. The water transmission mains would require extended runs.

This option would require a new raw water transmission main from the Dollar Cove inlet station to the new treatment plant. This main would run 1,400' in Chinquapin Homeowners Association roadways, cross Dollar Creek on the existing bridge. The transmission main would be bored under Hwy 28 within the exisitng filled roadway, crossing under the NTPUD sewer force mains. The remaining 2,960 feet is across open ground up a wooded slope and following existing dirt roads within the Dollar Hill property.

Booster pumps to TCPUD would be included in the treatment plant. A new export main would be required to interite to the TCPUD system at the old "Watermelon Patch" property. an advantage to this location is that the TCPUD connection would be to a lower pressure zone, reducing pumping costs.

The Treatment plant and access roadway would be located on Bailey Soil Class 5-FuD.
Transmission main crosses Baily Soil Class 3-UmE, Class 6-TbD and Class 5-TbD. Crosses Dollar Creek on existing bridge.

Item	Size/ Notes			
Plant design flow, Q [MGD]		0.40	0.70	1.40
Inflation markup from 2003 to present				
ENR Construction Cost Index (2003-2009)		1.30	1.30	1.30
Water Treatment Plant				
Complete Direct Filtration, Pressure Plant	from EPA	$ 1,294,679	$ 1,932,757	$ 3,174,788
Plant cost w/ Inflation		$ 1,683,082	$ 2,512,584	$ 4,127,224
Access Roadway	100' @ $170/ft	$ 17,000	$ 17,000	$ 17,000
Land Acquisition		$ -	$ -	$ -
Subtotal		$ 1,700,082	$ 2,529,584	$ 4,144,224
Raw Water Supply/ Pumping				
10" PE inlet to 50' depth (500' length)		$ 50,000	$ 50,000	$ 50,000
Pumps	from EPA	$ 82,038	$ 122,265	$ 200,418
Enter exist pump station, rehab		$ 20,000	$ 20,000	$ 20,000
New 12" water main, Chinquapin roadways	1700' @ 125/ft	$ 212,500	$ 212,500	$ 212,500
New 24" bored casing/ 12" main at Hwy 28	100' @ $1,000/ft	$ 100,000	$ 100,000	$ 100,000
New 12" main, open ground	2,960' @ 100/ft	$ 296,000	$ 296,000	$ 296,000
Emergency Power(40 kw, 65 kw, 140 kw)	from EPA	$ 41,859	$ 62,662	$ 118,551
Subtotal		$ 802,397	$ 863,427	$ 997,468

Finished Water Transmission				
Station Discharge Pressure		Atmospheric	Atmospheric	Atmospheric
Booster Pump Station	N/A	$ -	$ -	$ -
New 12" water main (joint trench)	2,200' @ 50/ft	$ 110,000	$ 110,000	$ 110,000
Flow available to TCPUD, MGD		0.00	0.30	1.00
New Main to TCPUD	450' @ $120/ft	$ -	$ 54,000	$ 54,000
Booster station to TCPUD	Included in plant	$ -	$ -	$ -
Subtotal		$ 110,000	$ 164,000	$ 164,000
Electrical Power:				
Sierra Pacific Power connection fee		$ 50,000	$ 50,000	$ 50,000
Power Transmission Extensions	100' @ 100/ft	$ 10,000	$ 10,000	$ 10,000
Emergency Power(40 kw, 65 kw, 140 kw)	from EPA	$ 41,859	$ 62,662	$ 118,551
Subtotal		$ 101,859	$ 122,662	$ 178,551
Residuals Disposal (sewer)				
Wastewater flow, at 1% of production (gpd)		4000	7000	14000
TTSA fee (200 gpd/EDU, $5,000/EDU)		$ 100,000	$ 175,000	$ 350,000
TCPUD fee (250 gpd/EDU, $1,000/EDU)		$ 16,000	$ 28,000	$ 56,000
Wastewater disposal line to sewer	50' @ $150/ft	$ 7,500	$ 7,500	$ 7,500
Subtotal		$ 123,500	$ 210,500	$ 413,500
Total Project Costs:		**$ 2,837,837**	**$ 3,890,172**	**$ 5,897,743**
Capital Cost per GPM produced		$ 10,245	$ 8,004	$ 6,068

Annual Costs Analysis

Capital Cost amortized over 20 year life of plant

Project Captial Cost from above:			$	2,837,837	$	3,890,172	$ 5,897,743
For annual interest rate				4.90%		4.90%	4.90%
(20 year, AA tax free muni revenue bonds)							
Depreciation Life of Project [year]				20		20	20
Annual Capital Cost				$225,789		$309,516	$469,246

Annual O&M Costs for Treatment Plant:

Plant design flow, Q [MGD]				0.40		0.70	1.40
Water Treatment Plant Operation							
Operator Labor for Complete System	Labor Hours			1000	$	1,600	$ 2,500
	Skilled Operator Rate		$	65.00	$	65.00	$ 65.00
	Labor Cost		$	65,000	$	104,000	$ 162,500
Access Roadway Snow Removal	100' @ $3.00/ ft		$	300	$	300	$ 300
Facility Operation Subtotal			$	65,300	$	104,300	$ 162,800

Electrical Power:
for power consumption, assume 50% utilization
and 70% pump and motor efficiency

Station Elevation =	6500	ft
NTPUD tank full =	6465	ft
TCPUD Upper (grey) tank =	6756	ft
TCPUD Lower (green) tank =	6662	ft
Lake Low Water =	6223	ft

Raw Water Supply Pumping	Flow mgd			0.20		0.35	0.70
	Head, ft			277		277	277
	Kw-hr/ year			90,690		158,707	317,414
Finished Water To NTPUD	Flow mgd			0.20		0.20	0.20
to NTPUD tank	Head			0		0	0
By Gravity	Kw-hr/ year			-		-	-
Finished Water Export	Flow mgd			0.00		0.15	0.50
to TCPUD Lower (green)	Head			162		162	162
	Kw-hr/ year			-		39,779	132,597
Building Power (lights, controls, etc)	Bldg Sqft		$	1,000	$	1,500	$ 2,000
	Kw-hr/ year/ sqft		$	30	$	30	$ 30
	Kw-hr/ year		$	30,000	$	45,000	$ 60,000
Total Power Consumption	Kw-hr/ year			120,690		243,486	510,011
For Electric Rate	$/ Kw-hr		$	0.08	$	0.08	$ 0.08
Total Power Cost			$	9,655	$	19,479	$ 40,801

