GRANITE CREEK TMDL AND RECOVERY STRATEGY:

REVIEW AND RECOMMENDED UPDATES TO THE TMDL AND RECOVERY STRATEGY, WITH EMPHASIS ON THE LONG-TERM ACTION PLAN FOR 2008 AND BEYOND

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June 2008

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Introduction

The FY08 workplan for the *Granite Creek Recovery and TMDL Implementation Project* includes the following objective:

> **OBJECTIVE 2.** Ensure the Granite Creek Recovery Strategy and TMDL are kept current through periodic review and revision to reflect new information.

Task 8 specific to this objective reads:

> *"Review the TMDL and long-term Action Plan and propose updates and modifications as needed based on BMP effectiveness monitoring in Tasks 1 and 4 and water quality data analysis in Task 6."*
>
> *"Description: TMDLs need periodic reevaluation after several years of carrying out the Recovery Strategy. In FY07, several key TMDL assumptions were evaluated with respect to the flow-to-sediment relationship, average monthly flows, and load capacity and in-stream sediment loads. In June 2007, five years of water quality data were analyzed and sediment load reductions quantified. The FY07 results will be augmented by the FY08 turbidity analysis (Task 6 above) to provide more accurate calculations of existing sediment loads in Granite Creek and load reductions achieved since 2002. After analysis, previous assumptions may need revision and in-stream sediment loads modified to reflect new information. Additionally, the Action Plan included in the Implementation Strategy will need updating to reflect new BMPs and projected actions that have, or will, take place since the original Action Plan was developed in 2002."*
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> *"The "Water Quality Concerns at a Glance" summary page needs revision to reflect new sediment load calculations, and the TMDL document updated to describe new land uses and lease activities. The Action Plan of the TMDL Implementation Strategy was completed in 2002 and is an essential element of the TMDL in guiding recovery efforts. The original Action Plan identified both near-term priorities for 2002 through 2003, as well as longer-term tasks for 2003 and beyond. Short-term tasks have been completed. The long-term Action Plan needs to be updated to reflect actions completed since 2002 and to identify new priority tasks, scheduled completion dates, and responsible parties for 2008 and beyond. Modifications to BMPs based on data analysis in Task 6 and water quality monitoring results in Task 1 would be reflected in the Action Plan. The updated Action Plan would be in a format identical to the original and would serve as an addendum to the approved TMDL".*

Product: *Recommended updates to the existing TMDL. An updated list of Action Plan tasks/completion dates/responsible parties for the TMDL Implementation Strategy"*

This report provides updates to key sections of the 2002 Granite Creek TMDL to reflect the results of the FY07 comprehensive analysis of water quality data collected from 2002 through mid-2007. The comprehensive analysis and update of sediment loads completed in FY07 points to a number of needed updates to both the TMDL and Action Plan (*aka* Implementation Strategy).

This review and update is not intended to be a comprehensive re-write of the original TMDL, rather, it will focus on updates to the long-term Strategy.[1] Specifically, it updates the TMDL-at-a-Glance summary page and the long-term Action Plan included in the original Implementation Strategy. Sections of the FY07 report - *Granite Creek TMDL and Recovery Strategy: Review and Cumulative Analysis of Water Quality Data, Sediment Load Reductions, and Validation of TMDL Assumptions* - are incorporated throughout the review. Copies of the full FY07 report are available from the ADEC Anchorage NPS Program office.

The Stepwise Process Used for Updating the TMDL and the Recovery Strategy

The following steps were taken in the review and analysis of the original TMDL and Action Plan.

1. Review the "TMDL At a Glance" page and insert updated values for load capacity, existing in-stream source loads, load allocations, update the recent history of waterbody assessments, and propose new future actions. The comprehensive analysis of sediment loads completed in 2007 covering the period 2002-2007 points to a number of necessary updates in both the TMDL load prescriptions and the Action Plan implementing the TMDL.

2. Review and update the one-page Action Plan of the 2002 Implementation Strategy. The original Action Plan (*aka* Implementation Plan) identified both near-term actions for 2002 and 2003 and longer-term actions for 2003 and beyond, based on EPA's approval of the TMDL in September 2002. The Action Plan needs updating to include current ongoing and future tasks, responsible parties, and a completion date for each task.

3. Complete a narrative description of all newly updated tasks/parties/completion dates described in Step 2 above.

   The process will summarize what original Action Plan tasks have been accomplished from 2002 through mid-2008, as well as identifying new Action Plan tasks into the future

[1] Per Laura Eldred (ADEC project manager) email communication of April 22, 2008, updating or modifying the Granite Creek TMDL is considered a lower priority than updating the Implementation Strategy (Action Plan). EPA and DEC have determined that the Granite Creek TMDL will not be formally updated or modified at this time but would like to know in a general sense what proposed TMDL updates may be in the future.

to assist CBS in its grant applications planning as well as ADEC's annual listing of Priority Actions for Granite Creek.

The updated Action Plan, narrative descriptions of actions in the Implementation Strategy, and TMDL-At-a-Glance page can be compiled as a possible addendum to the original TMDL for easy insertion. Alternatively, these updates could also be used as addenda to the 2007 report - *Granite Creek TMDL and Recovery Strategy: Review and Cumulative Analysis of Water Quality Data, Sediment Load Reductions, and Validation of TMDL Assumptions.*

4. Review new turbidity data and TSS data collected since May 2007 and use the results to guide updates to the tasks and BMPs in the long-term Action Plan.

The key reports used in the update process were the 2002 *Granite Creek TMDL and Watershed Recovery Strategy* and the 2007 *Granite Creek TMDL and Recovery Strategy: Review and Cumulative Analysis of Water Quality Data, Sediment Load Reductions, and Validation of TMDL Assumptions.*

Prior to a detailed discussion of each of the four steps above, it is important to highlight the key findings and results of the 2007 report. The "Lessons Learned" section of the 2007 analysis is germane to this update process and is included below. While the 2007 analysis was focused on water quality analysis and TMDL updates, the key findings also provide insight into necessary revisions to the Action Plan.

"Lessons Learned" from TMDL Implementation: Conclusions and Recommendations (taken from 2007 comprehensive report)

The evolving nature of determining the sediment load capacity and in-stream loads is obvious as one collects more and more water quality data. Original assumptions of average monthly stream flow and the relationship of sediment to flow rate invariably are revised as more thorough data are collected under the TMDL Implementation Plan. This was the case for Granite Creek.

The Granite Creek TMDL and Watershed Recovery Strategy served as a "blueprint" for a number of subsequent TMDLs developed since 2002. At the time of its development, the importance of the Implementation Strategy and Action Plan were emphasized by CBS, its project contractor and ADEC. This is reflected in the document's title: "Granite Creek Watershed Recovery Strategy and Action Plan and a Total Maximum Daily Load (TMDL) for Sediment and Turbidity ".

The intended emphasis is first on implementing and updating the Recovery Strategy to solve problems. CBS is pleased that ADEC has adopted the view of emphasizing revisions to the Implementation Strategy over formal revisions to TMDL load prescriptions at this time. While prescriptive TMDLs and load reductions are required in EPA regulations as a benchmark for evaluating success, the process of solving problems towards meeting the load prescriptions is

invariably the most challenging and important aspect of the process. Such is the case with Granite Creek.

TMDLs are developed using the best available information. Sometimes, relatively little information is available. A number of findings - or "lessons" - are apparent in this cumulative analysis of water quality data from Granite Creek. The lessons below will be instructive to others when the reexamination of assumptions and pollutant loads is called for in other approved TMDLs developed for Alaskan waterbodies.

- Virtually any TMDL reexamined five years after development will show that some original assumptions were either too conservative or too liberal, or a combination of both. This is a function of better understanding watershed processes and/or physical changes in the watershed after many years of data collection.
- Verifying sediment load reductions is important. It is possible to compare pre-TMDL sediment loads with 2006 loads and show rough trends from 2002 through 2006. Plotting TSS and turbidity concentrations over several years also provides valuable real-time information on the percentage or degree of compliance with water quality standards and the sediment Load Capacity (LC) for Granite Creek.
- Ideally, water quality data should be collected on a *truly random schedule* to avoid any skewing or "high bias" inherent in collecting data during heavy rain or storm events. The Granite Creek project has often targeted high flows in an effort to develop a stronger statistical relationship between high flows and sediment (TSS) loads and turbidity levels, data that was lacking when the TMDL was developed.
- Protocols for reexamining TMDL assumptions and load calculations several years after they are approved – and periodically updating the TMDL - are not well defined. There appears little benefit in formally amending the original TMDL repeatedly, as new information collected in the future, as well as new activities occurring annually in the watershed, will undoubtedly alter it further. Rather, the process and assumptions used should be reviewed and reported, and perhaps including the results of the updated analysis as a supplement or addendum to the original TMDL.
- The Implementation Plan, *aka* Action Plan, would benefit from periodic updates to refine ongoing and future tasks and BMPs. The same could apply to updating the watershed description to address new sources and activities in the Granite Creek watershed since 2002.
- Semi-annual audits have been a useful, formal tool to document compliance of lease operations with municipal lease agreements, water quality standards, and the TMDL and should be continued.
- Diligence in carefully tracking and monitoring new developments from the planning stage through the operation phase should continue to ensure the Granite Creek Master Plan and permitted land use activities address and conform to the TMDL.
- The "main focus" should continue to be confirming compliance with water quality standards from all operations and making scheduled adjustments to the Implementation Strategy to further refine and improve pollution control BMPs.

