PESTICIDES AND THE SILVER CREEK PRESERVE

An Assessment of the Feasibility and Necessity of Soil and Water Testing for Contaminants

Prepared For:
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July 6, 1998

PREFACE

This report focuses upon the issue of water quality in Silver Creek on one hand and the application of pesticides upon adjacent crop lands on the other hand. More specifically, its task to examine the necessity and feasibility of embarking upon an extensive study of: (1) the effect of past pesticide use on the present; and (2) the effect of present pesticide use on the future. Since such a project would undoubtedly be costly both in terms of human and fiscal resources, this report also tries to estimate the anticipated costs of such an enterprise. In short, The Nature Conservancy (TNC) has requested a preliminary assessment to clarify the basic technological concepts, synthesize factors bearing upon the feasibility and necessity of such a study and to make recommendations.

In order to accomplish this task I have reviewed relevant literature, internet databases, and discussed the subject with long term growers in the region, agency scientists, government officials and other individuals knowledgeable about this issue (see Appendix 1). The reader should be forewarned the traditional practice of extensive footnoting has been suspended with but a few exceptions, most assertions found herein are a matter of public record and can be verified by standard references.

I. PESTICIDES AND PUBLIC OPINION

Surely the topic of water pollution, from both point and non-point sources, has been a topic of concern on a nation-wide basis ever since the early 1970s. As a nation Americans have become increasingly aware of the importance of healthy water absent from chemicals capable of causing illness, genetic abnormalities, birth defects, and toxic death. Even a state with such pristine waters as Idaho has not been immune from the detection of toxins in its rivers and groundwater. In July of 1998, for example, the City of

Pocatello discovered the industrial toxic solvent TCE (trichloroethylene) had leached into its groundwater from the Bannock County landfill.

Sadly, most of the major pieces of federal environmental legislation enacted during the 1970s were triggered by flash events such as the tragedies of Love Canal, New York and Woburn, Massachusetts. Even so, concern for healthy soils and waters led to the passage of:

Clean Water Act (1972)
Safe Drinking Water Act (1974)
Toxic Substances Control Act (1976)
Resource Conservation and Recovery Act (1976)
Comprehensive Environmental Response, and
Compensation Liability (Superfund) 1980
Insecticide, Fungicide and Rodenticide Act (1981)
Hazardous Materials Transportation Act (1984)

Along with an increased awareness of the connection between water and toxicity came several major studies such as the Environmental Protection Agency's National Organics Reconnaissance Survey (NORS, 1975); National Organics Monitoring Survey (NOMS, 1977); National Screening Program for Organics in Drinking Water (NSP, 1979) and the Rural Water Survey (RWS, 1979). Unfortunately, the shear size and complexity of these studies make it difficult to review them in this report. One important lesson, however, can be gleaned: the wise and prudent manager of any groundwater associated resource---such as the Silver Creek Preserve---is on the right track of due diligence to explore the possibility of pesticides and water and soil contamination. Of course, one may well probe the topic and discover no cause for alarm nor justification for the expenditure of costly resources---which I believe is essentially the case at Silver Creek---yet to ignore the prospect altogether would be imprudent in light of recent environmental issues across the nation.

*For general reading see *Groundwater Protection: Final Report of the National Groundwater Policy Forum,* (Washington, D.C.: Conservation Foundation, 1987);John C. Stewart, *Drinking Water Hazards: How to Know if There are Toxic Chemicals in Your Water* (Hiram, Ohio: Evirongraphics, 1990); Raymond Gabler, *Is Your Water Safe to Drink* (Mount Vernon, New York: Consumer Reports Books, 1989).

II. THE SILVER CREEK PRESERVE

The Nature Conservancy cooperatively manages an area of approximately 9500 acres in southern Blaine County, Idaho through the use of conservation easements, agreements, and fee simple ownership. Within this area, the Silver Creek Preserve, itself, is comprised of a core 880 acres, most of which is adjacent to the stream itself as it meanders down a 20 mile corridor trending generally from northwest to southeast. Surrounding the stream are fields that have been, and still are, under cultivation for irrigated crops. The primary recharge zone for the springs that feed Silver Creek (to be discussed below) is an area known as the "Bellevue Triangle" (see Appendix Item 4). Conversations with local growers, water district board members and soil conservation district agents as well as extrapolating from the 1992-96 USDA's *Survey of Agriculture* indicates about 45,000 acres are presently under cultivation. The overwhelming amount of this triangular area from Hailey to Stanton Crossing to Picabo is irrigation farming. Within the triangle just over 15,000 acres are used for malting barley and some feed barley. Other small grains, notably oats and some canola, comprise about 500 acres with perhaps another 500 acres of potatoes and seed potatoes. Remaining croppage is alfalfa, hay, and pasture.