Residuals Disposal (sewer)			
Wastewater flow, at 1% of peak (gpd)	4000	7000	14000
TTSA fee (200 gpd/EDU, $144/6mo/EDU)	$ 5,760	$ 10,080	$ 20,160
TCPUD fee (250 gpd/EDU, $201.76/EDU)	$ 3,228	$ 5,649	$ 11,299
Annual Sewer Fees	$ 8,988	$ 15,729	$ 31,459
Annual Cost Totals:			
Annual Production, MG (@ 50% of capacity)	73.0	127.8	255.5
Annual O&M Costs:	$ 83,943	$ 139,508	$ 235,059
O&M cost per 1,000 gallons	**$ 1.15**	**$ 1.09**	**$ 0.92**
Amortized annual captial cost	$ 225,789	$ 309,516	$ 469,246
Total annual cost:	$ 309,732	$ 449,024	$ 704,305
Total cost per 1,000 gallons produced including Captial and O&M	**$ 4.24**	**$ 3.51**	**$ 2.76**

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Feasibility Study
Surface Water Treatment Plant
For
Dollar Cove Water System

Appendix A
NTPUD Standard Task Order

Appendix A

Exhibit "A" – Scope of Work
Exhibit "B" – Deliverables
Exhibit "C" – Schedule of Services

EXHIBIT "A"
SCOPE OF WORK

The purpose of this project is to prepare a feasibility study of modifying existing inactive lake intake structures and piping to accept a water treatment process to serve the Dollar Cove water system, presently served through an interruptible water supply agreement with an adjacent water system; and investigate the feasibility of developing a water treatment process capable of additional capacity to meet North Tahoe Public Utility District supply needs and provide additional capacity to serve Tahoe City Public Utility District's needs.

The goals of this study are:

A. Review lake water quality data.
B. Review available technology to meet drinking water treatment standards.
C. Determine the feasibility of modifying the existing lake intake structures and piping to accept a water treatment process or provide offsite water treatment.
D. Recommend a present-day budgetary allowance for construction of treatment facilities if the project is found feasible.

EXHIBIT "B"
DELIVERABLES

- Brief written report on findings satisfying Goals A and B in the Scope of Work;
- Technical Memorandum of feasibility of Goal C in the Scope of Work; and
- Technical Memorandum with budgetary recommendations.

EXHIBIT "C"
SCHEDULE OF SERVICES

- Goals A and B are due 30 days after execution of this Task Order
- Goal C is due 45 days after execution of this Task Order
- Goal D is due 60 days after execution of this Task Order

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Appendix B
System Demand Projections

Projected System Demand:

Monthly production records since 1983 for the Dollar Cove water system (Dollar Point Unit 8, Dollar Cove, and Lake Forest #3) have been reviewed in order to estimate future production requirements.

Several demand growth projections have been considered here with their anticipated demand at 2020 and 2030 (10 and 20 years). Only data from 1996 to present was included in curve fits due to wide demand fluctuations in prior years. The peak day demand was estimated as 120% of peak month consumption.

