Copper River Watershed Project

Community Actions Community Voices

Eyak Lake Stormwater Mitigation Case Study

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater runoff from naturally soaking into the ground. Stormwater can pick up debris, chemicals, dirt, and other pollutants where it becomes Nonpoint source pollution. Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. These pollutants include: fertilizers, herbicides, and insecticides from agricultural lands and residential areas; oil, grease, and toxic chemicals from urban runoff and energy production; sediment from improperly managed construction sites, crop and forestlands, and eroding streambanks; salt from irrigation practices and acid drainage from abandoned mines; and bacteria and nutrients from livestock, pet wastes, and faulty septic systems. States report that nonpoint source pollution is the leading remaining cause of water quality problems. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, we know that these pollutants have harmful effects on drinking water supplies, recreation, fisheries, and wildlife.

In 2003 the City of Cordova submitted a proposal to install a storm drain system in the Vina Young Subdivision that would connect to the Lake Avenue system. The Vina Young subdivision, located in the eastern section of Cordova off of Lake Avenue, was constructed in the early 1980's. No drain system was installed at the time of initial development, residential streets remained gravel until chip-sealed in the summer of 2004. With this, the effect of a moderate or heavy rainfall in an area that averages over 150 inches of precipitation is erosive. All the storm runoff coming off the adjacent hillside is joined by runoff from residential rooftops, and driveways and enters the streets where it increases velocity and sediments until it finally enters the storm drain system on Lake Avenue, and eventually Eyak Lake.

The Copper River Watershed Project (CRWP) deployed passive sampling devices into Eyak Lake in the fall of 2005, late spring, and early summer of 2006 to measure the relative levels of various non-point sources of polycyclic aromatic hydrocarbons (PAH) in the runoff draining into the lake. The passive samplers consisted of polyethylene membrane devices (PEMDS), and were deployed for 30 days at 5 sites within Eyak Lake, which provided a time-integrated metric of PAH contamination. Two samplers were deployed in front of the stormwater discharge near Nirvana Park; one was deployed adjacent to the former Cordova Electric Cooperative (CEC) power generation station (a CEC warehouse now sits on the property), one near Power Creek, and one on the lake side of the weir across Eyak River.

Passive samplers were sent to Auke Bay Laboratory in Juneau, AK for analysis. PAH composition patterns were heavily petrogenic, indicating that uncombusted oil such as spills or urban runoff was the source. Total PAH concentrations were greatest at the deployment sited near Nirvana Park and CEC power station. Concentrations of PAH were greatest during fall, presumably associated with stormwater runoff from heavy fall precipitation. Although the highest concentrations are well below Alaska Water Quality Standards, they are near the threshold for toxicity to salmon embryos, but any such impacts are likely to be sporadic and localized because incubation in upwelling habitats would protect embryos from exposure.

Eyak Lake is of major concern because it provides habitat for multiple anadromous fish populations and is very beneficial to the economy of Cordova. Eyak Lake provides critical spawning, rearing and wintering habitat for sockeye salmon, coho salmon, sea-run cutthroat trout and Dolly Varden. Alaska Department of Fish and Game staff biologists estimate an annual returning escapement of 50,000 sockeye salmon, and 7,500 coho salmon. Their estimate for overall ex-vessel value of commercial harvest of sockeye and coho salmon is $955,435 to $1,572,784. The outlet of Eyak Lake, Eyak River, boasts one of the most popular sport fisheries in Prince William Sound. ADF&G records estimate that 1,099 sockeye salmon and 4,788 coho salmon were caught from this system in 2000. Sustaining Eyak Lake's popular fishery requires restored and protected spawning and rearing habitat.

In addition to commercial and sport fisheries, Eyak Lake is critical to the local residents of Cordova for their rural subsistence life style. Local residents harvest xxxx sockeye salmon yearly under the local personal use fishery. The Native Village of Eyak recognizes Eyak Lake as an important cultural legacy to their ancestral settlement in this area over 3,000 years ago.

Because of this importance to the local economy, and rural lifestyle, the Copper River Watershed Project began looking at different strategies to mitigate non-point source pollution from storm water runoff into Eyak Lake. This case study was compiled during the winter of 2007 to gather information on different strategies that are currently used around the country to prevent non-point source pollution from entering our waterways.

The four strategies CRWP feels will best work in the existing infrastructure of Cordova and residential area surrounding Eyak Lake are:

- Catch Basin System
- Catch Basin Inserts
- Stormwater Wetland
- Porous Pavement
- Public education.

CATCH BASIN STORM DRAIN SYSTEM

CRWP agrees with the City of Cordova that a catch basin storm drain system in the Vina Young sub-division is the best strategy for the existing infrastructure that will collect stormwater runoff as soon as possible off the streets with the installation of catch basins spread along both sides of residential street. The basin will allow sediment and other contaminants to settle to the bottom of the basin, while water will be transported within the pipe system connecting the catch basins, and eventually connecting into the Lake Avenue system then draining into Eyak Lake. Trapping the storm water in frequent catch basins and containing it in pipes will give less time for the water to pick up contaminants, and will dramatically reduce roadside erosion.

Although probably the best strategy for the existing infrastructure of Cordova, Catch basins have three major limitations:

- Even ideally designed catch basins cannot remove pollutants as well as structural stormwater management practices such as wet ponds, sand filters, and stormwater wetlands.
- Unless frequently maintained, catch basins can become a source of pollutants through re-suspension.
- Catch basins cannot effectively remove soluble pollutants or fine particles.