TNC acquired Silver Creek and its adjacent lands from the Janss Corporation in 1975 and has supervised it ever since. Silver Creek is ecologically unique providing an un-paralleled fishery and habitat for plants and animals. Its "just right" combination of water chemistry, stream gradient, nutrient load, and supportive climatology connects to make a near perfect set of conditions for abundant life. Silver Creek and its tributaries create a cold stream biota comprising a habitat often not found in freestone river riparian systems.

The geology of the Wood River Valley explains a large part of Silver Creek's uniqueness. Below the Bellevue triangle is a basement complex consisting of impermeable Tertiary and pre-Tertiary consolidated sedimentary volcanic and intrusive rock. At one time, late Tertiary---probably Pliocene, about 2 to 5 million years ago---the river exited to the southeast towards what is now Picabo. After that, probably during

Pleistocene period, basalt flows from the Challis Volcanics (whose earliest Eocene eruptions began about 60 million years ago) choked off the river exit and a lake was formed. As sediments filled the lake the rising bottom eventually caused the river to find a new outlet near where Stanton Crossing is today. In alternating fashion this process happened several times causing lakes to form in between the shifting of exits from southeast to southwest and back again. Periods of lake building appear to correlate with known records of alpine glaciation.

As a result, the valley is filled with lake deposits and changing riverbeds thus making the recharge zone for Silver Creek a "stacked platter" of several different layers of water bearing mediums. The aquifers underlying the triangle are composed of alluvial deposits of gravels, sand, silts and clays. To the north of Base Line road is a single layer water table or alluvial aquifer, but further south between Glendale Bridge and Base Line road the system is different. Here the underground water system changes into a multiple layer system with an upper layer being an unconfined alluvial aquifer while the lower strata is comprised of interfingers of artesian water under pressure.

Groundwater moving southeasterly through the alluvial medium eventually surfaces as springs below Baseline Road. Overall, the water bearing strata averages about 1.5 miles across by 65 feet deep with a hydraulic conductivity estimated to be 0.025 feet per second. Adjusted for evapotranspiration and seepage, underflow at Hailey is estimated to be about 48 cfs or 34,773 af/year. Groundwater creating the tributary springs comes from a variety of sources including natural precipitation, underflow from the north, seepage from the streambed of the Big Wood River, and irrigation (both for crops and from irrigation canals). The springs are created when the groundwater hydraulic gradient intersects the surface just to the north of Highway 20. These springs, in turn, form the feeder creeks of Patton, Cain, Chaney, Stalker, Mud, Wilson, Grove, Thompson, and Loving Creeks.

Within Silver Creek, average flows of about 140 cfs make for slow stream and scour velocities which, when coupled with high alkalinity, combine to provide fecund conditions for aquatic insects and plants necessary for trout spawning and growth. These conditions converge to establish a delicate habitat supporting over 150 species of birds and 20,000 native plants and shrubs.

III. POTENTIAL SOURCES OF CONTAMINATION

Since Silver Creek is a spring fed stream the primary concern is with groundwater contamination. The major sources of groundwater contamination are: (1) industrial disposal (accidental or intentional); (2) leaching from waste dumps and landfills; (3) leaching of septic tank cleaning fluids; (4) leaking from underground storage tanks; (5) contamination from surface waters; and (6) leaching or sheet runoff from animal wastes, fertilizers and pesticides. Contamination of groundwater through pesticide and fertilizers has been widespread in the United States and is the primary concern of this report. In California, for example, groundwater in a 7,000 square mile region of the San Joaquin Valley farmers have applied over 3 billion pounds of pesticides over in the past 20 years. Today this region is heavily impregnated with the pesticide DBCP (dibromochloropropane) and is causing a serious problem in drinking water.

While groundwater contamination sources are most frequently associated with human activity but can also occur naturally as water moves through the soil medium. All groundwater contains some impurities the nature of which depends upon the soil horizons and geological strata through which it moves. A wide variety of natural contaminants can be found in groundwater depending upon the ionization and adsorption characteristics of the soil as well as its alkalinity and acidity, microbial action, and radioactive decay. The radioactive effects of decaying geologic materials contribute over twenty forms of radionuclides found in groundwater.

CLASSES OF CONTAMINANTS

BIOLOGICALS - American surface and groundwaters are frequently tested for biological contaminants in drinking waters. Just recently (July 1998), an outbreak of E-coil bacteria was found in the drinking water supply of Rexburg, Idaho. Biological contamination generally comes from three sources. Single cell organisms such as

Salmonella, Shigella, Vibrio cholerae, pathogenic E. coli, Yersinia, and Legionella pneumophila pose well known problems for drinking water. The same can be said for Parasitic Protozoans and other cystic organisms as *Giardia lamblia, Entamoeba histolytica,* and *Cryptosporidia.* A third type biological contaminant found in water are viruses such as Coxsackie, Hepatitis A, Polio, Norwalk, Echo, Reovirus, and Adenovirus.

INORGANICS - Inorganic substances present in water include metals, salts, and other compounds that do not contain carbon and have an electrical charge. The U.S. Office of Technology Assessment has identified 37 inorganic substances known to occur in groundwater. Twenty-seven of these inorganic elements are metals and EPA has established primary drinking water standards for 10 of these inorganic compounds.