Average monthly flow (AMF) is a critical variable in estimating load capacity and in-stream sediment loads, as both are directly proportional to stream flow. In the original TMDL completed in 2002, the estimated average monthly flows underestimated actual average monthly flows measured over a 5-year period for the majority of months. The newly-calculated AMFs have resulted in an *increase* in both the allowable sediment load (load capacity) as well as existing in-stream sediment loads over those values used in the original TMDL.

This recalculation of both the allowable and existing sediment loads makes it difficult to easily compare sediment reductions from 2002 to 2008. *Perhaps a more important question is whether the TMDL and Recovery Strategy have worked to reduce sediment loads over time since 2002 and prior years. The answer is yes. Also, the trend in the percentage of exceedances of the turbidity standard has been one of gradually decreasing over the period 2002-2007.*

SALIENT POINTS FROM THE 2007 COMPREHENSIVE WATER QUALITY REPORT

1. Existing in-stream sediment loads were reduced significantly in 2003 and 2004 compared with 2002, with more modest reductions calculated for 2005 and 2006. This is likely due to the accelerated installation of multiple settling ponds and ditching network in 2002.

2. Water quality standards are being met the vast majority of time. The structural BMPs (settling ponds, riparian buffers, roadside channel modifications, etc) are working effectively to control turbidity and sediment runoff.

3. *Annual* in-stream sediment loads are below the *annual* allowable loading capacity for the creek. Combined-year analysis suggests that November's in-stream sediment load exceeds November's monthly loading capacity, with September and December near the allowable monthly loading capacity. This highlights the need for continued attention during these fall months.

4. The 2002 TMDL estimated annual in-stream TSS load was 140.85 tons/yr. The 2007 revised annual existing in-stream sediment (TSS) load is 187.06 tons/yr. The 2002 estimated Loading Capacity (LC) for Granite Creek was 122.00 tons TSS/yr. The 2007 revised annual Loading Capacity is estimated at 244.86 tons TSS/yr. Load allocation reserved for future point and non-point sources is newly calculated as 244.86 tons/yr – 187.06 tons/yr = 57.80 tons TSS/yr.

5. An estimated 81.9% of the annual total sediment load in Granite Creek occurs from September through December, with 58% of the annual load contributed during two months, November and December. Flows from January through July contribute relatively little (less than 18%) sediment to Granite Creek's annual sediment budget.

6. Roads can be a significant source of turbid runoff for short periods of time, coinciding with heavy rain and a high traffic.

7. Well-constructed, properly sized, and maintained settling ponds are very effective and operate well during heavy rain events. Smaller ponds not linked in a series are less effective and provide less residence time for treatment, particularly during heavy rains.

8. Episodic rainstorm/rain events still contribute sediments to the creek, as smaller pond retention capacity is overwhelmed, road runoff is significant and stream banks erode.

9. Annual sediment loads are estimates and will continue to be revised as more water quality monitoring and stream flow data become available.

10. Data collection targeting high flow events skews the data set, most likely causing an overestimate of sediment loads, as compared to strictly random sampling. This effect was statistically moderated somewhat with the 208 discharge measurements and the 52 simultaneous stream flow and TSS data sets collected from 2002 through 2006.

11. This cumulative analysis suggests that the original 2002 estimates of average monthly flows underestimated average monthly flows for 8 of 12 months, and overestimated flows for four months. Additionally, five years of data collection suggest the original TSS-to-flow relationship used in the TMDL is not entirely accurate for Granite Creek. A new regression equation is now generated to more accurately define this relationship.

12. Establishing the mathematical relationship between turbidity and TSS concentrations over five years provides several benefits. First, water quality sampling could potentially rely on turbidity measurements alone, or a reduced number of TSS samples, in estimating TSS with a reasonable amount of accuracy. This is both cost-effective and provides real-time information without the need for laboratory analysis. Secondly, turbidity concentrations are more easily estimated and understood by gravel operators and other lease operators in conducting visual self-monitoring of the effects of their operations on water quality.

13. The heart of the Granite Creek TMDL remains the Implementation Strategy/Action Plan. It is recommended that the focus continue to be on the Recovery Strategy and implementing the BMPS and water quality monitoring in the Action Plan**,** rather than focusing strictly on sediment load prescriptions. Carrying out effective stormwater controls and other BMPs for new developments to ensure minimum sediment runoff to Granite Creek will pay large dividends. Periodically updating the Action Plan and watershed description to keep them current is recommended.

I. "TMDL-AT-A-GLANCE" UPDATES

The "TMDL-At-a-Glance" is a required summary page for all TMDLs approved by EPA. It provides a quick overview of important variables for the reviewing public. It identifies the hydrologic unit in question, its location on a state map, standards of concern, designated uses affected, environmental indicators, major sources or pollution, loading capacity, existing source load allocation, future source load allocation and/or wasteload allocation, margin of safety, recent waterbody assessments, and proposed future actions.

For Granite Creek, this summary was last updated in June 2002 just prior to TMDL approval.

The 2007 comprehensive water quality analysis referenced above resulted in a number of key findings. Those relevant to the TMDL-At-a-Glance page include:

- Five years of data collection and completion of a stage discharge curve for Granite Creek have shown that original average monthly flows for Granite Creek were underestimated for 8 of the 12 months. Given the direct relationship of flow rate to sediment load, the result is that both loading capacity (LC) and in-stream sediment loads are higher than originally estimated in the 2002 TMDL.

- The newly calculated annual sediment loading capacity is 244.86 tons TSS/year.

- The newly calculated annual in-stream sediment load is 187.06 tons TSS/year. Future source load allocation and/or wasteload allocation is 57.80 tons TSS/year.

- For November, in-stream sediment loads exceed the allowable sediment load capacity. During September, October and December, in-steam sediment loads are close to the allowable monthly loads. Periodic exceedances of turbidity criteria occur during these months. These findings highlight the difficulty in controlling sediment during heavy rains typical in Sitka during the fall season.

Proposed Future Actions and Recent Waterbody Assessments are also updated on the one-page TMDL-at-a-Glance summary page.

Tables 5 and 6 from the 2007 comprehensive analysis are included as attachments. They summarize month-by-month in-stream sediment loads and load capacity, average monthly flows, natural background loads, and annual sediment loads in tons TSS/yr.

Additionally, Table 4 from the 2007 report is included. It shows the relationship of TSS, turbidity and flow rates from simultaneously collected samples at Station GC1 from October 2002 to January 2007.

Total Maximum Daily Load (TMDL) for

Sediment and Turbidity

in the waters of Granite Creek in Sitka, Alaska

(Revised, June 2007)

TMDL AT A GLANCE:

Water Quality-Limited?	*Yes*
Hydrologic Unit:	*10203-005 (Lat 57º 06'N; Long.135º 23'W)*
Standards of Concern:	*Suspended sediment and Turbidity*
Designated Uses Affected:	*Growth and Propagation of Fish, Shellfish, other Aquatic Life and Wildlife; Recreation*
Environmental Indicators:	*Turbidity and Total Suspended Solids (TSS)*
Major Sources:	*Gravel and material mining, material stockpiling, roads, and industrial stormwater runoff*
Loading Capacity:	*244.86 tons TSS/year; 3.94 to 57.80 tons TSS/month*
Existing Source Load Allocation:	*187.06 tons TSS/year (November exceeds monthly LC)*
Future Source Load Allocation and/or Wasteload Allocation	*57.80 tons TSS/yr reserved for LA and/or WLA*
Wasteload Allocation:	*No individual NPDES permitted point source discharges; set to zero*
Margin of Safety:	*Implicit; included through conservative assumptions*
Recent Waterbody Assessments:	*Semiannually in fall and spring, 2002 through 2008.*
Proposed Future Actions:	*Improve collection and treatment of industrial stormwater runoff; pave gravel roads; strengthen lease agreements and conduct semi-annual audits; reroute drainage away from Granite Creek; establish functional vegetated buffers; explore opportunities for fisheries enhancement; continue monthly water quality monitoring and watershed-wide assessments and effectiveness monitoring.*

II. UPDATES TO THE GRANITE CREEK RECOVERY STRATEGY ACTION PLAN: 2008 AND BEYOND

The one-page Action Plan of the 2002 Implementation Strategy provides a simple reference to actions taken to implement the original TMDL. The Action Plan (*aka* Implementation Plan) identified both near-term actions for 2002 and 2003 and longer-term actions for 2003 and beyond. The majority of listed tasks have been completed or are ongoing. The Action Plan clearly needs updating to include future tasks, responsible parties, and a completion dates for each task to accurately project activities into the future.

