As a senior engineer managed facilities plan development, including collection, liquid treatment, and solids handling. Provided capacity analysis and comparison of alternatives at numerous locations, primarily in the states of CA, WA, OR, and Hawaii.

A process engineer with extensive experience in facility planning and capacity setting. Well versed in activated sludge process design and comparisons and has significant experience in oxidation ditch and SBR design / operation. Has previously managed offices for national consulting firms and is a recognized expert in the areas of biological nutrient removal, trickling filter and rotating biological contactor design.

PROFESSIONAL EXPERIENCE

Mr. Harrison has over 40 years of experience in the study, evaluation, and design of wastewater facilities. His specialty area is in modernization of wastewater treatment plants, especially for nutrient removal and for enhanced process control. His unique professional development has ranged from teaching to regulator oversight, and from operator training to facility design. His expertise includes process design, system comparisons, and facility planning. He has previously managed offices for national consulting firms and is a recognized expert in the areas of biological nutrient removal, trickling filter and combined fixed film and suspended growth Systems.

PROJECT EXPERIENCE

Of the nearly 150 wastewater related projects Mr. Harrison has completed, over 100 of these involved prosses investigation/analysis or studies. In a most cases the investigations were presented as technical memorandums or reports. In other cases the results of Mr. Harrisons efforts were captured in detailed facility plans. The following are areas where investigations, analysis, studies or facility plans were completed.

Application	**# of Analysis or Studies**
Facility Plans	7
Municipal Studies	28
Fixed Film System Analysis	34
Industrial Wastewater Analysis	32
International or Expert Witness	15

Representative projects which demonstrate areas of skill typically required include:

Facility Plans and Municipal Studies

John managed facilities plan development including: collection, liquid treatment and solids handling. He has also provided capacity analysis and comparison of alternatives at numerous locations including most recently at: Clackamas County, OR (Kellogg Plant); Lompoc, CA; Glendale, CA; Nevada City, CA; Cold Springs, NV; Santa Rosa, CA; Lebanon, OR; and at the Kona International Airport (Keahole, HI). Additional facility plan or capacity work was performed on projects in Washington State at Arlington, Dallesport and Winlock.

The following are representative activated related projects on which Mr. Harrison has provided services.

City and County of Honolulu, Waianae, HI (1996). Subconsultant on the upgrade of the 5.2 mgd primary treatment facility at Waianae to secondary treatment. Services included providing advice during facility design, writing of the operations manual and onsite training during startup.

Beale Air Force Base, CA: Customer concept document investigating alternatives for upgrading the 1.5 mgd domestic wastewater treatment plant. The evaluation included comparing denitrifying filters to the use of solids contact/filters for nitrate removal and effluent polishing. Disinfection evaluations compared UV radiation to using liquid chlorination/dechlorination. Denitirfication will initially be achieved by creating an anoxic zone in the return secondary sludge line. This innovative approach uses existing basins as anoxic reactors. The client considers John's services essential through final design and startup.

Tillamook, OR: Facility plan followed by predesign of a hybrid activated sludge plant that included features of both oxidation ditch and biological selector for improved operability.

Winston, OR: Process comparison, facility plan and predesign for construction of a 1.4 MGD activated sludge plant with biological nutrient removal (BNR) capability. The BNR plant has selectors to remove either phosphorus or nitrogen using either the A/O and Johannesburg processes.

Burbank, CA: Capacity study, predesign and design for the upgrade of an 8.0 MGD plug-flow activated sludge plant to biological nutrient removal. The upgrade included installation of biological selectors plus the replacement of outdated/aged infrastructure including aeration equipment.

Sand Island WWTP and Sewer Basin Facility Plan, City and County of Honolulu. Responsible for facility planning for collection system improvements and upgrades to the Sand Island WWTP. The project involved a comprehensive study of alternatives for both treatment of liquid wastewater and solids processing. RMTC also performed a preliminary analysis of existing solids handling units (including anaerobic digestion) and assisted with short-term decision

Fixed Film System Analysis

Provided engineering services on over 50 projects where fixed film (FF) reactors or combined FF and suspended growth (FF/SG) processes were involved. Of these projects most required process analasis. Other investigations included specialized testing to gauge the remaining life of plastic media. Many other projects included forensic investigation of failed reactors. The fixed film reactors he has worked on include rock media, plastic fixed media and random cylindrical PVC media. He is a nationally recognized expert on combinations of fixed film (trickling filter and biofilters) and solids contact and aeration basins.

The following are representative fixed film related projects on which he has provided services.

Bremerton, WA. Assisted the City in replacing TF media and returning a roughing filter to service after having been shutdown for 20 years. John worked directly for the City for three evaluation/study projects and then as a subconsultant to a local engineering firm during construction and startup of the restored and improved roughing filter activated sludge system.