Inorganic elements are often referred to as "Trace" elements and occur naturally in soil and water. Generally speaking, trace elements become a health concern when present in excessive concentrations. There are two major classes of trace elements, the oxoanions on one hand (those ions which combine readily with oxygen) and the heavy metals on the other hand. Oxoanions are very soluble and would include such elements as arsenic, boron, chromium, molybdenum, selenium, uranium, and vanadium. These elements are often found in western soil horizons and groundwater where they combine with salts to make for high Total Dissolved Solids (TDS), mostly a problem for root zone plants.

Heavy metals are the focus of testing for organics in drinking water, a basic list of these elements are cadmium, copper, lead, mercury, nickel, and zinc. The normal source of these metals found in groundwater and soils are from the land application of sewage sludge and to a lesser extent from fertilizers, pesticides, and mining residues. The primary worry with heavy metals in the environment is for animal and human toxicity should they enter the food chain by plant and animal uptake. Clearly the heavy metal of most concern with respect to human consumption and drinking water standards has been lead. Heavy metals are a ground water concern particularly when mobilized by either strong acidic or high redox potentials: neither of which is present in the Silver Creek environment.

RADIOACTIVES - Natural radionuclides are deposited both in surface and groundwater but groundwater will often have a higher level of radioactivity. Since radioactive elements are not stable and decay over time they are measured by whether they emit an alpha particle (two protons and two neutrons), a beta particle (one electron), or a gamma particle. Radioactivity in Idaho is due to the complex geology associated with a regional Overthrust Belt. Radionuclides in water and air are not uncommon and water providers are required by EPA to regularly test their wells. Historically, such tests have indicated radioactivity in public drinking water is not a concern in the Big Wood River Valley.

ORGANIC COMPOUNDS - Organic compounds comprise the largest and most complicated category of contaminants. All organic compounds contain carbon and are subdivided into two subcategories: natural and artificial. Although many organic substances occur in nature, such as petroleum from decaying plant and animal matter, the area of primary concern for water contamination are the tens of thousands of human made or Synthetic Organic Compounds (SOC) developed subsequent to World War II. The American Chemical Society and the Chemical Abstracts Service have registered more than 4 million chemicals and most of these are SOCs. These compounds are used in the manufacture of paints, solvents, food additives, plastics, detergents, and dyes. In particular, SOCs have played a larger role in the development of pesticides. The Office of Technology Assessment found, over a decade ago, the presence of 175 different SOCs in groundwater, and what is especially disturbing is the concentration of SOCs in groundwater is often several orders of magnitude greater than in surface waters. For example, concentrations for the solvent trichloroethylene (TCE) in groundwater have reached as high as 27,300 parts per billion (ppb) whereas as one of the highest reported surface water concentrations was only 1 60 ppb. Figure One lists the 33 SOCs reported most often in domestic wells in the United States; most SOC contamination has been East of the Mississippi, especially in the Northeastern states.

SOCs are present in Idaho's groundwater but fortunately not to the extent of involvement in other states. National studies conducted in the 1980s found trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane in 11 percent of Idaho's wells tested. Ground-water testing in Idaho for the SOC pesticides 1,2 Dichloroethane, 1,1, Dichlor-

Figure 1

Concentration of Toxic Organic Compounds Found in Drinking Water Wells and Surface Water

Chemical	Groundwater concentration (ppb)*	Highest surface water concentration reported (ppb)
Trichloroethylene (TCE)	900-27,300	160
Toluene	55-6,400	6 1
1,1,1 -Trichloroethane	965-5,440	5 1
Acetone	3,000	NI
Methylene chloride	47-3,000	13
Dioxane	2,100	NI
Ethyl benzene	2,000	NI
Tetrac hloroethyle ne	717-1,500	21
Cyclohexane	540	NI
Chloroform	67-490	700
Di-n-butyl-phthalate	470	NI
Carbon tetrachloride	135-400	30
Benzene	30-330	4.4
1,2-Dichloroethylene	91-323	9.8
Ethylene dibromide (EDB)	35-300	NI
Xylene	69-300	24
Isopropyl benzene	290	NI
1,1-Dichloroethylene	70-280	0.5
1,2-Dichloroethane	250	4.8
Bis (2-ethylhexyl) phthalate	170	NI
DBCP(1,2-dibromo-3-chloropropane)	68-137	NI
Trifluorotrichloroethane	35-135	NI
Dibromochloromethane	20-55	317
Vinyl chloride	50	9.8
Chloromethane	44	12
Butyl benzyl-phthalate	38	NI
Gamma-BHC (Lindane)	22	NI
1,1,2-Trichloroethane	20	NI
Bromoform	20	280
1, l-Dichloroethane	7	0.2
Alpha-BHC	6	NI
Parathion	4.6	0.4
Delta-BHC	3.8	NI

'ppb = parts per billion; 1 ppb = 1/1000 ppm; 1 ppm = 1 mg/l. NI = Not investigated.