Table 1 below represents the June 2008 updated Action Plan for Granite Creek. It uses the identical format as the original Action Plan. [2]

Table 1. Updated Granite Creek Action Plan for 2008 and Beyond

GRANITE CREEK WATERSHED RECOVERY STRATEGY	RESPONSIBLE PARTY(S)	COMPLETION DATE
THE ACTION PLAN FOR 2008 and BEYOND		
GRAVEL LEASE OPERATIONS		
1) Implement stormwater pollution prevention plans	Operators, CBS	Ongoing
2) Install new stormwater drainage and treatment improvements. Enlarge some existing ponds and install new settling ponds.	Operators,CBS	Summer 2008;ongoing
3) Clean out and maintain settling ponds annually	Operators, CBS	Annually, 6/1-7/15
4) Provide on-site operator assistance in stormwater controls	CBS and Contractor	Ongoing
5) Complete semi-annual audits of lease operations	Contractor for CBS	Twice per year
6) Maintain pit floor and grade roads to divert drainage to ditches and collection ponds	CBS, Operators	Annually
7) Ensure fuel storage occurs at least 50 ft away from streams; encourage use of secondary containment to capture accidental spills	Operators	Ongoing
8) Consider a fuel storage amendment to the local lease agreements	CBS	By Spring 2010
9) Complete a site drainage plan for industrial leases or guidance for a surface water management plan	Contractor, CBS	6/30/10 for final plan; 6/30/09 interim criteria
STREAMSIDE BUFFER PROTECTION		
1) Protect and establish stable, vegetated buffers along North and South Forks. Provide structural protections to limit encroachment.	CBS	Ongoing
2) Conduct active reseeding of erodible soils, stormwater conveyances and stream buffers and evaluate success.	CBS	May 2009
3) Prepare and implement a North Fork Riparian Protection Plan	CBS, Contractor	1/ 09 draft; 6/1/09 final
4) Implement the 2006 soil stabilization and revegetation guidelines on roadside ditches, stream banks, detention basins, and eroded areas	CBS	Ongoing; annually
MONITORING, BMP EFFECTIVENESS, & DATA MANGMT		
1) Implement random monthly and watershed-wide water quality and BMP effectiveness monitoring per the ADEC-approved QAPP	CBS/Contractor	Monthly since Nov 2002
2) Revise and/or update the project QAPP as needed for new developments. Update 2003 Monitoring Strategy, as needed.	Contractor	September 2008; ongoing
3) Record Granite Creek stream elevations concurrent with TSS and	CBS, Contractor	Monthly

[2] Table 1 focuses on new tasks. The status of tasks in the original 2002 Action Plan is summarized in Section III. The majority have been completed. Ongoing tasks are carried over to the updated Action Plan. The reader is referred to the Attachments for a complete listing of 2002 Action Plan tasks.

turbidity monitoring		
4) Encourage operator self-monitoring of operations	CBS/contractor	Ongoing
5) Inventory adult salmon populations and coho spawning habitat and general stream condition	CBS/contractor	August-Nov annual
6) Continue use of other biological indicators to supplement WQ data	CBS	Annual (see #5 above)
7) Manage project monitoring data electronically in a STORET-compatible spreadsheet	CBS, Contractor	Annual. July 15 report.
8) Analyze new turbidity and sediment (TSS) data and update sediment load models developed in FY07. Update the database.	Contractor	7/15/08; 7/15/09
9) Provide cumulative analysis of water quality data to assess Strategy	Contractor	6/30/08, 6/30/09
10) Modify BMPs based on monitoring and cumulative analysis results.	Operators, CBS	Ongoing
11) Field test new BMPs and experimental designs for their effectiveness in reducing turbidity and sediment loads	Contractor	Fall and spring tests
12) Apply innovative turbidity controls and conduct experimental tests	Contractor	FY04 through FY09
ROAD RUNOFF AND MAINTENANCE		
1) Reduce sediment runoff to creek with improved road maintenance	CBS	Ongoing
2) Pave roads where feasible to reduce sediment runoff	Operators (ACS)	June 07; fall 2008
3) Minimize breaching of road banks	CBS	Ongoing
4) Close and stabilize old lease access road	CBS	Projected fall 2008
GOLF COURSE/BENCHLAND OVERBURDEN WASTE DISPOSAL SITE		
1) Reroute ditch water/leachate away from Granite Creek and directly to Sitka Sound	CBS	On hold after FY05 easement efforts failed
2) Evaluate the potential of high volume runoff to neighboring lots	Contractor	Field check 2x/year
3) Maintain forested wetland buffer between disposal site and creek	CBS	Ongoing
4) Implement the CBS Stormwater Pollution Prevention Plan and monitor compliance	CBS, contractor	Semiannual monitoring
MUNICIPAL MANAGEMENT AND OVERSIGHT		
1) Dedicate staff to oversee CBS lease operations and followup on audit recommendations	CBS Public Works	Ongoing
2) Follow-up actions on semi-annual audits of lessee operations	Contractor; CBS follow-up	Semiannual
3) Provide financial and other incentives to operators for model or innovative pollution control efforts (eg. paving in lieu of royalties)	CBS	Ongoing
4) Maintain existing watershed team to advise CBS on controls	CBS	Ongoing
5) Verify vehicle and fuel storage compliance with lease terms	CBS, Contractor	Annually 2x/year
6) Plan for and manage effects of new developments in the watershed to comply with the TMDL. Update the Granite Creek Master Plan.	CBS Public Works & Planning Depts.	Ongoing; Last update in FY04.
7) As part of planning under Task 6, review the "Plan Review Station" approach for CBS reviews to ensure it is working efficiently	Contractor	Annually
8) Reclaim abandon lease sites using practices in the 2005 amended Reclamation Plan	CBS	DMcGraw lease in 2006; other leases pending
UPDATES TO RECOVERY STRATEGY AND TMDL		
1) Periodically review and update the Granite Creek Recovery Strategy and Action Plan. Implement BMPs in the updated Action Plan.	Contractor, CBS, ADEC	June 2008; June 2009; ongoing
2) Keep the TMDL current through periodic updates based on new water quality monitoring results.	CBS, contractor, ADEC	June 2008
3) Implement the 2006 revegetation guidelines for erodible soils and streamside buffers	CBS	Ongoing
FUNDING		
1) Apply for grants to carry out the Watershed Recovery Strategy	CBS	Annually

III. THE UPDATED IMPLEMENTATION STRATEGY (ACTION PLAN) - NARRATIVE DESCRIPTION OF RECOMMENDED FUTURE ACTIONS

The updated Implementation Strategy (Action Plan) is organized along Operational and Management Issues and includes both source-specific and general tasks. Forty five (45) tasks and/or BMPs are listed. All major land uses in the watershed are addressed, with most attention focused on gravel/pit run mining operations and roads as they are the major sources of sediment to Granite Creek. Certainly, new funds will be needed to carry out many of the tasks. The phasing of the tasks over time recognizes this reality.

The City and Borough of Sitka - as the major landowner in the watershed - plays the most important role in carrying out the Action Plan.

Critical to the success of the Strategy is the close cooperation of industrial lease operators. The established watershed team assembled to address water quality and habitat issues should continue to serve in an advisory capacity to the CBS through the implementation phase. A close partnership will help promote consensus on innovative solutions and open up grant funding opportunities.

Recent EPA Region 10 guidance "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)" establishes a framework for achieving load allocations for waters impaired solely or primarily by nonpoint sources. That guidance was reviewed thoroughly in developing the original Action Plan in 2002 and remains a useful reference.

The following actions will, individually and collectively, help meet the recreational, fisheries and water quality goals for the Granite Creek watershed. Some are voluntary actions that require initiative. Many are being successfully used in other watershed protection efforts in Alaska.

SUMMARY STATUS OF ACTION PLAN TASKS FOR 2002 THROUGH 2007

In the 2002 Action Plan, twenty-three (23) tasks were recommended for immediate or near-term implementation for 2002 through 2003 (see *Attachment*). Another six tasks were listed for 2003 and beyond. Twenty-one of twenty-three near-term tasks are completed. Most had defined completion dates. Several are ongoing, such as regular water quality monitoring and establishing stable, vegetated streamside buffers. Milestones over five years include completion of the Granite Creek Watershed Recovery Strategy and TMDL in June 2002, ensuring operators and the CBS all completed required Stormwater Pollution Prevention Plans (SWPPPs) by June 2002, semi-annual audits of lease operations, institutionalized water quality monitoring, protecting and maintaining streamside buffers, and completion of the stage-discharge curve for Granite Creek. Multiple reports covering revegetation guidelines, innnovative turbidity reduction tests, improved planning and project review procedures to address new developments in

Granite Creek, and a comprehensive analysis of 2002-2007 water quality data are among the deliverables.