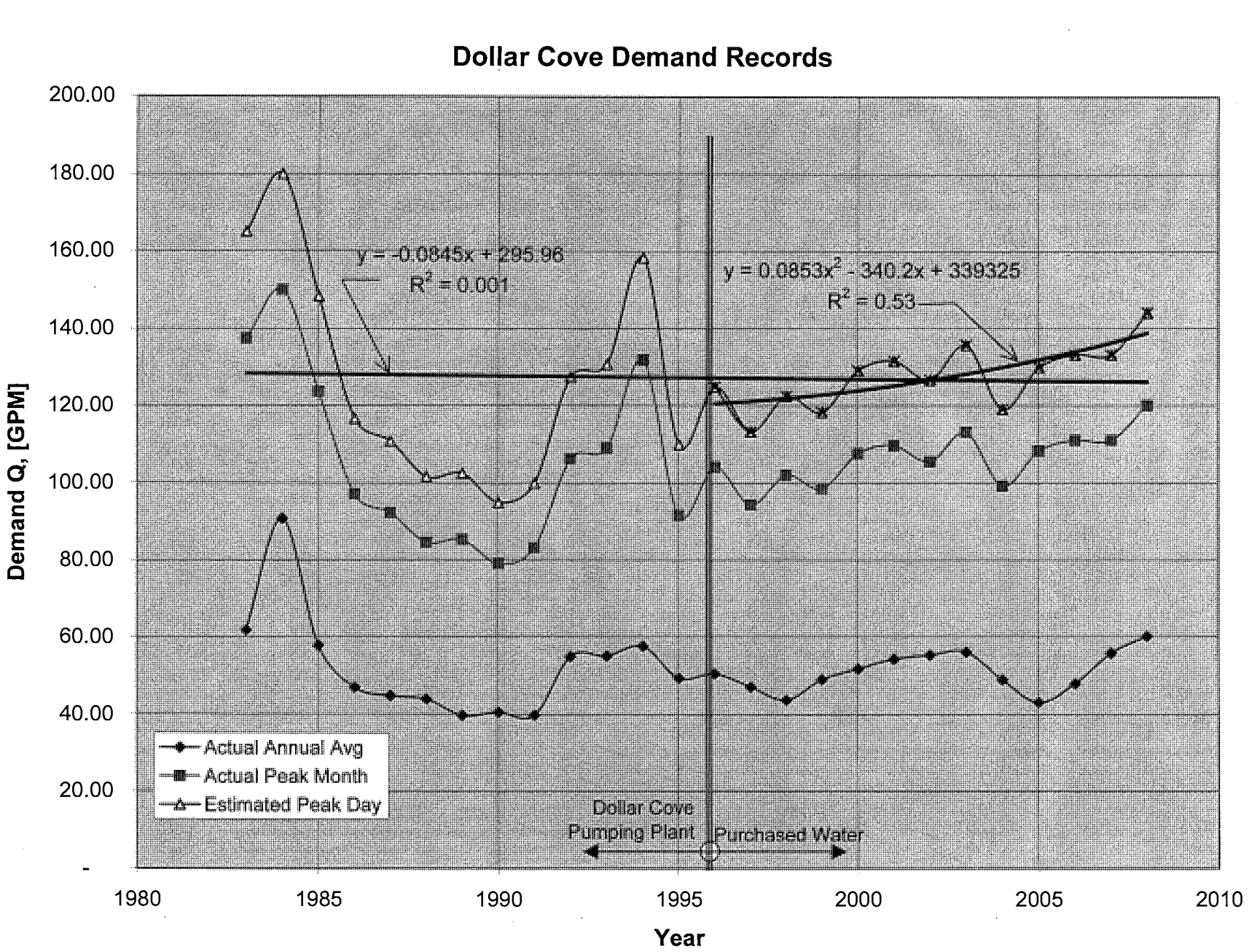
As GPM

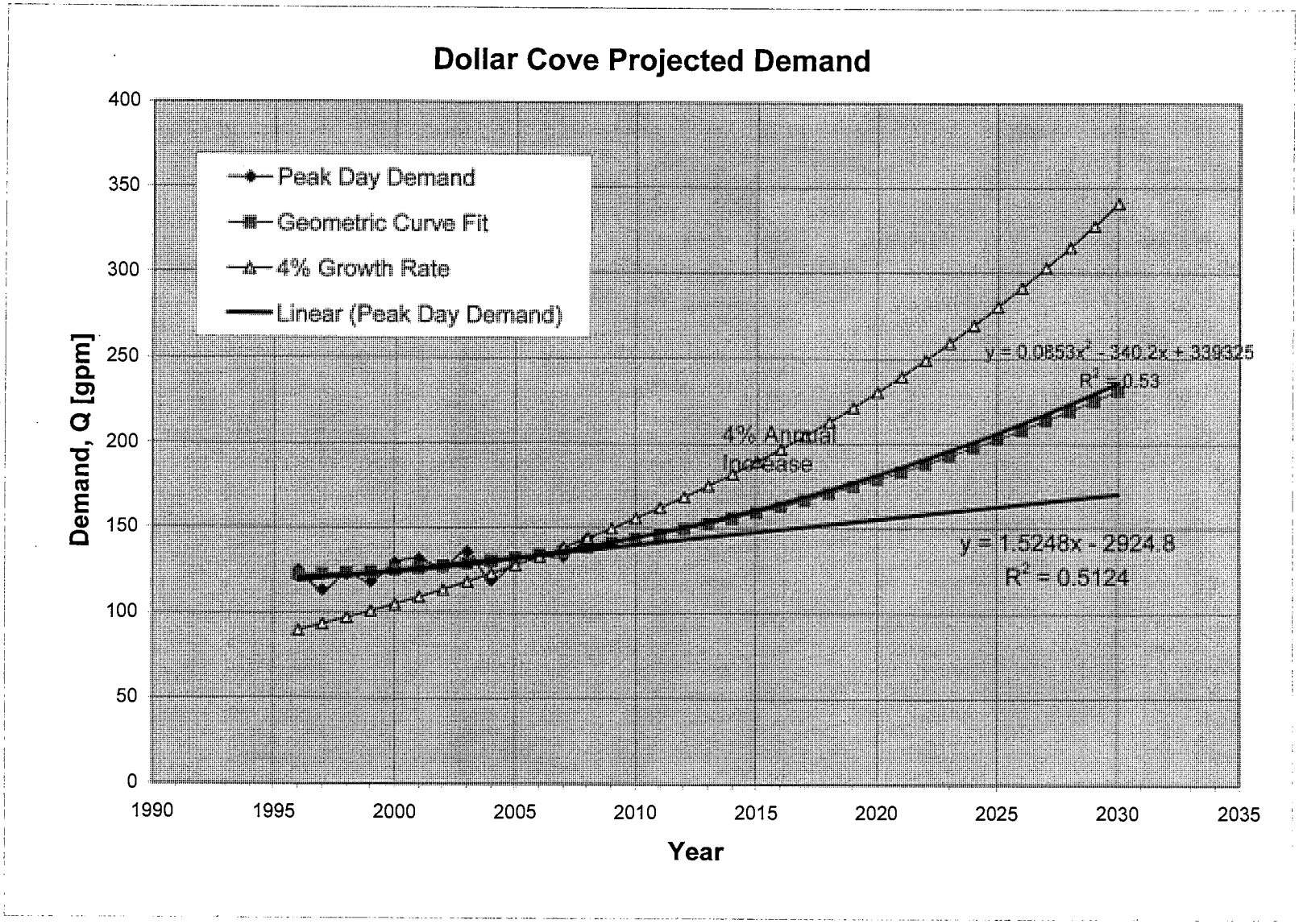
	2008	2010	2020	2030
Straight Line	140	143	159	174
Polynomial	138	144	187	255
Geometric (4%)	144	156	231	341

Based on peak month demand for the last 14 years of record, a second order polynomial curve fit is $y = 0.0932x^2 - 371.76x + 370745$ ($R2 = 0.5297$)

The polynomial curve provided the best fit to the production data ($R^2 = 0.53$). For a 20 year projection, to the year 2030 the design peak day flow would be 255 gpm. A more conservative 4% per year growth (index year 2008) requires 341 gpm design flow.

255 gpm (0.37 MGD) will be considered minimum demand for Dollar Cove Water System.


Dollar Cove Demand Records
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
Demand Q, [GPM]
y = -0.0845x + 295.96
R² = 0.001
y = 0.0853x² - 340.2x + 339325
R² = 0.53
Actual Annual Avg
Actual Peak Month
Estimated Peak Day
Dollar Cove
Pumping Plant
Purchased Water
1980
1985
1990
1995
2000
2005
2010
Year


Dollar Cove Projected Demand
Peak Day Demand
Geometric Curve Fit
4% Growth Rate
Linear (Peak Day Demand)
y = 0.0853x² - 340.2x + 339325
R² = 0.53
4% Annual Increase
y = 1.5248x - 2924.8
R² = 0.5124
Demand, Q [gpm]
Year
0
50
100
150
200
250
300
350
400
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035

B-3

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Appendix C
Diatomaceous Earth Filtration Process Analysis

There are many configurations of DE filtration equipment, considered here are:
- Horizontal plate and frame (filter press) type
- Vertical leaves, Vacuum Filter

The horizontal filter press style (Schneider Filtration Systems) produces a dry spent DE cake, with no waste water flow.
For Schneider Model 100 filter at Design Flow Rate = 300 gpm (two stacks of 15 plates)
Filter size: 22' x 8.8' x 19' tall
Size of equipment to exceeds building capacity.

Vertical leaves, Vacuum DE filters have been successfully used at the neighboring Fulton Water Company. The required equipment footprint is small. A 400 gpm vacuum DE filter w/ pumps (Mermaid Filter) is 10' x 5' x 6' tall. Their complete system is installed in a 24'x16' building.

The disadvantages of the vacuum DE filter systems are:
- Labor intensive, requiring periodic DE addition and manual filter cleaning.
- Delivery and handling of bulk DE material.
- Disposal of spent DE slurry.
- Requires continuous flow through filter leaves to hold DE cake on septums. Start and Stop operation requires a recirculation pump to maintain flow. Even momentary power or equipment failure can result in loss of filter cake and should require cleaning and restarting system.