Source: Council on Environmental Quality, *Contamination of Ground Water by Toxic Organic Chemicals* (Washington, D.C.: U.S. Government Printing Office, 1981), Table 8, pp. 36-39

oethane, Dichloroethylenes, Methylene chloride, and Vinyl chloride were not present in Idaho groundwater even though they were found in many other states. Conversely, 2,4-D, BHC, Chlordane, DDT, Dicamba, Dieldrin, Heptachlor, Lindane, Malathion, PCNB, PCP, Parathion, Silvex, and Trillate are confirmed chemicals that have been detected in Idaho's groundwater.**

IV. PESTICIDES

Pesticides are developed to kill target organisms. Actually the word "Pesticide" is an umbrella term subsuming numerous subcategories. Pesticides have been developed to kill plants (herbicides), rats (rodenticides), bugs (insecticides) as well as miticides, fungicides, nematocides, molluscicides and etc.

Pesticide contamination has increasingly become a public concern beginning in the early 1970s since they often contain powerful toxins designed to terminate life either directly as a poison or indirectly through the disruption of organic processes. Generally speaking, any pesticide is of a concern for groundwater when it is detected: (1) within eight feet of the soil surface; (2) below a crop's root zone; or (3) below the soil microbial zone. Characteristics of pesticides that increase the probability of ground water contamination are; (1) high water solubility; (2) low adsorption to soil particles; (3) level of toxicity; and (4) long persistence in the environment measured by half-life. One characteristic in particular has been a concern for groundwater: the capacity for a pesticide to leach beyond the root zone into the aquifer itself. The potential for pesticide leaching is a function of: (1) water solubility being greater than 3 ppm; (2) soil adsorption coefficients being less than 1,900 cm^3g^{-1}; a hydrolysis half-life greater than 14 days; (4) an aerobic soil metabolism half-life greater than 610 days; and (5) an anerobic soil metabolism half-life greater than 9 days.

Pesticides as Synthetic Organic Compounds

Most all pesticides are SOCs. Unfortunately, there exists no easy way to group SOC pesticides. For example, SOC pesticides are often classified by their molecular size such as large, heavy and non-volatile molecules or as lighter, smaller and highly volatile molecules. Another way of referring to SOC pesticides is by the actual pesticide itself such

** John Stewart, *Drinking Water Hazards (1990), p.157*

as Dicamba, Picloram, and Atrazine but then SOC pesticides are also frequently called by the manufacturer's trade name such as ASSERT or AVENGE or perhaps RODEO. At this point the confusion begins in earnest. Atrazine, for example, is the pesticide found in AaTREX, AKTIKON, ALAZINE, ATRED, ATRANEX, ATRATAF, ATRATOL, AZIONTOX, and a dozen other manufacturer's trade names. Yet, Atrazine as a pesticide is also a trade name, as in Atrazine G-300027! To make matters more confusing, Atrazine, itself, is in a chemical class of the "triazines" used to control broadleaf and grassy weeds. A fifth way of grouping SOC pesticides is by their evolution referencing them as being first, second and third generation pesticides. Developed in the late 1940s, the "first generation" pesticides were also known as chlorinated hydrocarbons such as DDT, Chlordane, Heptachlor, and Endirin. Even more confusing are the SOC pesticides that were developed before the so-called first generation pesticides made of coal-tar compounds, sulfur or and sometimes petroleum mixtures such as Copper Sulfate.

A sixth way to divide SOC pesticides is by their ingredients using the active chemical compound carried by an inert or inactive element. A glance at active ingredients quickly reveals why this method is not popularly used to discuss SOC pesticides. The active ingredient in CURTAIL it is clopyrid: 3,6-dichloro-2-pyridinecarboxylic acid monoethanolamine salt and 2,4 dichlorophenoxyacetic acid, triisopropanolamine salt. Still another method groups pesticides by chemical family such as pyrethroids, diphenolic ethers, sulfates, or acetamides. Even though there are many chemical families, it appears most pesticides can be assembled into several basic families: phenoxyls, organophosphates, organochlorines, carbamates, pyrethrins and pyrethroids, glyphosates and triazines. A final way to group SOC pesticides is to separate them according to which method of laboratory analysis is used by EPA to determine an SOC's presence. In this instance, chemicals are divided into categories such as EPA Method 604 for Phenols, or perhaps EPA Method 608 for Organochlorines.

As a result of multiple techniques for grouping synthetic organic compounds any discussion of the topic can bewildering. If, for example, a farmer is asked what pesticide/s he is uses to control broadleaf weeds in malting barley the answer could be by trade name (BANVEL D), EPA Method 515, by pesticide (Dicamba), by chemical family (benzoic acid), by active ingredient (dimethylamine salt) or more simply as a "herbicide." All are the same thing.