Two tasks have been delayed or not fully addressed. In June 2003, all permits, funding and authorizations were secured for the rerouting of ditchwater/leachate away from Granite Creek and directly into Sitka Sound. The project was blocked when two adjoining property owners changed their verbal commitment and would not give CBS an easement for a portion of the re-routed drainage pipe across their property. The second task – dedicating a full-time staff person to oversee CBS lease operations at Granite Creek and other leases in the borough– has not occurred due to financial constraints. Alternatively, the CBS maintains a team of Public Works Maintenance employees that throughout the year clean out settling ponds and catch basins, grade the lease road, and hydroseed erodible soils. Also, the CBS Environmental Division spends significant time on monthly water quality monitoring, buffer rope/flagging inspections and repairs, fabrication of silt screens and equipment for innovative turbidity tests at the settling ponds and offers other support as needed. Their contribution is documented in the project's grant and match amounts.

Six additional tasks were identified for "2003 and beyond" in the original Action Plan. Three of the six have been completed. A revegetation and soil stabilization for Granite Creek was completed in April 2006. Research and application of various innovative turbidity controls was conducted and completed in FY04, FY05 and FY07. Reports were prepared for each of these efforts. The CBS Planning Department in 2005 completed a Master Plan for Granite Creek.

The remaining three tasks are ongoing and are "carried over" to the new Action Plan covering June 2008 and beyond. These include completing a surface water drainage plan for the industrial lease area, conducting fisheries enhancement projects, and implementing a "Plan Review Station" approach for interdepartmental CBS reviews of permits in the Granite Creek watershed. This process is used for all development projects and has greatly improved early notification between department for projects, and Planning Commission agenda and packets. Also, additional steps for coordinating CBS review of conditional use permits and lease agreements for Granite Creek was approved by the Planning and Public Works Departments in June 2004. Periodically reviewing the coordination procedures is an Action Plan task.

THE ACTION PLAN FOR 2008 AND BEYOND

The long-term Implementation Strategy for reducing sediment inputs to Granite Creek includes several ongoing tasks that are cornerstones of the recovery effort. A high degree of compliance with water quality standards and TMDL load prescriptions has been demonstrated through June 2007. Several fall months provide challenges to effectively controlling sediment runoff to the creek. Recent EPA and ADEC efforts to recognize the Granite Creek Recovery Strategy as a National Success Story in summer 2008 speak to the improvements made over several years in protecting water quality and

fisheries resources. Short-term efforts need to be augmented with longer-term tasks that take a proactive, "big picture" view of how to maintain watershed health and meet the community's vision for what the watershed should look like in the future.

Task narratives below are keyed to the major categories and task numbers (e.g. Monitoring and Data Management) listed in the updated Action Plan summary *Table 1*. Responsible parties and completion date, where applicable, are also cited in the narrative.

1. GRAVEL LEASE OPERATIONS

☛Task 1. *Implement stormwater pollution prevention plans and alter BMPs as needed.*

This is an ongoing task. Responsibility lies with lease operators and the CBS. All Granite Creek lease operators (gravel operators, golf course, old overburden site) and the CBS (new overburden site and common pit run site) have completed the required SWPPPs for stormwater control. Semi-annual audits evaluate compliance with their terms and the terms of CBS lease agreements. Altering BMPs to meet changing conditions is common in an effort to improve pollution controls.

☛Task 2. *Install new stormwater drainage and treatment improvements. Enlarge some existing ponds and install new settling ponds to increase retention capacity and treatment of sediment.*

This is an ongoing task. Properly designed and maintained settling ponds are among the most effective structural BMPs for protecting water quality. Starting in July 2001, multiple settling ponds have been installed throughout the lease area to collect and treat turbidity and sediment. Operators are responsible for installing and maintaining ponds on their lease sites; the CBS is responsible for pond installation on public lease sites. On-site audits will determine the need for additional ponds in newly developed or expanded areas. At least two new ponds have been slated for installation by fall 2008. Also, several existing ponds on the Tisher lease site and Dormand McGraw lease site have been identified for enlargement through increasing the area and/or depth of the ponds. Annual sediment cleanouts of ponds helps to ensure optimal performance.

☛Task 3. *Clean out and maintain settling ponds annually.*

This is an ongoing task. Settling ponds are cleaned annually by both the CBS and the operators. Mucking out sediments in settling ponds is critical to maintaining their storage capacity and effectiveness in removing sediments and turbidity. The timing window for cleaning is June 1 – July 15 to provide the maximum protection for anadromous and resident fish. Silt screens and haybales are also checked during this annual maintenance step. Operators are responsible for cleaning/maintaining ponds on their leases; the CBS cleans/maintains ponds that they constructed. A measure of success is demonstrating adequate retention time and storage capacity of settling ponds.

☛Task 4. *Provide on-site operator assistance in stormwater controls.*

This ongoing task involves helping lease operators optimize stormwater pollution control efforts. This can involve offering suggestions on drainage diversions, new settling pond placement or enlargement of existing ponds, visual turbidity monitoring, and use of wattle barriers, haybales and gravel berms to retain and treat water in swales. Both the CBS and its project contractor provide ongoing operator assistance.

☛Task 5. *Complete semi-annual audits of lease operations.*

Formal environmental audits of lease operations are completed by the project contractor in the fall and summer of each year as part of the Recovery Project. The standardized checklist of categories and tasks, coupled with a "running" chronological summary of how each task is addressed over time, provides a formal record of findings for CBS follow-up. The audits have proven to be a very useful tool in effecting changes in operator BMPs and correcting water quality problems. Audits are ongoing (twice/year) as long as the project continues.

☛Task 6. *Maintain pit floor and grade roads to divert drainage to ditches and collection ponds.*

Road grading is a shared responsibility and completed each year by both the lease operators and the CBS Public Works Maintenance staff per mutual agreement. The key is to ensure drainage is diverted to ditching and then to settling ponds for optimal treatment, rather than running down the road and bypassing settling ponds. Paving several road segments has reduced sediment runoff in the lower lease access road area.

☛Task 7. *Ensure fuel storage occurs at least 50 ft away from streams; encourage use of secondary containment to capture accidental spills.*

Fuel storage near the creek has historically not been an ongoing problem. In fall 2007, several coal oil drums were temporarily stored within 50 ft of the North Fork adjacent to a settling pond that drained into the creek. Secondary containment is not employed by any operator in Granite Creek. This task addresses the ongoing need to ensure fuel and oil products are not even temporarily stored adjacent to the creek and to discuss with and educate operators on the proper location for fuel storage. Operators have this responsibility; CBS has enforcement and oversight authority through the municipal lease agreement.

☛Task 8. *Consider a fuel storage amendment to the local lease agreement.*

Existing CBS material site lease agreements include language protecting stream buffers and water quality through prohibiting storage of equipment, aggregate stockpiles and other materials within 25 feet of Granite Creek. No similar explicit stipulation exists that prohibits storage of fuel products within 50 feet of Granite Creek. Some month-to-month temporary leases, *but not the long-term leas*es, have historically included language

prohibiting storage of petroleum products or any hazardous waste products on the lease site.

Recommended changes to lease agreements can occur either through amendments to the existing long term lease or through the renewal of those leases. Adding new conditions is best done at renewal, as changes to a long term lease is a lengthy process. Recommended lease amendment language has been prepared for CBS consideration

☛Task 9. *Complete a site drainage plan for industrial leases or guidance for a surface water management plan.*

Individual operators have variably addressed stormwater issues on their individual leases, as required under their approved SWPPPs. A comprehensive look at surface water drainage in the *entire* industrial lease area would support future decisions on culvert sizing and locations, upland interception and diversion of sheet flow away from the pit floor, the need for additional retention basins, and longer-term remediation actions. Developing *criteria* for a surface water drainage plan covering the CBS pit run site is an action identified in the FY09 workplan. However, it is limited in scope. A drainage plan that includes surveying and engineering design encompassing the entire industrial area and bluffs above it is needed, including interception of water flowing through the pit run site. The project contractor and CBS are responsible for completing preliminary criteria for a drainage plan by June 30, 2009. A complete site drainage plan is estimated for completion by June 30, 2010.

2. STREAMSIDE BUFFER PROTECTION

☛Task 1. *Protect and establish stable, vegetated buffers along North and South Fork. Provide structural protections to limit encroachment. Gradually expand buffer width.*

Maintaining vegetated and protected streamside buffers is one of the most effective BMPS in protecting water quality of Granite Creek. This important ongoing task has included installing ropes and flagging, and placement of log berms and other structural barriers to limit encroachment, active hydroseeding of erodible soils, and allowing alder and natural grasses to grow undisturbed. These efforts have been successful along several critical segments of the North and South Forks in reducing sediment input to the creek. Continued effort is needed. The CBS, with assistance from the project contractor, will continue to identify new measures and priority segments needing attention, and mutually-agree on priorities. The CBS is responsible for implementing those actions.

☛Task 2. *Conduct active reseeding of erodible soils, stormwater conveyances and stream buffers and evaluate success of efforts.*

Active hydroseeding of 6 to 8 priority areas was completed by CBS in May 2007 and June 2008. The truck-mounted hydroseeding unit purchased in FY07 has proven to be very efficient and user friendly, and has allowed for rapid seeding and touchups with excellent grass growth. The continued use of the hydroseeder for the North Fork riparian

area, stormwater ditches, and eroding stream banks and swales, is expected to extend into the future as part of annual project workplans. Evaluating each year's success is essential to make adjustments and prepare for subsequent seeding efforts.