Everett, WA. The Everett Wastewater Pollution Control Facility (EWPCF) typically treats 20 mgd using secondary treatment consisting of an unusual mix of TF solids contact and natural/aerate lagoons. Two of the TFs had media that were in service for 26 years. Assisted Operations staff in the excavation and assessment of the aged media. The investigation showed the aged media was constructed using forming processes which produced stronger media than currently available today (at comparable sheet thickness). Unique service conditions and the use of thin plastic sheets resulted in an estimated remaining life for the media of less than 5 years. Services included conducting two workshops for operation and CEU awards for attendees.

Martinez, CA. Analyzed operating data for the 1.2 mgd two-stage rock trickling filter followed by plastic media nitrifying trickling filter. Conducted a site visit with two interactive presentations. The last presentation included results of data analysis and operational review. A second project included assistance in excavation of plastic trickling filter media, media testing and estimation of remaining useful life of the trickling filter media. As an outcome of the investigation the District has concluded that the plastic TF media, although nearly 30 years old, does not need to be replaced in the near future.

The City of Salt Lake City, UT. As a subconsultant, the services included study at a 56 mgd combined trickling filter and activated sludge facility. Trickling filter media included both rock and plastic media. An outcome of the analysis was an understanding of the interactions of the activated sludge and various fixed film reactors. We were able to remove a plug of plastic trickling filter media and make observation on the effects of flow distribution (dosing rates) on process performance.

MCB Camp Pendleton, Oceanside, CA. Supported Naval Facilities Engineering Command design/build contractors in the rehabilitation of a 0.35 mgd trickling filter. Rehabilitation work included replacing rock filter media with plastic modules and a hydraulically driven distributor with a mechanical drive. Mr. Harrison's services included review of contractors submittals and evaluation of both filter media strength/type and rotary distributor flushing.

The City of Salmon Arm, BC. Mr. Harrison's services were retained to review and comment on a draft report after pilot studies were conducted at the City of Salmon Arm's 1.6 mgd activated biofilter plant. Comments were provided on flushing, biomass weight and cyclic changes from sloughing.

City of Tillamook, OR. Completion of a study, design and construction of a corrective action plan (CAP) ordered by the State of Oregon. Operational and facility changes were implemented to improve plant performance.

Beale Air Force Base, Yuba City, CA. Evaluation of modernizing a 1.5 mgd rock trickling filter plant to meet effluent reuse standards (CA Title 22) and stringent receiving stream standards. Issues included meeting new turbidity and stringent disinfection limits. The plant is being upgraded to a hybrid trickling filter solids contact facility with denitrification in the sludge reaeration flow stream.

Investigation of Plant Problems. Expert witness and forensic investigations have been completed by Mr. Harrison at both Kansas City, MO and Denver, CO. For the City of Kansas City Missouri, he investigated problems at a 60 mgd trickling filter plant, where a 150 foot diameter plastic media filter collapsed. At the 25 mgd TF/SC Plant Littleton-Englewood (near Denver), he investigated the collapse of roughing filter. His work included evaluating and providing opinions on media specifications and facility design.

Project Management of FF/SG Plants. Mr. Harrison served as project manager of the 15 mgd trickling filter and activated sludge plant at Turlock, California. He has served as both a design reviewer and as project engineer in predesign and planning activities for trickling filter or combined processes at the 14 mgd facility at Casper, WY; the 3.7 mgd Hillsboro, OR; and 8.2 mgd facility at Bremerton, WA; a 7.2 mgd facility at Muscatine, IA; an 11 mgd facility at Roseburg, OR (which involved several processes including TF/SC); and improvements to the existing Omaha, NE facility.

Project Engineer of FF/SG Plants. As lead engineer, he oversaw design activities associated with 2 combined filter and activated sludge plants for Frito Lay. Serving as subconsultant, he provided design expertise and oversight for the 2.6 mgd expansion of an existing rock filter at the U.S. Naval Station at Treasure Island, San Francisco, CA, including the addition of a new trickling filter with plastic-synthetic media.

Studies where filters were either constructed or improved with Mr. Harrison's principal involvement include: the 8.6 mgd combination of existing rock trickling filter media with new facultative lagoons at Montego Bay, Jamaica. His evaluation as principal engineer for the 30 mgd Willow Lake Wastewater Treatment Plant at Salem, OR resulted in the conversion of a pure oxygen activated sludge plant operated in parallel with rock trickling filters; to a series operated, conventional air activated sludge plant receded by rock trickling filters (commonly known TF/SC). His involvement as special consultant in preliminary studies in Tafila, Jordan, led to the construction of a 0.2 mgd TF/SC plant utilizing rock filter media.