V. PESTICIDE CONTAMINATION AND SILVER CREEK

Examining the necessity and feasibility of an in-depth pesticide study for Silver Creek is a complicated question and should be guided by the desire to ensure scarce resources are put to their highest and most beneficial use. While the general public would probably favor an extensive investigation of possible pesticide contamination within the Preserve and its adjacent lands, certain prior economic and scientific factors need to be considered. In short, a two fisted discussion of key considerations should be undertaken prior to launching into such a costly enterprise. To examine the effect of the historic pesticide applications upon the present as well as present applications upon the future could easily run into tens of thousands if not hundreds of thousands of dollars. Laboratory fees are quite expensive often involving the use of costly equipment such as gas chromatography and mass spectrometers. Alchem Laboratories, for example, charges $1,071 for a 9 category SOC analysis of a single sample; one can only guess at the costs involved for a multiple sample study of soils, water and sediments. Also, additional costs would be incurred for sample collection, collation, and transportation to say nothing of fees associated with data interpretation and analysis. Greg Miners, president of Residuals Management Inc., estimated a full-blown pesticide study of the area and surrounding grids could run as high as $100,000. With these costs in mind, let's examine key factors that should be considered prior to initiating such a costly undertaking.

THREE BASIC QUESTIONS

Three basic questions frame the discussion of feasibility. More specifically, what criteria should be used to determine contamination, if we are to draw samples then what limitations should be considered, and lastly what balance point should guide the discussion to weigh the most efficient use of scarce human and fiscal resources?

What Criterion Should be Used?

What principle should be used to decide whether or not sufficient evidence exists to justify an in-depth study of pesticides? It is true the Environmental Protection Agency has established Maximum Contaminant Levels (MCL) for drinking water but these standards are for human consumption. Silver Creek is not, however, a source of drinking water and human consumption of these waters does not take place. While Silver Creek is a secondary recreational stream, the fishing which takes place is catch and release so no human consumption takes place. This fact alone obviates the food chain worry often associated with the older fat soluble organochlorines. In fact, Silver Creek might have an odd reverse contamination situation by human contact. When Union Pacific Railroad first purchased the land in 1936 probably less than a few hundred people even knew about Silver Creek's hidden treasures. By 1975, the Nature Conservancy's early records showed 1,000 visitors a year and that figure jumped to 7,600 by 1987. Today, closer to 12,000 people a year come to Silver Creek bringing with them waders from other streams, automotive emissions, dust, and bank erosion.

But even if Silver Creek is not used as a reservoir to impound drinking water shouldn't we be concerned anyway about its physical health as a habitat? Yes, this is precisely why the TNC has regularly conducted limited water quality tests. In June of 1991 through 1993 TNC staff began drawing samples to monitor Silver Creek and its tributaries; samples have been taken twice yearly since then. Tests for pH, flow, temperature, dissolved oxygen, conductivity, turbidity, sediment depth, aquatic plant cover, nitrates, phosphates and ammonia indicate acceptable levels. Pesticides were not sampled at that time.

Can we not exchange the justification criterion from human consumption MCLs to MCLs for aquatic animals? Unfortunately this is a burgeoning field and little is known about the effect of pesticides upon salmonids and other species and even then these studies are widely scattered in the literature. Nonetheless, it is the future intent of Silver Creek management to explore the effect of pesticides upon fish and wildlife. The United States Forest Service studied the possible effects of popular herbicides 2,4-D (dichlorophenoxyacetic acid), glyphosates (ROUNDUP and RODEO), Picloram (TORDON, AMDON), and Dicamba (BANEX, BANVEL, BANVEL D, BRUSH BUSTER) and came to the conclusion rainbow trout and other species of aquatic insects were very tolerant to these pesticides (see Pesticide Background Statements, Volume 1 "Herbicides" by United States Forest Service Agriculture Handbook No. 633, 1983). Similar results were found in a search of the University of California's Melvyl databank. It should be underscored, however, this topic extends beyond the scope of this feasibility study and further substantiation is needed. Several databanks do exist which could assist in illuminating the sensitive connection between aquatic animals and SOC pesticides.

Returning to the question of efficient use of fiscal and human resources, the issue remains should TNC mount an extensive effort to study pesticides in the Silver Creek Preserve? Perhaps another way of assaying this question is to look for known pathologies? What is the general health of the stream and its wildlife? From all apparent indicators Silver Creek is flourishing. It is true on one occasion fish a large number of salmonids were found dead below the Preserve in June of 1992. Speculation abounds over the cause of this isolated incident but most experts believe it was associated with low streams and high temperatures during water years 1987 through 1994. The morning of the fish kill stream records by the USGS reveal dissolved oxygen levels (2.5 to 3.2 mg/L) were well below the level considered to be the threshold of fish mortality (6 mg/L). Aside from this single incident the health and abundance of aquatic life appears excellent.

What Factors Limit the Likelihood of Finding Pesticide Contamination?