☛Task 3. *Prepare and implement a North Fork Riparian Protection Plan.*

The closure of the old lease access road adjacent to the North Fork, projected to occur by late 2008, offers an excellent opportunity to expand the width of the riparian buffer along key segments of the tributary and provide permanent protection to the North Fork. Sealing off and stabilizing the old road right-of-way are primary objectives. Reusing the vegetated layer from stripped overburden, existing material stockpiles and cut logs, and backfilling and hydroseeding are options under consideration. This task was approved by ADEC as part of the Granite Creek project's FY09 workplan. The Plan will be completed by the project contractor for CBS review and approval by June 1, 2009. A draft plan will be available by January 15, 2009. Implementation will occur in FY10 and beyond.

☛Task 4. *Implement the 2006 soil stabilization and revegetation guidelines on roadside ditches, stream banks, detention basins, and eroded areas.*

Several ongoing activities within the watershed implement the April 2006 report "*Guidelines and Best Management Practices for Soil Stabilization and Revegetation in the Granite Creek Watershed"*. Examples are the initial hydroseeding efforts by CBS during May 2007, covering road ditches, eroded stream banks, roadside detention basins, and cut banks. Hydroseeding follow-up work also occurred in June 2008. The completion of the North Fork Riparian Plan (Task 3 above) is another example of carrying out the guidelines. The guidelines cover a variety of soil types and situations, from steep banks, riparian areas, roadside ditching and the like. This ongoing task is addressed annually in the approved workplan.

3. MONITORING, BMP EFFECTIVENESS AND DATA MANAGEMENT

☛Task 1. *Implement random monthly and watershed-wide water quality and BMP effectiveness monitoring per the ADEC-approved QAPP.*

This continuing task is a cornerstone of the project's recovery effort. Both monthly monitoring at Station GC1 and watershed-wide monitoring at eight permanent stations will continue into the future. Water quality monitoring is needed to determine compliance with standards and the effectiveness and adequacy of BMPs towards that objective. New developments occurring in the watershed may require new stations and approaches to fully document impacts. New water quality data will also be used to periodically update the FY07 revised sediment load models and load calculations.

☛Task 2. *Revise and/or update the project QAPP as needed for new developments or changes to the Sampling Plan. Update the 2003 Monitoring Strategy, as needed.*

The Granite Creek QAPP was approved in September 2001 and revised in 2004 to include adult salmon count methodology. In FY08, a review of the QAPP determined that further revisions were not warranted for current operations. The QAPP will be reviewed again in FY09 to determine the need for revision, specifically to address methods for surveying and documenting coho salmon spawning habitat or any new parameters, stations or sampling plans not included in the 2004 QAPP. While ADF&G apparently has no written protocols for such surveys, a section in the QAPP may need to be added to document methodology and data quality objectives.

The project contractor would be responsible for completing any updates to the QAPP. September 15, 2008 is identified as the due date, contingent on a finding that revisions are necessary. Written supporting analysis will be provided if changes are not warranted.

The 2003 Monitoring Strategy for Granite Creek is a companion to the QAPP and, ideally, should be revised at the same time that the QAPP is revised. This task is ongoing.

☛Task 3. *Record Granite Creek stream elevations concurrent with TSS and turbidity monitoring.*

The Granite Creek stream gage was installed by the USGS in November 2002. It is read monthly by CBS Environmental staff simultaneous with collected of TSS and turbidity data at Station GC1. Elevations are then converted to flow rate (cfs) using the stage-discharge curve/rating table and allow for calculating the statistical relationship between stream flow and sediment load. This is a continuing task.

☛Task 4. *Encourage operator self-monitoring of operations.*

All lease operators completed Stormwater pollution prevention plans in 2002. An operator workshop on stormwater controls was hosted by CBS in November 2001. Operator self-monitoring of water quality is called for in the SWPPPs, both visually and, more formally, through quarterly sample collection. Where problems may exist, operators are in the best position to take immediate corrective actions on a real-time basis. Training operators in basic monitoring and visual screening of turbidity levels is included in this task. Both the CBS and the project contractor have responsibility for "coaching" operators to ensure this task is completed. The project contractor has also assisted operators with questions on sample and reporting requirements as part of their Stormwater general permit.

☛Task 5. *Inventory adult salmon populations and coho spawning habitat and general stream condition.*

This annual task continues efforts started in FY05 to supplement water quality information with adult pink and coho salmon population counts. Biological health is an

important barometer of Granite Creek recovery. In FY09, the project workplan was expanded to include mapping and narrative description of important coho spawning habitat in the North Fork and a description of general stream condition. The North Fork is the primary tributary used by coho salmon and is relatively unaffected by development. The project consultant, with assistance from CBS and the Sitka ADF&G Sport Fish Division, completes the surveys from August through November of each year. A final report would be available by June 30, 2009.

☛Task 6. *Continue use of other biological indicators to supplement water quality data.*

Evaluating the need for and possibly adding new cost-effective biological indicators to the current suite of indicators at Granite Creek may be warranted in the future. An example is the addition of general stream condition indices in the FY09 workplan and the mapping of important coho spawning habitat. Other potential indices could be percentage of vegetative cover along segments of tributaries, or assessment of juvenile salmon rearing habitat. The need for additional indices would be determined during each ACWA grant application window.

☛Task 7. *Manage project monitoring data electronically in a STORET-compatible spreadsheet.*

Since November 2002, all project water quality data have been entered into an Excel spreadsheet that conforms to ADEC STORET guidelines. The CBS and project contractor both contribute and collaborate closely on entering and maintaining the project's electronic database. The ongoing task is an essential part of the project. Data are provided annually in both CD-ROM and hard copy form to ADEC by July 31 of each year as part of the Final Report.

☛Task 8. *Analyze new turbidity and sediment (TSS) data and update sediment load models and load calculations developed in FY07. Update the project database.*

This task is identified for both FY08 and FY09 workplans. In FY08, the project contractor will update sediment load calculations completed in FY07 with new data collected in FY08. This will ensure that estimates of monthly in-stream loads, load capacity and load reduction calculations are kept current with all available water quality information. More information results in a stronger statistical relationship between flow rate, sediment and turbidity levels. The due date for the FY08 tasks is July 31, 2008.

In FY09, the workplan continues to analyze data collected in FY08 and FY09 (since June 2007) and updates the sediment load models developed in FY07. All data collected will be added to the project database for updating and "fine tuning" models and mathematical relationships, including the relationship of flow rate to sediment concentration and the TSS-to-turbidity relationship. The task is not intended to be a comprehensive review, as such a review of five years of water quality data was already completed in FY07. A report with findings was completed in June 2007.

The contractor who completed the FY07 comprehensive analysis will also complete the analysis of new water quality data. The due date for the FY09 update is July 15, 2009. Given ADEC and EPA's position that formal amendments to the approved Granite Creek TMDL are not a near-term priority, it is not expected that the annual updating of water quality models will continue indefinitely.

☛Task 9. *Provide cumulative analysis of water quality data to assess Strategy effectiveness.*

This task was first completed in FY07 with the comprehensive analysis of five years of data collection at Granite Creek. It is expected that a follow-up comprehensive analysis may be warranted every three years or so. Task 8 describes a less rigorous examination of data without the requirement to amend all sediment load calculations each year with new data.

☛Task 10. *Modify BMPs based on monitoring and results of cumulative analysis.*

BMP effectiveness monitoring is an essential component of the recovery effort. Regular collection of turbidity and TSS data on the effects of existing and new BMPs determines the need for any revision to protect water quality. This "iterative" process is an ongoing task and is part of each approved project workplan. Both the lease operators and the CBS have responsibility to ensure this task is met. The project contractor provides the water quality data in support of making any revisions and field "coaches" operators to affect changes.

☛Task 11. *Field test new BMPs and experimental designs for their effectiveness in reducing turbidity and sediment loads.*

The ever-changing landscape at Granite Creek requires an evolving suite of actions/BMPs to address new developments. Installing new culverts, vegetating ditches, paving roads to reduce sediment runoff, and field testing experimental methods to reduce sediment runoff are naturally-evolving tasks. Over the last five years, efforts have focused on using conventional check dams and grass reseeding to improve holding times and filtration of ditch-run stormwater. Splash rocks, flocculants and using geotextile fabrics for filtering settling pond effluents have all been tested in prior years. Some have been effective; some not. The use of wattle barriers and other BMPs not previously tested will be considered. Three possible new techniques include culverting the length of key drainage ditches, repeated ditch seeding in the spring during low water flows, and placing a series of small terraced settling ponds to collect and treat stormwater discharged from culverts down the stream bank gradient. Discharges down unvegetated stream banks can cause significant resuspension of sediments during high flows. Water quality data will be collected on all tested options to evaluate their relative success in reducing TSS and turbidity.

The grantee (CBS) and its contractor will collaborate on designing and carrying out field tests of techniques designed to reduce sediments and turbidity. The completion date for FY09 efforts is June 30, 2009. It is expected that this task will continue beyond FY09.