Bulk DE consumption:
DE consumption is a function of the filterable solids of the feed water, and the length of filter runs. Each run requires precoating of the filter septums w/ 0.2 lb/ sqft. The body feed is then supplied at a rate of 5 mg DE per 1 mg of filterable solids.
Precoat: for 400 sqft filter, precoat = 400 x 0.2 lb/sqft = 80 lb
Body Feed = 5 mg/l DE x 2.6 mg/l x 0.4 MGD x 8.345 = 43.4 lb/ day (use 50 lb/day)
Assuming 5 day filter runs, DE consumed = 80 lb + (50 lb x 5) = 330 lb/ run
Average daily consumption = 66 lb/ day
Monthly consumption = 1,980 lb/ month
In 50 lb bags, requires (40) 50 lb bags per month
Cost for DE, delivered in 50 lb bags is approximately $500/ ton.

Spent DE disposal:
At the end of each run, the filter basin, with spent DE would be flushed and washed into a settling/ dewatering basin. Waste DE would then be allowed to settle and the wash water

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decanted to the sanitary sewer. The dewatering basin would then require periodic cleaning and disposal of DE sludge. The sludge would not be disposed to sewer.
Basin drain to waste = 1,122 gallons
Septum wash water = 100 gallons
Waste flow = 1,222 gallons/ cycle
For 5 day cycle, wastewater flow = 1,222/ 5 = 244 gpd
Volume of DE to be removed is approximately 33 cuft per cycle = 198 cuft/ month (7.3 yd).
For wet weight of DE = 20 lb/cuft, weight of spent cake = 3,960 lb

Other unit processes and components required for a complete plant would be:

- Inlet line rehabilitation
- Submersible supply pumps
- Booster pump(s)
- UV reactor(s) for remaining 1 log giardia and 3 log virus inactivation
- Hypochlorinator for residual

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Appendix D
Membrane Microfiltration Process Analysis

Microfiltration Membrane Packaged System:
The following membrane manufacturers have been contacted and considered for this study.

- Hydranautics
- Koch Membranes
- Aquasource
- Pall Aria Membranes
- Memcore (Siemens)

Hydranautics is a membrane manufacturer only, not producing packaged systems.
Aquasource is only being distributed in Europe.

For available packaged systems, design flow rate, and basic equipment footprint is:

Manufacturer	Model	Flow [gpm]	Skid LxW [ft]	Footprint [sqft]
Koch Membranes	HPF-12	300	22' x 6'-8"	150
Pall Aria Membranes	AP-4	50-350	20'-9"x10'-9"	225
Memcore (Siemens)	XS-48	320	14'-4"x7'-10"	112

The inside floor area of the existing pump station is 26'-9" x 12'-9" (341 sqft)
The Memcor system has the smallest footprint and will be considered further. The facility will be sized to produce the maximum flow of 320 gpm capable of the Memcor XS-48.

Finished Water Production:
While the filter flow rate for the Memcor XS-48 is 320 gpm. The daily production is reduced by time taken in backwash, Clean in Place cycles, and finished water used for backwash. For a 30 minute backwash frequency, the manufacturer estimates 88% on line production time. In addition, 110 gallons of finished water is wasted during each backwash cycle.

Peak Flow Rate = 320 gpm
Production on line = 88%
Filtrate consumed per backwash = 110 gallons
Backwash Frequency = 30 minutes
Averaged filtrate to backwash = 3.67 gpm (110/30)
Filtrate produced = 281.6 gpm
Actual production rate = 278 gpm (0.40 mgd)
The actual production rate exceeds the required production rate of = 0.37 mgd.

Budgetary price from Memcor for XS-48 package w/ controls = $300,000

Waste Stream:

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Two options are considered here, direct backwash to sewer, and backwash concentration. Direct backwash requires less equipment, but sewer fees are higher. Backwash concentration uses a dedicated filtration unit to reduce waste volume, reducing sewer fees, but requiring greater capital costs and floor area.

Direct to Sewer Backwash:
Each backwash cycle produces 300 gallons of waste water which must be disposed of. The backwash uses 110 gallons of finished water and 190 gallons of raw. For 30 minute frequency, average backwash waste to sewer is 10.0 gpm or 14,400 gpd. The backwash cycle takes about two minutes, for a peak flow rate of 150 gpm.
Percent Waste = 10 gpm / 278 gpm = 3.6% waste stream.

Sewer Connection Fees:
Daily flow to waste = 14,400 gpd (10 gpm x 1,440 minutes)
Pumped Flow Rate to sewer = 12 gpm (see Packwash Disposal Pump below)

Solids loading rate:
For assumed raw water Total Suspended Solids of 2.5 mg/L, and 90% removal efficiency
Solids loading rate = 0.40 MGD x 2.5 mg/L x 0.9 x 8.345 = **7.51 lb/day**

TTSA connection fee:
For hydraulic loading, based on 200 gpd/ EDU
For solids loading, based on = 200 gpd @ 200 mg/L = 0.3338 lb/day/EDU

For hydraulic loading, 14,400 gpd/200 gpd/EDU = 72 EDU (controls)
For solids loading, 7.51 lb/day / 0.3338 lb/day = 22.5 EDU
At $5,000 per EDU, TTSA connection fee = 72 x 5,000 = $360,000

Assuming NTPUD connection fees at 250 gpd/EDU = 58 EDU
And $1,000 per EDU
NTPUD Connection Fee = $58,000

For direct disposal to sanitary sewer
Total Sewer Connection Fees = $418,000

Backwash concentration option:
Waste flow calculated above are filtered through a dedicated Memcore XP-3 packaged filter system. Waste flow from the XP-3 backwash concentration filter is assumed at 8% of waste from main process XS-48.
Flow to sewer = 14,400 gpd x 0.08 = 1,152 gpd

TTSA Connection Fee:
For hydraulic loading, 1,152 gpd/200 gpd/EDU = 5.8 EDU
For solids loading, 7.51 lb/day / 0.3338 lb/day = 22.5 EDU (controls)
At $5,000 per EDU, TTSA connection fee = 23 x 5,000 = $115,000

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Assuming NTPUD connection fees at 250 gpd/EDU = 4.6 EDU (use 5)
And $1,000 per EDU
NTPUD Connection Fee = $5,000

For concentrated bachwash to sanitary sewer
Total Sewer Connection Fees = $120,000
Connection fee savings with backwash concentration = $298,000

Additional cost for XP-3 microfiltration system approximately $150,000
Use backwash concentration

Backwash Holding Tank (required for both options)
Backwash water from the Memcor XS-48 package flows by gravity through a 6" flanged fitting. There is a NTPUD sewer lift station adjacent to this pump station. The invert of the sewer inlet to the wet well is at 6,241.76'. The floor of the water pump station is at 6,233'. Backwash cannot flow by gravity to the sanitary sewer, a holding tank and pump will be required.