Historically, the spatial application of pesticides in the Bellevue Triangle recharge zone of Silver Creek has not been substantial compared to similar regions. This statement is not meant to say pesticide application has been absent but compared to other agricultural regions such as the High Plains of Texas, the Central Valley of California or the corn states of the Midwest the application of pesticides per unit of land area has been minimal. One reason explaining this difference is attributable to the shortness of growing season due to the cold climate of a high desert regime. The growing season for this region is probably less than 120 days or only a third of other major agricultural regions. The limitations of climate also restrict crop selection. Small grains typically require less fertilizers and pesticides which are the crops grown in this region as barley and oats, canola, potatoes (although this crop is being reduced), and pasture\alfalfa operations. Even then, most of the barley raised is for malt barley and sold under contract to Coors and Busch, two companies very restrictive about the use of pesticides. The same can be said for alfalfa and hay sold to dairies who will not buy pesticide laden feed that could potentially affect their products.

Certainly chemicals have been---and are currently---applied in the Bellevue triangle. What must be considered, however, is if this amount of application is enough to worry about given the region's climatological and economic constraints. We know about 90 percent of pesticide application in the Bellevue triangle are herbicides which are much lower in toxicity than insecticides and fungicides. If this region had a 365 day growing season and, say, cotton or row crops were being raised then a concern for pesticides application would be stronger than under present usage.

Another aspect to be considered is the contribution of both point and non-point pollution to Silver Creek. Surface waters, such as the Big Wood River, can become collection points for pesticide runoff and industrial contamination. However, this is not the case in the Silver Creek area since it is a cold stream biota fed by underground springs not the Big Wood River. One could assert the river is responsible for some recharge into the alluvial aquifer either through its own streambed or via irrigation diversions. While this is true, it still means water passes through the sub-strate soil medium where molecular adsorption and microbial degradation provide a cleansing effect. Conversely, some sheet runoff does occur in spring but the questions remains "...is this amount enough to justify expensive testing?"

Are There Problems With Sampling?

A third perspective affecting the feasibility of studying pesticides in the Silver Creek Preserve centers upon the sampling process itself. What compounds should be sampled and how frequently should they be sampled? Assurance of both reliable and valid samples is necessary. A reliable sample permits the analyst to be confident an accurate measure has been drawn, one capable of providing identical results if it were repeated a number of times. A valid sample is one that accurately measures what one is supposed to be measuring. In either case, these methodological demands call for the taking of multiple samples. Additionally, from what medium should samples be drawn? Simply taking a single water sample from the stream itself has its own set of problems. Flow velocities of Silver Creek move water through the Preserve approximately every 22 hours. Thus a $1,000 SOC stream sampling would only be scanning pesticides recently applied or ones leaching into the stream from prior applications. The more toxic pesticides such as the organochlorines were banned in 1972 and would be more likely found today in sediments or soils that water. The newer pesticides have much shorter half lives (some in less than 6 hours) and would not be measurable in water. These more recently developed pesticides such as the phenoxies and glyphosates have a very short half life, are easily degradable by soil microbes, are much lower in toxicity and as a general rule do not leach thus it is not likely to be present in a surface water sample of Silver Creek. The implication here is that surface water grab sampling may not tell TNC the whole story calling for a more rigorous program of soil and sediment sampling.

Along a similar plane comes the question of "when" to sample? Should samples be drawn during the height of the growing season? Is it better to sample after the rainy seasons in the spring when sheet runoff is highest or in the high application period? With respect to sampling frequency it should be taken into account the adjacent land to the Creek itself is flat and non-point runoff is relatively minimal. By and large the conclusion to be drawn from an assessment of these factors is that it is probably best to draw multiple samples from various locations in both aqueous and non-aqueous environments. These considerations, of course, increase the economic costs of the program.

RECOMMENDATIONS

Can and should a thorough analysis of possible pesticide contamination be undertaken for Silver Creek and its adjacent environment? Clearly these are two separate questions. The "can" question may be answered in the affirmative; yes, it can be done. Such a study would be done in longitudinal panels and involve testing for identified pesticides in soils, water, and sediments. The "should" dimension raises a different issue altogether.

Would such a study be costly? Certainly, but exactly how costly is difficult to assess until a research design is concluded. Even with volunteer help it seems that such a study could exceed $50,000. Would such a study tell us more than we already know? Surely such a study would be informative but just "how much" more informative is where the difficulty resides. Based upon discussions with other scientists it seems to be the consensus such a project would not be the highest and best use of scarce human and fiscal resources. Moreover the funds required to complete a thorough water, sediment, and soil sampling for historic and contemporary pesticides would overshadow other alternative uses of scarce funds. Absent indicator pathologies and given historical use of pesticides in a limited growing season on these types of crops from a purely groundwater source guides me to recommend a more incremental approach.

Recommendation No. 1

Ask the Idaho Department of Environmental Quality to conduct a Beneficial Use Reconnaissance Project (BURP) using the 1996 Water Body Assessment Guidance process.

Tributary streams to the Big Wood River have already been BURPed and this biological assessment of aquatic insects, fish and habitat would produce a standard, quantitative, and state of the art scientific method of establishing stream biological health.