☛Task 12. *Apply innovative turbidity controls and conduct experimental tests.*

Extensive tests with filter fabrics were completed in FY04 and again in FY06 at several settling pond-culvert sites to examine viable turbidity reduction techniques. While the long-term results were not favorable on a small scale, the tests did show that filter fabrics effectively reduce turbidity for a short time before plugging up. Use of nested screens to capture sediments from settling pond culverts proved somewhat more effective. While no experimental pond tests are scheduled as part of the FY09 ACWA grant workplan, it is prudent to include the possibility of future tests at the settling pond series. As new methods evolve, some might warrant testing. The project contractor would be responsible for completing the tests and reporting the results to CBS and ADEC.

4. ROAD RUNOFF AND MAINTENANCE

☛Task 1. *Reduce sediment runoff to creek with improved road maintenance and grading.*

Road runoff during rain events and heavy truck traffic is a continuing source of sediment to Granite Creek and presents control challenges. Grading and resurfacing the various segments of the Granite Creek lease access road is important to direct sheet flow to ditching and settling ponds and to avoid bank breakouts where silty water runs off down slopes and into the creek. The CBS Public Works Maintenance Department is responsible for grading on an annual basis and often works an agreement with select operators to complete the task on select road segments. With the completion of paving of the new lease access road scheduled for fall 2008, and closure of the old lease access road, less road length will require grading in the future. The result will be reduced sediment runoff to the creek.

☛Task 2. *Pave roads where feasible to reduce sediment runoff.*

The first section of the Granite Creek lease access road was paved in June 2007 by lease/asphalt plant operator ACS (Larry Shinn). ACS expects to complete phase 2 of paving – the portion of the lease access road running from the lease entrance gate to the road accessing the Tisher lease site – in fall 2008. Paved roads significantly reduce sediment runoff to creeks and the results are immediate. With completion of Phase 2 paving, several segments of road in the industrial lease area will still remain unpaved. A goal of the Recovery Project is to seek innovative funding options with operators to allow for further paving and other pollution control improvements. The CBS Public Works Director is the lead for these discussions with operators.

☛Task 3. *Minimize road bank breaching.*

This ongoing task involves periodic inspections to confirm berming on the side of the road is intact adjacent to stream courses and drainage is diverted to constructed ditches and settling ponds for treatment. CBS employees are responsible for maintenance. Two problematic sites have historically required the most attention – the bank breach at the main gate to the lease area that drains into the North Fork and the area across the road just upstream from the bottomless arch culvert going under the road. Grading, rock berming and hydroseeding have all been successfully used to stabilize the latter area. For the breach at the main gate, intercepting and diverting drainage away from the banks and into the ACS series of settling ponds should correct the periodic problems. Also, completing paving through that area (projected for fall 2008) will help correct the problem.

☛Task 4. *Close and stabilize old lease access road.*

The opening of the new lease access road through the old ACS (Shinn) lease site in 2007 reduced the long-term need for the old access road that runs adjacent to the North Fork. Historically, the North Fork has received the majority of runoff from pit run material extraction operations and truck traffic. In April 2008, CBS closed the old lease access road to truck traffic and installed Jersey barriers. The closure of the old lease access road offers an excellent opportunity to expand buffer widths and provide permanent protection to the North Fork. This important first step would be followed by development and implementation of the North Fork Riparian Protection Plan discussed above.

5. GOLF COURSE/BENCHLAND OVERBURDEN WASTE DISPOSAL SITE

☛Task 1. *Reroute ditch water and leachate generated from the old overburden site away from Granite Creek and directly to Sitka Sound.*

This task is currently on hold. In FY03, this task was funded through a combination of ACWA grant and local cash funds. In June 2003, all permits, funding and authorizations were secured for the rerouting of ditchwater/leachate away from Granite Creek and directly into Sitka Sound. The project was blocked when two adjoining property owners changed their verbal commitment and would not give CBS an easement for a portion of the re-routed drainage pipe across their property. Insufficient public land for the ROW existed to allow the project to proceed. Iron staining of the lower portions of Granite Creek, while not a health or environmental hazard, continues to prompt occasional calls and letters from the public. CBS seeks a solution to this aesthetic issue while respecting private property rights affected by rerouting the drainage.

CBS and its project contractor would have lead responsibility is securing permits and funding for the task.

☛Task 2. *Evaluate the potential for high volume runoff or altered drainage from the golf course area to neighboring lots.*

While not confirmed by CBS or its contractor, some citizen complaints have been received by CBS alleging that since completion of the driving range and golf course preparation work, increased stormwater drainage has been coming form the golf course and affecting downslope homes. This task would investigate the issue further and provide a factual basis for any needed actions. The project consultant, in conjunction with CBS, would complete field inspections during both the fall and spring months to assess drainage conditions and report back to CBS staff for follow-up. This task is expected to be included in the FY10 workplan.

☛Task 3. *Maintain the forested wetland buffer between the CBS waste overburden site and Granite Creek.*

A roughly 150 foot vegetated buffer separates the toe of the CBS waste overburden site/biosolids disposal site and Granite Creek. Maintaining this buffer in undisturbed condition is a very effective BMP to maximize filtration and assimilation of any leachates, metals and fecal coliform bacteria generated from the source site. Semi-annual monitoring of three sampling sites is conducted under a solid waste permit, issued separately from the Granite Creek Recovery Project. CBS is responsible for buffer maintenance and conducting water quality monitoring under the solid waste permit.

☛Task 4. *Implement the CBS Stormwater Pollution Prevention Plan for the area and monitor compliance with conditions.*

Twice per year, during the fall and summer months, an environmental audit is conducted of all lease operations, including the overburden waste disposal site. This is an ongoing task. The project contractor completes the audits as an agent for CBS. Findings address drainage diversion upslope from the facility, documentation of any standing surface water at the overburden site, degree of stormwater generation from the toe of the facility into the vegetated wetlands, and photographic documentation of conditions.

5. MUNICIPAL MANAGEMENT AND OVERSIGHT

☛Task 1. *Dedicate staff to oversee CBS lease operations and follow-up on audit recommendations.*

CBS is responsible for overseeing and enforcing the terms of municipal lease agreements and for follow-up on the results of semi-annual environmental audits. The original intent in 2002 of dedicating a single full-time staff person to oversee CBS lease operations at Granite Creek and other leases in the borough has not occurred due to financial constraints. Alternatively, the CBS maintains a team of Public Works Maintenance employees that throughout the year clean out settling ponds and catch basins, grade the lease road, install new ponds, and hydroseed erodible soils. Also, the CBS Environmental Division provides significant time on monthly water quality monitoring, buffer rope/flagging inspections and repairs, fabrication of silt screens and equipment for

innovative turbidity tests at the settling ponds and offers other support as needed. Collectively, this team approach has proven efficient and has an ongoing function as long as industrial lease operations continue.

☛Task 2. *Follow-up on actions identified in semi-annual audits of lessee operations.*

The semi-annual audit reports prepared by the project contractor provide a written record of the degree lease operations comply with lease agreements and TMDL prescriptions. The Public Works Director is responsible for ensuring and directing any follow-up from the PW Maintenance staff. The project consultant provides copies of the reports to the CBS management team and debriefs them on the findings of each field audit. This team approach has worked well and is an ongoing task.

☛Task 3. *Provide financial and other incentives to operators for model or innovative pollution control efforts (e.g. paving in lieu of royalty payments)*

A number of innovative approaches have been used by CBS in cooperation with lease holders to affect pollution control improvements. The most recent example was the Phase 1 paving of the Granite Creek Road from the top of the hill adjacent to the golf course down to the lease area entrance. An agreement was reached with the asphalt plant operator to pave the road in exchange for reduced lease payments to the CBS. This represented an equivalent value exchange that resulted in a significant water quality improvement through eliminating silty road runoff over a lengthy road segment. CBS is encouraged to explore similar financial incentives with operators to affect water quality improvements.

☛Task 4. *Maintain the existing watershed team to advise CBS on controls.*

The interagency watershed team (CBS, ADF&G, ADEC, project contractor and lease operators) was established in 2002 to advise the CBS on current operations, needed stormwater controls, monitoring and fisheries concerns affected by lease operations. This watershed approach is less adversarial than inspections by individual agencies. The team should continue to operate, with focus on reestablishing functional buffers, placement of new settling ponds, adult salmon inventories, and fisheries enhancement ideas. This ongoing task ensures operators are part of the team and leads to mutually-agreed on solutions to stormwater control problems.

☛Task 5. *Verify vehicle and fuel storage compliance with lease terms***.**

This is an important action item in each of the semi-annual audits of lease operations. Equipment setbacks from the roped and flagged riparian boundaries are evaluated, as well as material stockpile setbacks and fuel and oil drum storage. Recent temporary storage of coal oil drums adjacent to the North Fork was pointed out by the project contractor to the lease operator, and a request made to move the drums immediately to an area away from the creek. CBS Public Works staff are responsible for follow-up to ensure these actions are taken in a timely manner.