Backwash Holding Tank (below grade)
Size to accept three backwash cycles
Backwash volume per cycle = 300 gallons
Three cycles = 900 gallons
Provide 900 gallon basin below floor, use 4'x4'x8' long concrete vault
Locate under backwash drain fitting on filter skid

Backwash disposal pump:
For average backwash flow of 300 gallons in 30 minutes = 10 gpm
Pumping head = 6241.76' – (6233-4.5) = 13.26'
Provide submersible sump pump w/ float level switch
Such as Barnes SE411 w/ 4.12" trim impeller
Pumping rate = 12 gpm
Plumb to waste w/ 2" PE pipe.

Multibarrier Inactivation
The Memcor Microfiltration Membrane system has been certified by the CDPH to 4 log giardia and 1.5 log virus removal. In order to provide multibarrier treatment an additional 0.5 log giardia inactivation through disinfection is still required. (Giardia inactivation controls over virus)

Two inactivation options are considered:
- Chlorine disinfection w/ contact time
- UV inactivation, w/ residual chlorine addition.

Chlorine:

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At 10°C, pH=8.0, and chlorine dose of 1.0 mg/l a Ct value of 27 is required. (Giardia controls, virus Ct required is 3.5)

Required Chlorine Contactor for 320 gpm flow rate:

12" pipeline (plug flow)	1,470 l.f.
36" pipeline (plug flow)	163 lf
Contact Basin, average baffling (0.5)	17,280 gallons

The 36" plug flow contact pipeline could be installed within the access path from the parking area. Distance to the parking lot is 160'. Required contactor length is 163'.
The access path is a utility corridor with existing underground gravity sewer, pressure sewer, gas, power, and water lines.
At $350/ ft, Contact Pipeline Cost = $57,000

UV Inactivation:
UV Inactivation can provide the secondary barrier required. The Trojan Swift SC product line are compact UV reactors intended for small community water supplies.

Use TrojanUVSwift SC model B08, 126 KW reactor
Budgetary quote for model B-08 = $42,000

Lake Intake Line:
The existing 16" steel intake line is no longer serviceable and will need to be refurbished or replaced. The existing line is 306 feet long from the station and terminates at 6205' (18' at low lake level). This line must be extended to a minimum depth of 25'. Greater depth is recommended in order to move the inlet 500' from the shore and achieve a depth of 50' from low water. The immediate sanitary hazards to this inlet line are Dollar Creek 200' south of the inlet line and the Dollar Main sewer lift station 300' North West of the inlet. By placing the inlet at 50' depth thermal stratification of Lake Tahoe minimizes mixing of the top 20' with colder deeper water.

In order to minimize disturbance in the shorezone, the existing inlet could be slip lined with PE pipe. The new portion extending beyond the existing. Inlet flow velocity should be limited to 2.0 ft/ sec to minimize water hammer, dynamic forces on line, and friction losses.

Use new PE inlet line. 10" SDR17 (100 psi)
O.K. to slip line existing 16" steel line.
New line 527' total to reach 50' depth. (extended 230' from existing)

Treatment Plant Supply Pump:
The proposed Memcor XS-48 package is an open reservoir with the membranes submerged. The supply pump needs only lift to the height of the filter equipment.

Design Flow = 320 gpm

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Top of membrane filter reservoir = 6240.5'
Low Lake level = 6223'
Safety margin for drought conditions, use 5' below rim
Friction Loss for new 10" PE inlet line (500') = 0.15 psi (negligible)
Total Pumping Head = 22.5' (6240.5-6223-5)

Use Goulds submersible turbine pump, Model 300L05434
5 Horsepower
Set at end of 10" inlet line.
Orient horizontally w/ flow inducer sleeve.
Budgetary Cost $3,200 for pump and motor
Power Cable, armored and jacketed #8, 500' at $5.00/ft = $2,500
Supply Pump Equipment Cost = $5,700

Booster Pump
For minimum size booster pump, use submersible pump in can.
Elevation Head to tank = 268 ft (6471+20-6223)
Friction Loss to tank = 8.8 ft @ 320 gpm
Total Pumping Head = 277 ft.
Design flow rate = 320 gpm

Use Goulds submersible turbine pump, Model 275H30-7
30 Horsepower
Set into 8" vertical pump can
Budgetary Cost $8,400 for pump and motor
Additional $8,400 for fabrication into booster can
Booster Pump Assembly = $16,800

Dollar Reservoir

1,600 FT TO TCPUD
UPPER HIGHLANDS TANK
(GRET, 6,756'±)

TCPUD HIGHLANDS
STORAGE TANK (GREEN,
6,662'±)

Water Tank

600' TO TCPUD
HIGHLANDS WELLS

TCPUD BOOSTER PUMP
STATION

092-010-052
LANZA

092-010-055
LANZA

092-010-042
092-010-033
NTPUD
29.0 Acres

092-010-053
CAL CONSERVANCY

NTPUD 350,000
GALLON DOLLAR COVE
TANK (BROWN, 6,435'±)

29 28
32 33

EXISTING 8"
WATER SUPPLY
MAIN (TCPUD)

Site B

Site A

Site C

EXISTING
DIRT
ROADS

093-010-037
093-010-038
093-010-039
092-010-040
092-010-041
NTPUD
56.6 Acres

092-160-081
HIGHLANDS
VILLAGE
(WATERMELLON
PATCH)

DOLLAR MAIN SEWER
LIFT STATION 360'
NORTH EAST OF INLET

PROPOSED 200'
EXTENSION TO 50'
DEPTH (LOW
WATER)

(E) 300'± LONG 16"
STL INLET LINE TO
19'-6" DEPTH (LOW
WATER)

EXIST PUMP
STATION

DOLLAR CREEK, 200'
SOUTH OF INLET

EXIST 8", 10" AND 12"
DISTRIBUTION MAIN THROUGH
CHINQUAPIN HOMEOWNERS
ASSOCIATION COMMON
AREAS

EXIST 100'± CROSSING
UNDER HWY 28

Old County

Hwy 28

Dollar

Creek

Highlands

County Club

Village

Polaris

Polaris

Martin

Watson

Paolan

Village

Hwy 28

Hwy 28

Bear Dr.