Recommendation No. 2

Conduct a single SOC water sample scan designed for the chemical families of phenoxies, glyphosates, organochlorines, organophosphates, carbamates, triazines, pyrethroids. The timing and location of this single scan sample to be determined by consultation.

Recommendation No. 3

Request DEQ to assist in the construction of a sediment load trap in Silver Creek itself, similar to the ones used in recent Snake River studies, and conduct an SOC scan for sediment loads for phenoxies, glyphosates, organochlorines, organophosphates, carbamates, triazines, pyrethroids.

Recommendation No. 4

Commonly used pesticides (past and present) are described in Appendix Item 2. It is recommended to further evaluate this list utilizing TNC staff or outsourced professionals to evaluate each pesticide for toxins, half-life, and the possible danger to aquatic fish, insects and wildlife of Silver Creek. Use this list to test for specific pesticides on a regular basis. A helpful resource in this endeavor would be the National Pesticides Telecommunication Network advice center. An example of information available on their Extension Toxicology Network (EXTONET) is found in Appendix Item 4 in the form of Pesticide Information Profiles for Picloram

Recommendation No. 5

Create an "Advisory Council" for the Silver Creek Preserve comprised of local farmers and conservation easement holders and perhaps someone from the recreation industry. Such a grass roots organization would enhance cooperative management and a pooling of knowledge.

APPENDIX

Appendix Item 1 - Individuals Consulted

Anderson, Dave Senior Water Quality Analyst, Idaho DEQ 736-2190
Bashaw, Jerry small grain grower in Bellevue triangle 788-6571
Borrecco, John USFS Wildlife biology coordinator in R5 (415) 705-2873
Brandt, Darren Senior Water Quality Analyst, Idaho DEQ 736-2190
Brown, Tracey Ph.D. Wildlife biologist UCLA (310) 284-8432
Buhidar, Sonny Senior Water Quality Analyst, Idaho DEQ 736-2190
Cenarrusa, John Blaine Count Weed Control 823-4017
Crum, Paul Field Agronomist for Coors (Burley) 678-3586
Eakin, Jim former University of Idaho Extension Agent, District 45 Board, 788-4061 Ellis,
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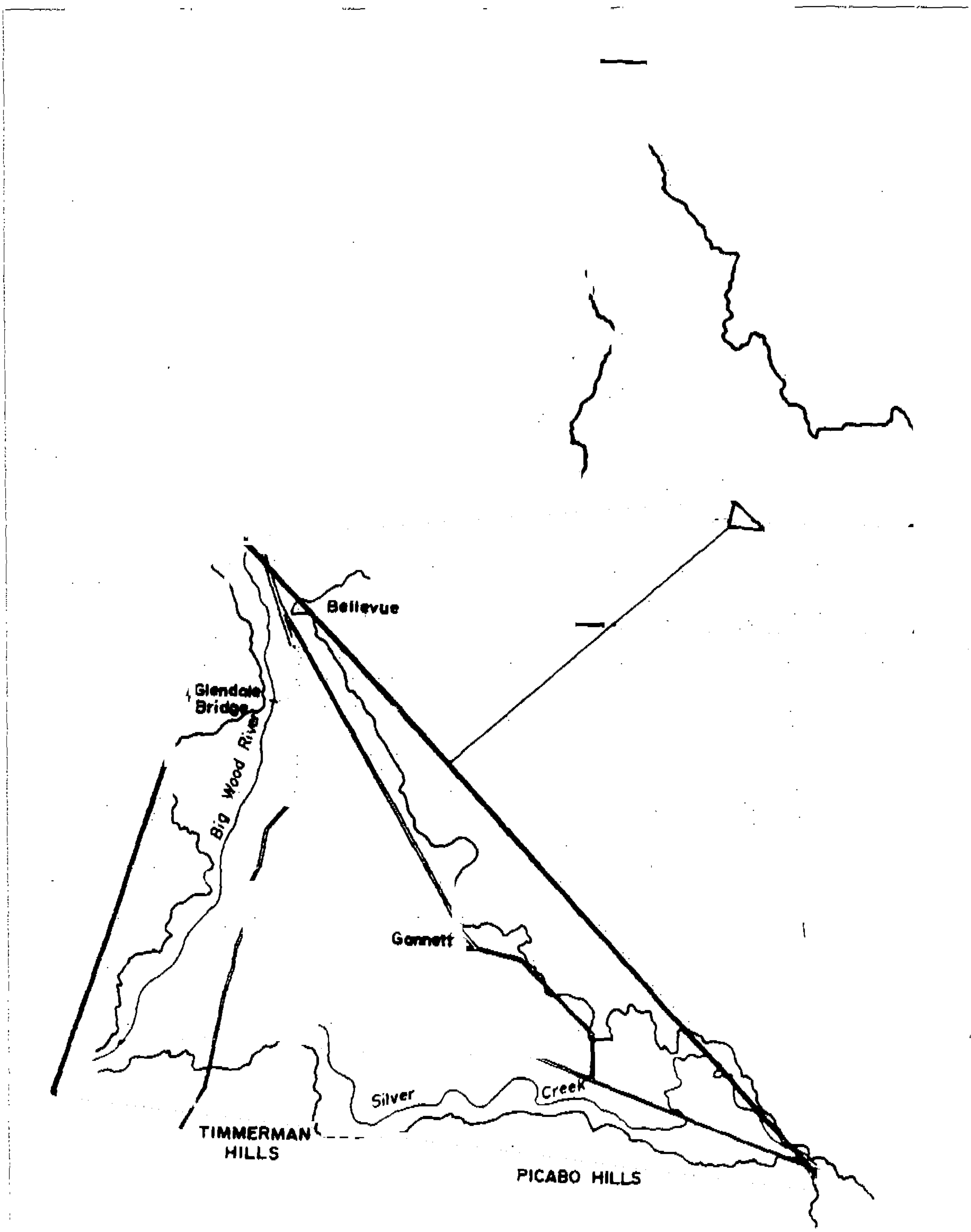
Appendix Item 2 - Pesticides Used in the Bellevue Triangle