☛Task 6. *Plan for and manage the effects of new developments in the watershed to comply with the TMDL. Update the Granite Creek Master Plan.*

The CBS Planning Department completed the most recent update to the Granite Creek Master Plan in 2004 -2005. Since that time, a new residential development and Class III landfill which includes an approved biosolids disposal site have been permitted and developed. The Master Plan would benefit from an update to include these new development activities as well as to project future likely developments in the watershed. The Master Plan updates must recognize and include provisions of the Granite Creek TMDL to ensure new developments are cognizant of, and comply with, the water pollution control actions in the Action Plan. The CBS Planning Director is responsible for the Master Plan updates. The Plan Review Station approach in Task 7 is also an important part of ensuring management of new development complies with the TMDL.

☛Task 7. *As part of planning for new developments, review the "Plan Review Station" approach for CBS reviews to ensure it is working effective.*

In June 2005, the project contractor completed the report *"Granite Creek Watershed Project Review Guidelines and Pollution Control Recommendations for Future Development – linking the Granite Creek Master Plan to the Granite Creek Recovery Strategy and TMDL"*. The report included revisions to both the conditional land use permit review process and the lease agreement review process for Granite Creek. The guidelines attempt to formalize and improve coordination between the CBS Planning Department and the Public Works Department and set up procedures to address a more coordinated review. Hosting preapplication meetings with applicants was one recommendation. Improved coordination is important given that actions of each department have a major effect on the other department. The goal is to help ensure new developments in the watershed are planned, reviewed, and approved with environmental protection in mind.

The cooperative review process will involve conducting interviews with key CBS management staff to see if any improvements could be made to procedures.

☛Task 8. *Reclaim abandon lease sites using practices in the 2005 amended Reclamation Plan. Monitor the water quality impacts of reclamation actions during and after operations.*

Lease operators are required to reclaim leases no longer active using the conditions in the original Reclamation Plan, as amended in 2005. Monitoring to ensure BMPs in the updated Reclamation Plan are followed, coupled with water quality monitoring to verify compliance with standards, must occur both during reclamation activities and also after they are completed. CBS sign-off on reclamation is dependent on returning the lease to a condition suitable to support future planned residential, commercial or industrial uses in the watershed.

Only one portion of a single material lease site has begun reclamation. Disposal of waste overburden at the abandoned head of the pit area has proceeded for several years at the Dormand McGraw lease site. Monitoring is ongoing to assess the effects of leachate runoff on Granite Creek.

This task is expected to be very important and will accelerate as accessible material and gravel deposits are exhausted in the Granite Creek watershed over the next five years.

6. UPDATES TO THE RECOVERY STRATEGY AND TMDL

☛Task 1. *Periodically review and update the Granite Creek Recovery Strategy and Action Plan. Implement BMPs in the updated Action Plan.*

Keeping the Action Plan current is an important task. The original Action Plan was completed in 2002 and has not been updated since that time. Objective 2 of the FY08 and FY09 Granite Creek workplans is to "ensure the Granite Creek Recovery Strategy and TMDL are kept current through periodic review, revision and field implementation to reflect new water quality information". The project contractor will complete formal updates to the Recovery Strategy in June 2008. A new Action Plan will be completed. All tasks listed above in this narrative are the result of this effort. The newly-updated Action Plan will guide future grant applications for remaining work in Granite Creek. Implemention of new BMPs in the Action Plan is an ongoing task.

☛Task 2. *Keep the TMDL current through periodic updates based on new water quality monitoring results.*

TMDLs need periodic reevalution after several years of carrying out the Recovery Strategy. In FY07, key assumptions related to the TMDL were evaluated, including flow-to-sediment relationships, average monthly flows, and load capacity and in-stream sediment loads. Five years of water quality data were analyzed and new calculations of sediment loads generated. New average monthly flow tables were also generated along with improved mathematical equations correlating TSS concentrations to flow rate and TSS concentrations to turbidity levels. In FY08, selected sections of the TMDL will be reviewed and minor updates made by the project contractor in cooperation with CBS. These include the "TMDL-at-a-Glance" summary page, the Action Plan summary, and a description of each of the tasks in the Action Plan. Per ADEC request, focus should remain on updates to the Implementation Strategy rather than the TMDL, as EPA and ADEC do not expect to revise/amend the Granite Creek TMDL in the near term. Hence, several narrative sections in the original TMDL (land uses, flow rate data, etc) were left unchanged at this time.

☛Task 3. *Implement the 2006 revegetation guidelines for erodible soils and streamside buffers.*

This is an ongoing task, with CBS having the primary responsibility. The 2006 guidelines and BMPS are keyed to five areas: steep banks and slopes; roadside ditches and stormwater conveyances; riparian buffers and streambanks; gravel lease operations; and Sea Mountain golf course. Soil stabilization in the later two categories is the responsibility of the respective lease operators. Considerable erosion control has been completed at the Golf Course by the leaseholder at its own expense.

The CBS began implementing the 2006 guidelines in May 2007, with completion of hydroseeding along common drainage ditches, CBS settling ponds, and along stream banks and roadside right-of-way areas. Follow-up hydroseeding is scheduled for June 2008 to address remaining priority areas. Additionally, haybale placement and other erosion controls have been carried out by the CBS Groundskeepers, Public Works Maintenance and Environmental staff. Active plantings of vegetation have not been a focus of attention, rather, establishing robust grass growth through hydroseeding is the primary objective at this stage. Over time, it is expected that more assertive stabilization techniques will be employed, such as those related to the North Fork riparian protection zone addressed in the FY09 workplan.

7. FUNDING

☛Task 1. *Apply for grants to carry out the Watershed Recovery Strategy*

The CBS has applied for and received federal ACWA grants each year since 2002 (FY02) to develop the TMDL and implement the Granite Creek Recovery Project.

CBS is expected to continue applying for ACWA grants for the Granite Creek project at least through FY11.

ATTACHMENTS

1. Original 2002 Action Plan in the approved Granite Creek TMDL

2. Tables 4, 5 and 6 of the 2007 Comprehensive Analysis of Water Quality Data report

Near term implementation table from *Final TMDL for Sediment and Turbidity in Granite Creek, Sitka, Alaska*; September 2002

GRANITE CREEK WATERSHED RECOVERY STRATEGY	RESPONSIBLE PARTY(S)	COMPLETION DATE
THE ACTION PLAN FOR 2002 TO JUNE 2003		
GRAVEL LEASE OPERATIONS		
1) Complete and implement stormwater pollution prevention plans	Operators, CBS	6/30/2002
2) Install engineered settling ponds for treatment of runoff	CBS, Operators	7/15/2001
3) Clean out and maintain settling ponds annually	Operators, CBS	6/1/2002
4) Host operator workshop on stormwater controls	CBS and Contractor	11/19/2001
5) Amend CBS material lease agreements to add water quality terms	CBS	6/30/2002
6) Grade pit floor and divert drainage to central collection areas	CBS, Operators	7/15/01, 6/2002
7) Stabilize the South Fork creek channel	Operators	6/30/02, ongoing
8) Establish stable, vegetated buffers along North and South Forks	CBS, Operators	6/30/2003
9) Drain material stockpile runoff to collection/treatment points	Operators	6/30/2002
ROAD RUNOFF AND MAINTENANCE		
1) Reduce sediment runoff to creek from road maintenance	CBS	6/30/02, ongoing
2) Minimize snow dumping and snow side casting into the creek	CBS, Operators	Ongoing
GOLF COURSE/OVERBURDEN WASTE DISPOSAL SITES		
1) Reroute ditch water/leachate away from Granite Creek and directly to Sitka Sound	CBS	6/30/2003
NEW BENCHLAND WASTE DISPOSAL SITE		
1) Complete and implement Stormwater Pollution Prevention Plan	CBS	4/15/2002
MANAGEMENT AND OVERSIGHT		
1) Dedicate staff to oversee CBS lease operations	CBS	5/1/2002
2) Conduct annual audits of lessee operations/host workshops	CBS	6/30/02; annual
3) Provide financial and other incentives to operators for model pollution control efforts	CBS	Ongoing
4) Complete a Granite Creek Watershed Recovery Strategy and TMDL	CBS/contractor	5/15/2002
5) Maintain existing watershed team to advise CBS on controls	CBS	4/15/02; annual
6) Verify fuel and vehicle storage compliance with lease terms	CBS	5/1/02; ongoing
MONITORING		
1) Implement regular and long-term water quality monitoring per the ADEC-approved monitoring plan (QAPP)	CBS/contractor	begin 10/15/01, ongoing
2) Develop a stage-discharge curve for Granite Creek	USGS/Forest Service	4/30/2003
3) Encourage operator self-monitoring of operations	Lease operators	Ongoing
FUNDING		
1) Apply for grants to carry out the Watershed Recovery Strategy	CBS	2/15/02; ongoing
THE ACTION PLAN FOR 2003 AND BEYOND		
1) Complete a site drainage plan for industrial leases	CBS and/or contractor	6/2004
2) Research and apply innovative turbidity controls	Operators, CBS	Ongoing
3) Conduct fisheries enhancement projects	CBS, ADF&G	7/15/01, ongoing
4) Use a "Planning Review Station" approach for CBS reviews	CBS Departments	6/30/2003
5) Develop a Master Development Plan for Granite Creek	CBS	6/2003
6) Complete a revegetation guidebook for streamside buffers	CBS, operators	6/2003