Industrial Wastewater Analysis

The following are representative industrial related projects on which Mr. Harrison has provided services.

Food Processing: Mr. Harrison has worked on numerous projects in food processing, including the design of treatment facilities for wastes from potato processors (Ore-Ida Foods and Lamb-Weston) and sludge concentration and disposal studies for primary, secondary and tertiary wastewater treatment facilities for Frito-Lay at Frankfort, Indiana. He has conducted wastewater studies to determine the treatability of waste from both Heublin's Plant in Stoughton, Wisconsin and the Hubinger Company's plant in Keokuk, Iowa. Mr. Harrison also served Heublin in the design of a new corn products plant as project manager of site search investigations regarding wastewater, solid waste, and air pollution impacts. He was project manager on wastewater studies for treating waste from combined domestic and apple processing wastewater from Sun-Rype in British Columbia, Canada. He has also completed wastewater studies at Sun-Maid's raisin processing plant at Kingsburg, California

Cannery and Frozen Food: Mr. Harrison's experience in the cannery and frozen food industry includes his being project manager of pilot studies and lead engineer in the design of wastewater facilities treating cannery plus domestic waste for the City of Turlock, California. His work also includes the study of waste treatment facilities for cannery and frozen food waste located in Walla Walla, Washington. He has also conducted feasibility studies for treatment of cannery waste from Agripac (located at Eugene, Oregon) and at United Food's frozen food plant in Selma, California.

Biological Nutrient Removal: In the area of nitrification, he has analyzed and performed confirming pilot tests, determining the feasibility and requirements of nitrification of industrial wastewater. This work includes overcoming ammonia toxicity problems at Pacific Resin's wastewater facility at Eugene, Oregon. Other work on ammonia removal has been done on the cold weather nitrification of fertilizer wastes from the J.R. Simplot facility at Pocatello, Idaho and on ammonia removal by chemical and physical means from produced water at Shell Canada's plant in Pincher Creek, Alberta, Canada.

Forest Products: Among the projects in the wood and forest products industry on which Mr. Harrison has worked is the study of treatment plant performance for the industrial waste of Weyerhaeuser Company at Cosmopolis, Washington. He has also evaluated subsurface disposal of waste at International Paper Company's plant in Vaughn, Oregon. His pilot plant experiences in the wood and forest products industries include work for both Masonite Corporation at Ukiah, California and International Paper Company in Gardner, OR. For the Masonite

Corporation he operated and analyzed pilot plant data for both activated sludge and aerated lagoon treatment processes. Following the pilot plant operations, he was lead design engineer on the design of full-scale facilities for the Masonite Corporation which included not only the activated sludge and aerated lagoon systems, but also a sprinkle irrigation system for disposing of treated wastewater. The pilot studies at International Paper's plant in Gardner, Oregon, included parallel testing of trickling filter, aerated lagoon, and rotating biological contactors for wastewater treatment. He designed and supervised both construction and operation of the pilot studies for International Paper. Other projects include investigating solids concentrating and disposal options for Evan's Products plant in Corvallis, Oregon and the field investigation and testing of water contaminants for Tomco's wood products plant in Sweet Home, OR.

Chemical and Petroleum: Mr. Harrison was project manager for two projects associated with chemical industry at Pacific Resins and Chemical in Eugene, Oregon. These projects involved BOD and nitrogen removal and overland flow application of treated wastewater. He also served as a project manager for the stud of phenol removal from wastewater at the Simpson Timber Company plant located in Tacoma, Washington. He gained additional nitrogen removal experience in laboratory pilot studies of nitrogen removal for the fertilizing manufacturing facility of J.R. Simplot at Pocatello, Idaho.

One of the projects in the petroleum industry in which he has worked is the study of ammonia removal processes for wastewater of Shell Canada Resources Ltd., Alberta, Canada. This work included an investigation of alternatives for removing ammonia from produced water. He ha also been the project engineer for preparing oil pollution prevention plans for the hardboard plant of Masonite Corporation, Ukiah, California. Other work includes a review of chrome removal processes for the treatment of cooling water at Gulf Oil's plant in Port Arthur, Texas.

Metal Finishing, Electronics and Hazardous Waste: In the metals industry Mr. Harrison has worked on the study of wastewater control and surface runoff for the Intalco Aluminum Corp. (located in Ferndale, Washington). This work included the preparation of a wastewater compliance plan for controlling site runoff of fluoride and other contaminants. He has also completed predesign studies of wastewater treatment facilities for the handling of domestic on-site wastes from Exxon's Los Bronces copper and molybdenum mine in Santiago, Chile. He was recently project manager of environmental studies and waste discharge permit negotiations for International Titanium Incorporated at Moses Lake, Washington. The work for International Titanium included evaluating the impact to municipal wastewater treatment facilities and to Moses Lake of high salinity wastes from the processing of titanium. His international experience includes both investigation and serving as an expert witness for New Zealand Steel. Mr. Harrison has worked on projects in the electronics field including the design of fluoride removal facilities for wastewater of INMOS, located in Colorado Springs, Colorado.