Dollar Cove Feasibility
Location Map

Figure 1

May 1, 2009
North Tahoe Public Utility District
Dollar Cove Study
09-06 NTPUD DC

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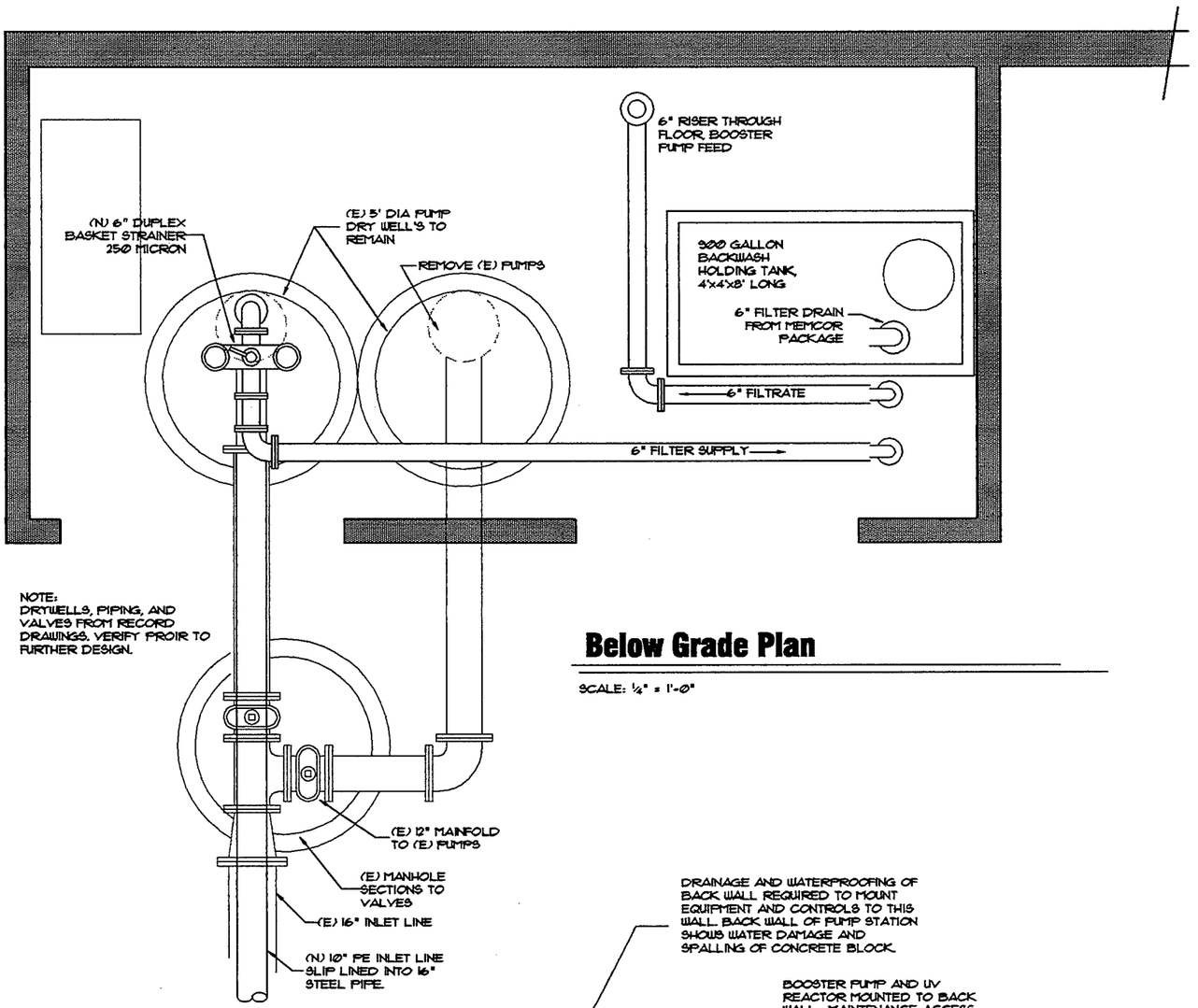
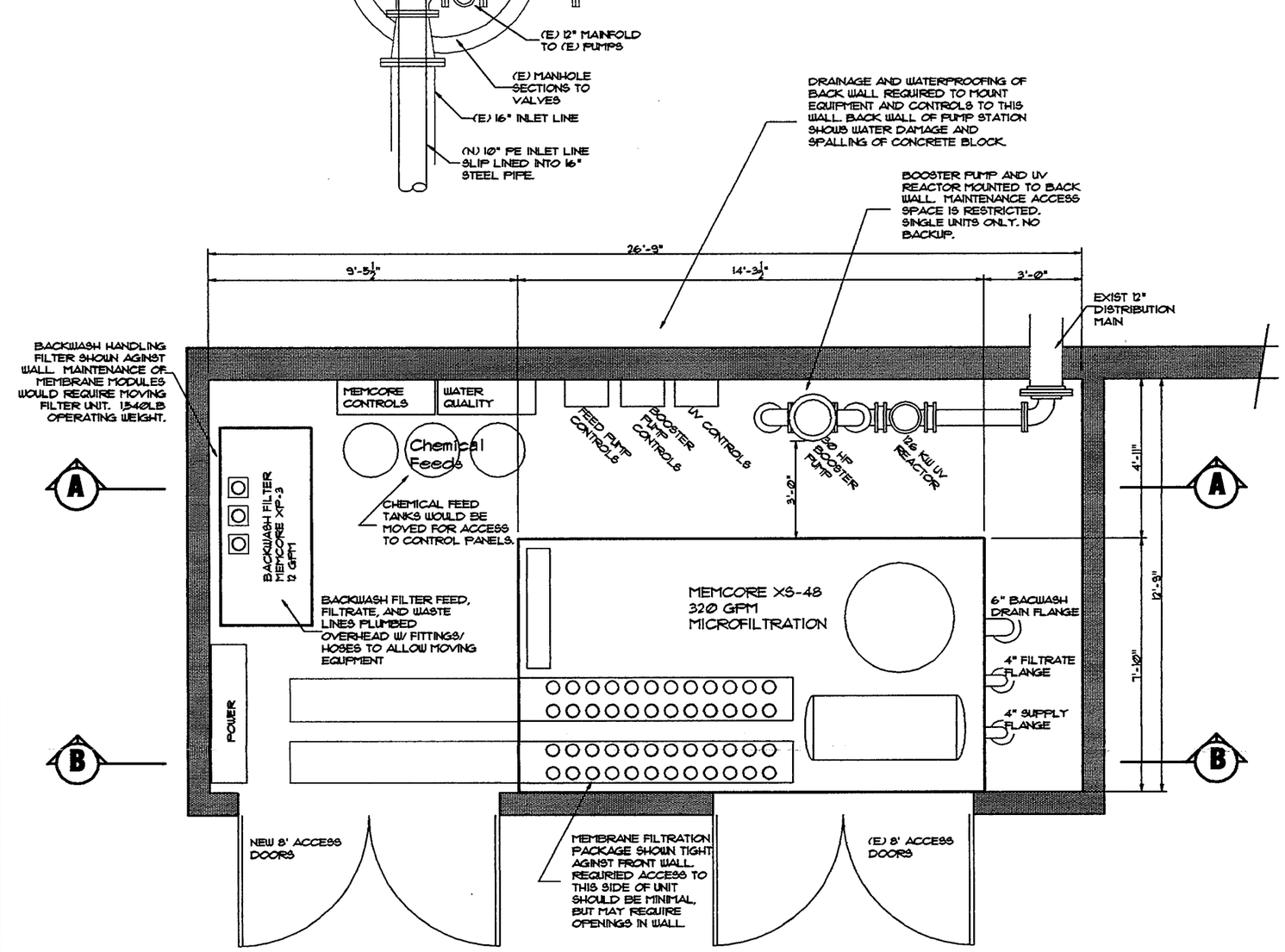
PAGE 2