Table 4. Relationship of Total Suspended Solids (TSS), turbidity, and flow rates at Station GC1, Granite Creek, Alaska, from October 2002 to January 2007. [3] [4]

Date[5]	TSS (mg/l)	Mean turbidity (NTU)	Turbidity Replicates (NTU)	Flow rate (cfs)	USGS staff gage height (ft)	Comments and notes
10/16/2002	47	44.8	45.2, 44.5			USGS installed
10/17/02	1.9	5.44	5.85, 5.02	51.3 *		permanent stream
11/08/02	0.4	2.57	2.54, 2.6	3.4 *	18.92	staff gage on
11/16/02	11.1	17.4	17.8, 17	137	19.82	November 8, 2002
12/11/02				11.9 *	19.18	
12/31/02	2	3.63	3.61, 3.66	10.2	19.14	
1/10/2003	0.05	0.54	0.6, 0.53	6.4 *	19.04	
3/1/03	0.75	2.88	2.86, 2.9	30.0 *	19.39	
3/18/03	0.3	2.79	2.72, 2.85	7.3	19.07	
4/16/03	0.8	4.00	4.19, 3.81	4.89 *	18.95	
5/22/03	0.2	0.44	0.45, 0.43	3.1	18.90	
6/19/03	1.7	2.52	2.38, 2.65	28.3 *	19.36	
8/11/03	0.9	0.92	0.89, 0.94	2.3	18.83	
9/25/03	8.2	3.44	3.85, 3.02			
10/04/03				84.6 *	19.66	
10/30/03	0.2	0.87	0.89, 0.86	10.2	19.14	
12/16/03	1.8	7.28	7.08, 7.49	16.7	19.25	
1/29/2004	0.2	0.58	0.61, 0.55	2.4	18.84	
2/8/04	6	6.81	7.42, 6.19	126	19.79	
3/8/04	1.5	3.22	3.35, 3.09	50.1	19.52	
4/7/04	0.1	1.70	1.78, 1.62	9.7	19.13	
5/17/04	0.1	0.51	0.52, 0.50	3.1	18.90	
6/16/04	0.1	0.49	0.48, 0.49	1.7	18.76	Second highest
8/12/04	0.03	0.38	0.38, 0.39	1.7	18.77	flow measured at
9/08/04				5.64 *	18.90	Granite Creek on
9/21/04	3.3	4.62	4.83, 4.40	90.2*	19.61	12/2/04. TSS max
10/05/04	2.2	6.45	6.84, 6.05	31.6	19.39	of 123 mg/l.
11/04/04	0.6	1.50	1.52, 1.47	21.5	19.31	Highest recorded
12/02/04	123	95.0	94.1, 95.9	1070	20.90	flow was on
						11/22/05.
1/17/2005	17.6	19.9	21.1, 18.7	242	20.05	USGS completed
2/24/05	3.4	9.12	8.99, 9.25	15.3	19.23	Stage Discharge

[3] Flow rates are derived from staff gage height readings converted using the USGS Stage discharge curve (SDC) unless otherwise noted.
* indicates actual flow measurements taken by USGS or USFS hydrologists for use in developing the stage discharge curve for Granite Creek

[4] Table 4 includes only those dates where simulataneous TSS and turbidity measurements were taken at GC1. Turbidity alone was collected at GC1 on several other dates and results are included in supporting tables.

4/4/05	0.7	1.74	1.75, 1.74	12.2	19.18	Curve (SDC) in June 2005 based on 11 actual flow measurements covering a range of flow rates.
5/25/05	0.7	1.29	1.26, 1.33	2.9	18.88	
6/14/05	0.9	---	---	6.3 *	19.04	
7/13/05	0.5	1.46	1.44, 1.48	4.0	18.95	
8/18/05	14	8.11	7.7, 8.52	60.5	19.57	
9/19/05	13	16.2	16.0, 16.4	259	20.08	
10/13/05	0.7	1.91	1.89, 1.93	36.7	19.44	
10/26/05	0.3	2.09	1.43, 2.75	12.2	19.18	
11/17/05	15.0	19.4	19.2, 19.6	253	20.07	
11/21//05	3.6	3.41	3.49, 3.33	282	20.12	
12/22/05	2.7	5.78	5.74, 5.82	33.9	19.42	
1/9/2006	2.9	9.39	9.42, 9.36	44.6	19.49	Staff gage damaged 9/25/06 during high flow. Gage partially restored; USGS to resurvey in early 2007
2/7/06	4.8	9.90	9.86, 9.94	58.3	19.56	
3/29/06	0.1	0.48	0.47, 0.50	4.9	18.99	
4/18/06	0.4	3.23	2.41, 4.05	15.3	19.23	
5/17/06	6.4	8.55	8.47, 8.63	85.7	19.67	
6/26/06	0.8	1.34	1.28, 1.41	24.4	19.34	
7/25/06	0.7	1.15	1.13, 1.17	16.7	19.25	
8/18/06	7.3	9.97	10.1, 9.83	126	19.79	
9/1/06	14	13.5	13.5, 13.6	542	20.46	
10/04/06	13	12.6	13.2, 12.1			
10/24/06	0.9	3.05	3.16, 2.92	80.1	19.65	
10/25/06	7.8	20.2	18.8, 21.5	94.6	19.70	
12/18/06	3	4.66	4.69, 4.63	9.3	19.12	
1/15/2007	4	4.87	4.94, 4.80	38.1	19.45	

Table 5. Monthly Suspended Sediment Loading Capacity (LC) for Granite Creek, showing both revised sediment loads and original 2002 TMDL load estimates in ( ).

Month	**Average Monthly Flow (cfs)[6] Revised (Original)**	**Natural Background Load (tons)[7]**	**Loading Capacity TSS (tons)[8] Revised (Original)**
January	44.5 (20.98)	1.86	19.26 (9.59)
February	29.0 (6.06)	0.56	11.33 (2.50)
March	19.8 (9.37)	0.93	8.57 (4.28)
April	9.9 (18.40)	1.50	4.15 (8.14)
May	13.4 (24.17)	2.17	5.80 (11.05)
June	15.5 (23.94)	1.80	6.49 (10.59)
July	9.1 (14.84)	1.24	3.94 (6.78)
August	62.4 (12.11)	0.93	27.00 (5.53)
September	79.5 (38.30)	3.00	33.29 (16.94)
October	66.7 (53.58)	4.34	28.86 (24.49)
November	138 (13.70)	1.20	57.79 (6.06)
December	88.7 (35.11)	3.10	38.38 (16.05)
Annual Total		**22.63 tons**	**244.86 tons (122.00[9])**

[6] Average monthly flows are calculated in Table 1. Original 2002 estimates are shown in (parentheses).
[7] Natural background sediment loads used in the original 2002 TMDL remain accurate and unchanged based on five years of water quality data collection.

[8] Monthly load capacity based on analysis of in-stream data. Includes natural background sediment load. Calculated as: (Monthly Q (cfs)) * (5.17 mg/liter TSS) * (0.0027) * (# days in month). The following regression equation developed from 50 simultaneous data sets was used to calculate the revised allowable TSS concentration:

$$TSS\ (mg/l) = 1.2204\ (\text{turbidity in NTUs}) - 2.934$$

[9]Load capacity (tons) includes the allowable sum of existing loads, future loads (LA/WLAs) and any explicit MOS.

Table 6. Monthly existing (in-stream) suspended sediment loads in Granite Creek, comparing 2007 calculations with original 2002 TMDL estimates in ( ).

Month	**Average Monthly Flow (cfs) Revised (Original)**	**Existing In-Stream Suspended Sediment (TSS) Load (tons)[10] Revised (Original)**
January	44.5 (20.98)	8.79 (8.78)
February	29.0 (6.06)	3.51 (0.46)
March	19.8 (9.37)	1.86 (0.78)
April	9.9 (18.40)	0.47 (10.43)
May	13.4 (24.17)	0.87 (14.16)
June	15.5 (23.94)	1.12 (9.70)
July	9.1 (14.84)	0.41 (1.24)
August	62.4 (12.11)	16.82 (1.01)
September	79.5 (38.30)	25.95 (24.82)
October	66.7 (53.58)	19.15 (44.85)
November	138 [11](13.70)	75.00 (31.11)
December	88.7 (35.11)	33.11 (23.51)
Annual Total		**187.06 tons (140.85 tons)**

[10] Tons of TSS/month = monthly average Q (cfs) * average TSS (mg/l) concentration corresponding to the average monthly flow (see text on using the TSS-flow regression equation) * 0.0027 * # of days in the month.

[11] November average includes 2 of the 3 highest flow rates recorded at Granite Creek from October 2002 through January 2007. Throwing out one or both of these flows from the average would result in a significantly lower existing in-stream load estimate for November. They are both left in here to provide a conservative worst case scenario.