2,4-D ai=dichlorophenoxy acid
Assert (herbicide, ai=imazamethabez.
Atrazine (herbicide) ai=drexelatrazine
Avenge (herbicide) ai=difenzoquat methyl sulfate.
Banvel (herbicide) ai=dimethlamine salt, mixed with 2,4-D
Bravo (EDCB)
Carbyne (herbicide)
Cerone (growth regulator)
Curtail (herbicide) ai=clopyralid 3;6-dichloro-2-pyridinecarboxylic acid onoethanolamine salt; also uses 2,4-D; and triisopropanolamine salt
Dazzel (insecticide) ai= 0,0-dimethyl 0-2-isopropyl-6-methy (pyrimidine-4-yl) phosphorothiuate
Diazinon (insecticide) ai=o,0-Dimethyl 0-2-isopropyl-6-methyl-pyrimidinyl
Disyston (insecticide)
Eptam (herbicide) ai=5-ethyl dipropythiocarbamate
Formula 40 (herbicide) ai=2,4-D
Harmony Extra (herbicide) ai=thifensulfuron-methyl;
Malathion insectide) 0,0dimethyl phosphorodithioate of dimethyl mercaptosuccinate
Manex (herbicide) EDBC
Poast
Prowl (herbicide) pendimethalin
Round Up (herbicide) ai=glyphosate
Rodeo (herbicide) ai= glyphosate
Stinger (insecticide/herbicide) ai=clopyralid
Thiodan (insecticide) ai=endosulfan
Tilt (fungicide)
Tordon (herbicide) picloram, 2,4-D and triisopropanolamine salt

Appendix Item 3 - The Bellevue Triangle



Appendix Item 4 - Example of EXTOXNET for Herbicide Picloram

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Oregon State University, the University of Idaho, and the University of California at Davis and the Institute for Environmental Toxicology, Michigan State University. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program

EXTOXNET primary files maintained and archived at Oregon State University

Revised June 1996

Picloram

Trade and Other Names: Commercial products containing the compound include Access, Grazon, Pathway, and Totdon. It may be used in formulations with other herbicides such as bromoxynil, diuron, 2,4-D, MCPA, triclorpyr, and atrazine. It is also compatible with fertilizers.

Regulatory Status: Picloram is a slightly toxic compound in EPA toxicity class III. Products containing it must bear the Signal Word CAUTION on the label. Ail products except tbr 'Fordon RTU and Pathway are Restricted Use Pesticides (RUPs). RUPs may be purchased and used only by certified applicators.

Chemical Class: pyridine compound

Introduction: Picloram, in the pyridine family of compounds, is a systemic herbicide used tbr control of woody plants and a wide range of broad-leaved weeds. Most grasses are resistant to picloram, so it is used in range management programs. Picloram is formulated either as an acid (technical product), a potassium or triisopropanolamine salt, or an isooctyl ester, and is available as either soluble concentrates, pellets, or granular tbrmulations. The materials in this document, retEr to the technical acid form unless otherwise indicated.

Formulation: Picloram is formulated either as an acid (technical product), a potassium or triisopropanolamine salt, or an isooctyl ester, and is available as either soluble concentrates, pellets, or granular tbrmulations.

Toxicological Effects:

Acute toxicity: Picloram is slightly to practically nontoxic via ingestion, with reported oral LD50 values of greater than 5000 mg/kg to 8200 mg/kg in rats, 2000 to 4000 rog/kg in mice, and approximately 2000 mg/kg in rabbits [1,58]. The reported dermal LDSO in rabbits is greater than 4000 mg/kg, a level which produced no mortality or toxic signs [58,6]. This indicates slight toxicity via the dermal route as well. Technical picloram is reported to cause no skin and moderate eye irritation in the rabbit, and to cause no skin sensitization in the guinea pig [1,58]. Some formulations have caused mild or slight skin irritation and skin sensitization in ....