Below Grade Plan

SCALE: ½" = 1'-0"



Floor Plan

SCALE: ½" = 1'-0"

Figure 3

Dollar Cove Surface Water Treatment Feasibility Study

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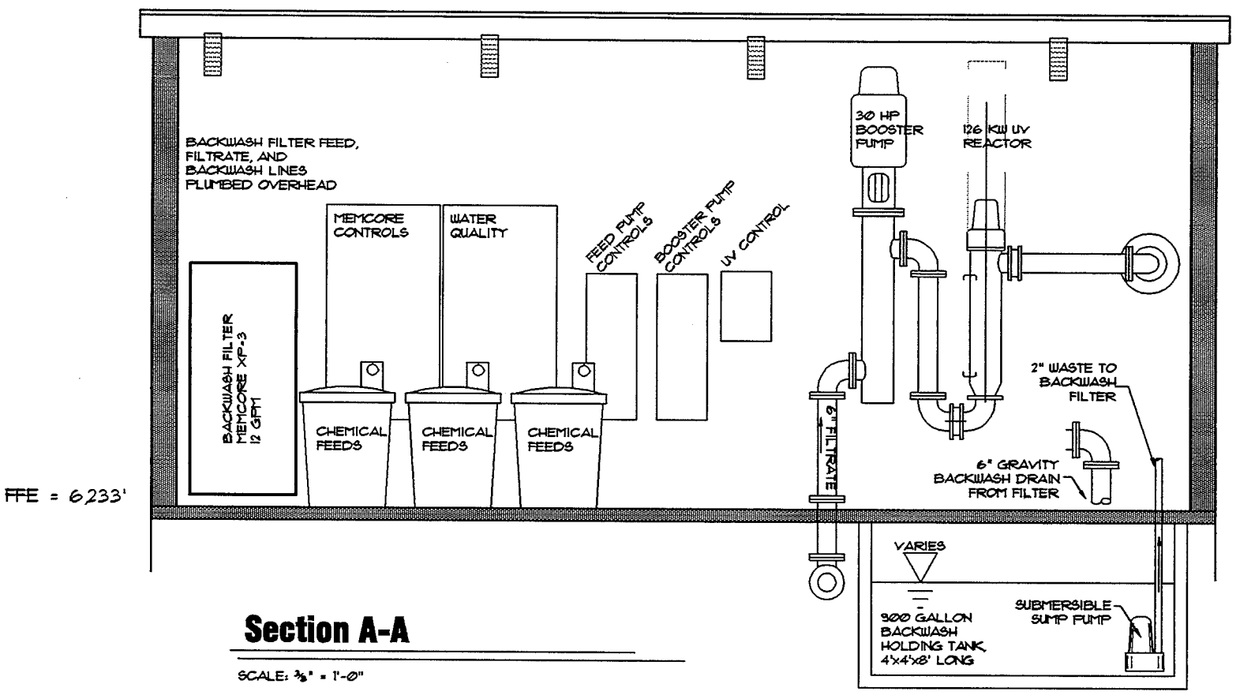
May 1, 2009	
North Tahoe Public Utility District	
Dollar Cove Study	
09-06 NTPUD DC	