The other three strategies will help enhance the catch basin system and further remove sediments and other pollutants.

CATCH BASIN INSERTS

Catch basin inserts are designed to remove oil and grease, trash, debris, and sediments. Some inserts are designed to drop directly into existing basins, while others may require retrofit construction. A simple retrofit option is to ensure that all catch basins have a hooded outlet to prevent floatable materials, such as trash and debris, from entering the storm drain system. Catch basin inserts for both new development and retrofits at existing sites may be preferred when available land is limited, as in urbanized areas.

One such insert, called the Snout® from Best Management Products Inc., is based on a vented hood that can reduce floatable trash and debris, free oils, and other solids from stormwater discharges. A SNOUT hood is installed over the outlet pipe of a catch basin or other stormwater quality structure that incorporates a deep sump (see Installation Drawing). The SNOUT forms a baffle in the structure which collects floatable debris and free oils on the surface of the captured stormwater, while permitting heavier solids to sink to the bottom of the sump. The clarified intermediate layer is forced out of the structure through the open bottom of the SNOUT by displacement from incoming flow. The resultant discharge contains considerably less unsightly trash and other gross pollutants, and can also offer reductions of free-oils and finer solids.

Other varieties of catch basin inserts exist for filtering runoff. One insert option consists of a series of trays, with the top tray serving as an initial sediment trap, and the underlying trays composed of media filters. Another option uses filter fabric to remove pollutants from runoff. Yet another option is a plastic box that fits directly into the catch basin. The box construction is the filtering medium; hydrocarbons are removed as the stormwater passes through the box while trash, and sediment remain in the box itself as the water exits. These tray and box devices have a very small volume, compared to the Snout system, and would typically require frequent maintenance and sediment removal.

STORMWATER WETLAND

Stormwater wetlands are structural practices that incorporate wetland plants. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the practice. Wetlands are among the most effective stormwater practices in terms of pollutant removal and they also offer aesthetic and habitat value. Although natural wetlands can sometimes be used to treat stormwater runoff that has been properly pre-

treated, stormwater wetlands are fundamentally different from natural wetland systems. Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands in terms of both plant and animal life.

In the case of Eyak Lake where the outlet of the Lake Avenue drain system empties into the lake near Nirvana Park, more plants could be planted to slow the flow down and filter the stormwater. Such wetland plants include skunk cabbage, sedges, more willows and alders along banks.

POROUS PAVEMENT

Porous pavement is a permeable pavement surface, often built with an underlying stone reservoir that temporarily stores surface runoff before it infiltrates into the subsoil. Porous pavement replaces traditional pavement, allowing parking lot stormwater to infiltrate directly and receive water quality treatment. There are various types of porous surfaces, including porous asphalt, pervious concrete, and even grass or permeable pavers. From the surface, porous asphalt and pervious concrete appear to be the same as traditional pavement. However, unlike traditional pavement, porous pavement contains little or no "fine" materials. Instead, it contains voids that encourage infiltration. Porous asphalt pavement consists of an open-graded coarse aggregate, bonded together by asphalt cement, with sufficient interconnected voids to make it highly permeable to water. Pervious concrete typically consists of specially formulated mixtures of Portland cement, uniform, open-graded coarse aggregate, and water. Pervious concrete has enough void space to allow rapid percolation of liquids through the pavement. Grass or permeable pavers are interlocking concrete blocks or synthetic fibrous grids with open areas that allow grass to grow within the voids.

Porous pavement is suitable for most regions of the country, but cold climates present special challenges. Road salt contains chlorides that may migrate through the porous pavement into ground water. Plowing may present a challenge to block pavers, because snowplow blades can catch the block's edge and damage its surface. Infiltrating runoff may freeze below the pavement causing frost heave, though design modifications can reduce this risk. These potential problems do not mean that porous pavement cannot be used in cold climates. Porous pavement designed to reduce frost heave has been used successfully in Norway. Furthermore, experience suggests that rapid drainage below porous surfaces increases the rate of snowmelt above.

Like all Best Management Practices (BMP), porous pavement should be combined with other practices to capitalize on each technology's benefits and to allow protection in case of BMP failure. However, construction using pervious materials may not require as much treatment as other BMP approaches. This combined approach might prove less land intensive and more cost effective. It may increase the amount of open space for public or tenant use. It may also lead to an increase in environmental benefits.

PUBLIC EDUCATION

Many resources for public education exist nationwide today for conveying to the public the harmful substances contained in stormwater runoff. We will hold a meeting with the Native Village of Eyak's Environmental Coordinator and City of Cordova staff to brainstorm on the most effective messages and communication routes for explaining to Cordova residents why storm water can be harmful to waterbodies and what individuals can do about reducing storm

water pollution. We'll also be working with the Cordova District Fishermen United board of directors and staff to communicate with their members, the Cordova fishing fleet.

Related Information Links

The majority of information discussed in the case study was gathered from the U.S. Environmental Protection Agency's website for National Pollutant Discharge Elimination System (NPDES). This NPDES website is a great source of information for everything related to Stormwater.

Below are links to the EPA's NPDES website, and links to the commercial businesses who manufacture and specialize in the above mentioned catch basin inserts, and porous pavement:

National Pollutant Discharge Elimination System (NPDES)
http://cfpub.epa.gov/npdes/home.cfm?program_id=6

Best Management Products, Inc. – The Snout®
http://www.bmpinc.com/

Porous Pavement
http://www.perviouspavement.org/

Installation Drawing of Snout® Catch Basin Insert.