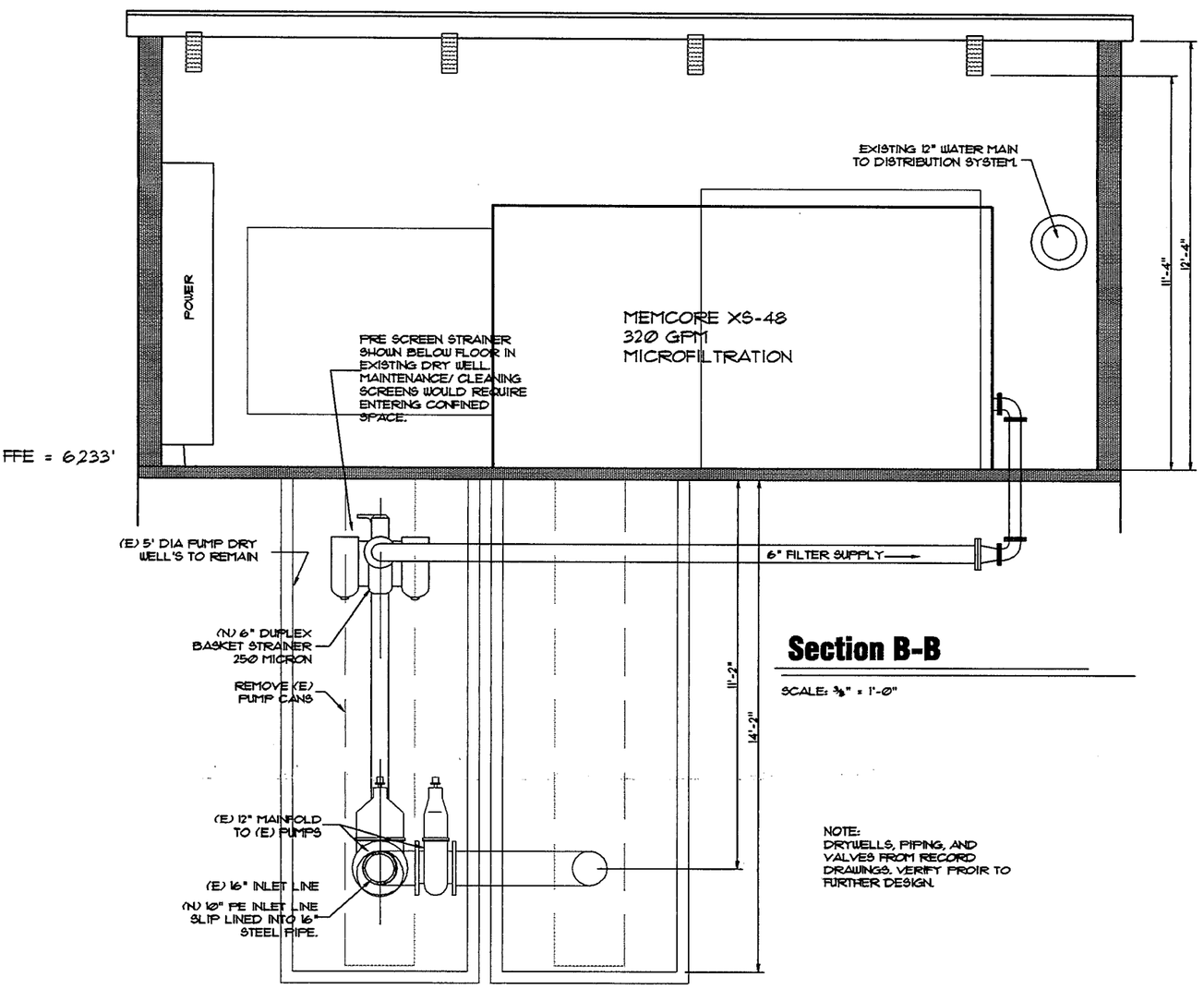
Site A

Existing pump station upgraded with treatment plant equipment to meet surface water treatment standards.



Section A-A

SCALE: 3/8" = 1'-0"



Section B-B

SCALE: 3/8" = 1'-0"

NOTE:
DRYWELLS, PIPING, AND VALVES FROM RECORD DRAWINGS. VERIFY PRIOR TO FURTHER DESIGN.

Figure 4

Dollar Cove Surface Water Treatment Feasibility Study

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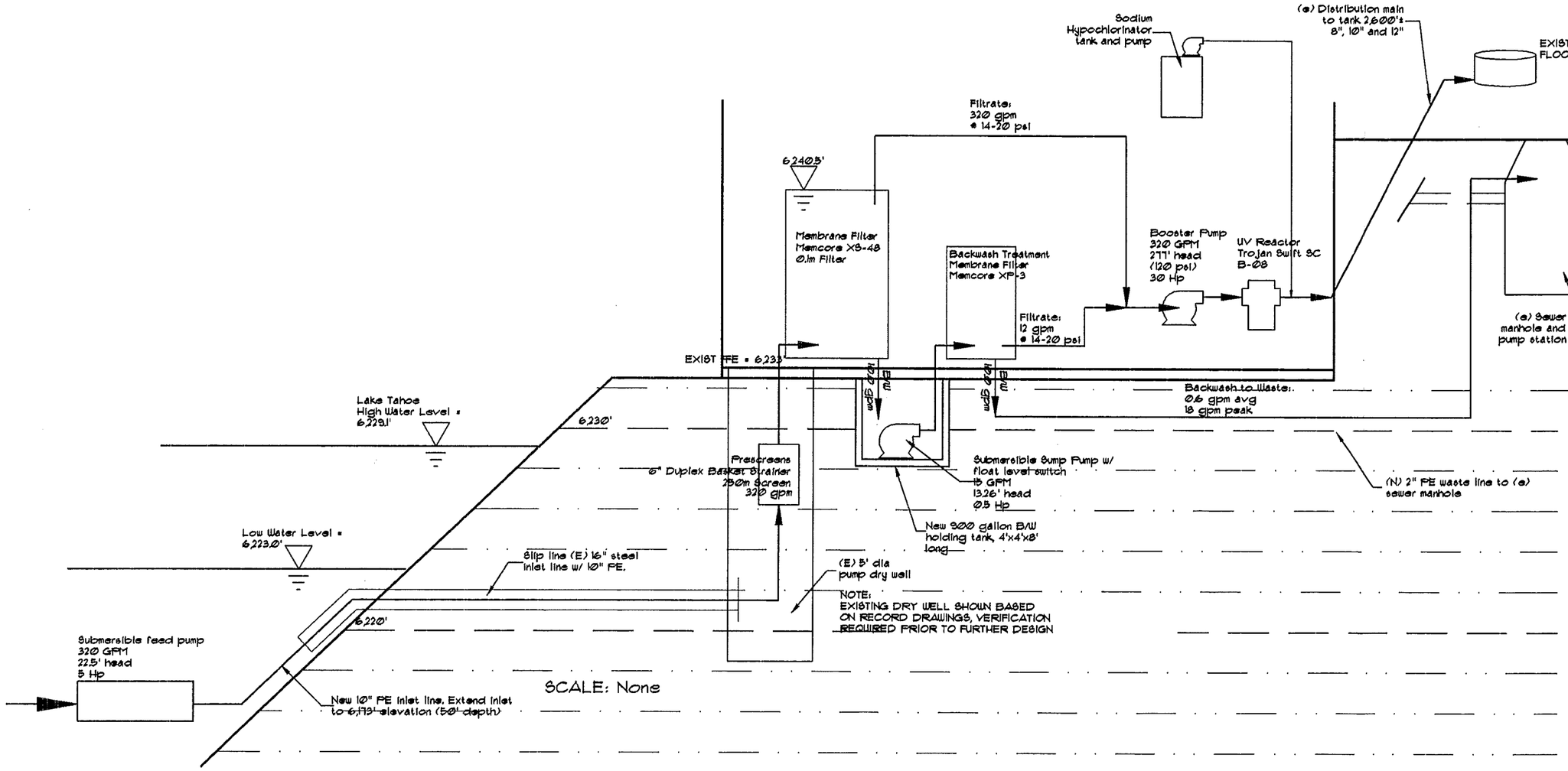
Site A

Existing pump station upgraded with treatment plant equipment to meet surface water treatment standards.



Major Process Flow Diagram
Site A - Existing Pump Station

Dollar Cove Surface Water Treatment
Feasibility Study

Figure 5

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Dollar Cove Study
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