In the area of hazardous waste management, Mr. Harrison was engineer for developing a work plan, remedial investigations, and feasibility studies of the hazardous waste of United Chrome in Corvallis, Oregon. Work for Frontier Leather has included the evaluations and assistance in sizing and design of a trivalent chrome removal and recovery system. Other work for Frontier Leather includes assistance in meeting hazardous waste management regulations and in planning their wastewater treatment needs.

Industrial Related Activities: Mr. Harrison has also studied effluent disposal and treatment alternatives for the meat products plant of the Old Trapper Smoked Products company, Tillamook, Oregon. He has also studied oil and grease biological breakdown for Proctor & Gamble in Sacramento, California. He has completed analysis of pretreatment and direct discharge limitations for waste discharges of aluminum, wool scouring, and resin manufacturing industries.

Industrial Regulations and Permitting. Since he has developed and managed the industrial pretreatment program for the State of Oregon, Mr. Harrison is familiar with the environmental policy making process. As a result of this regulatory experience, he has served as an expert witness in industrial related hearings for both Clackamas County, Oregon, and New Zealand Steel. He has also served as a mediator between numerous municipalities and industries regarding pretreatment standards.
Sludge Handling: Mr. Harrison has been manager of several projects in the areas of sludge handling and disposal. These include pilot tests at the wastewater treatment plant in Turlock, California, and at the Ore-Ida Foods plant in

Ontario, Oregon. The pilot work for Ore-Ida Foods was followed by development of a sludge program, for which Mr. Harrison was project manager. This program was instrumental in Ore-Ida Foods receiving the 1981 "Outstanding Contribution" award in pollution control for the State of Oregon given by the Pacific Northwest Pollution Control Association. He has also acted as project manager for the study of silt removal systems for both Lamb-Weston and Gourmet Foods. As project manager of studies for Evans Products in Corvallis, Oregon, he investigated solids handling and disposal methods of primary and secondary solids.

Leather and Textile: An example of projects in the textile and leather industries on which he has worked is the operation of ultrafiltration pilot treatment facilities for handling of wastes high in oil and grease from Pendleton Woolen Mills, Portland, Oregon. He has also been project manager for studies on troubleshooting plant operations for the waste treatment and solids disposal of wastes from Frontier Leather Company, Sherwood, Oregon. Work for Frontier Leather has included the evaluation and assistance in sizing and design of a trivalent chrome removal and recovery system. Other work for Frontier Leather includes assistance in meeting hazardous waste management regulations and in planning their wastewater treatment needs. In the area of wastes from dying operations, he was project manager of investigations on the effects of discharges from Flint Ink in Elizabethtown, Kentucky.

International or Expert Witness

Served as a project engineer on a number of international assignments ranging ranged from a 6-month project in Jeddah Saudi Arabia to several projects in Canada. Called on to investigate and serve as an expert witness in , especially in Hawaii while serving a local Consulting firm on Oahu.

The following are representative international projects on which Mr. Harrison has provided services.

Department of Navy, Apra Harbor, Guam (2008). Lead process engineer for a Department of Navy project on the repair and upgrade of a 4.3 mgd trickling filter solids contact plant serving a Navy base in Guam. Mr. Harrison worked closely with the design/build team to develop specifications and engineering drawings to rehabilitate the aeration blower system, replace trickling filter media and upgrade solid contact reactors.

Vancouver Metro, Vancouver, BC (2008). When it was necessary to add an additional trickling filter at the 21 mgd Lulu Island Wastewater Treatment Plant, Mr. Harrison's services were retained to provide an independent evaluation of filter media. His services included comparing the use of vertical filter media to cross flow media. Consideration was given to BOD removal performance and operating issues resulting from sloughing of biomass. As a result of the investigation, the Greater Vancouver Regional District selected vertical media for use in its new trickling filter.

Koror, Palau. Study of wastewater treatment alternatives comparing "natural" to mechanical systems, and centralized to noncentralized facilities (2.0 mgd).

American Samoa. Study and recommended improvements for odors produced at fish processing plants including olfactometer testing using a panel of public volunteers included university and regulatory team members.

The following are representative expert witness projects or forensic on which Mr. Harrison has provided services.

SPX Media Manufacturers. A forensic investigation was conducted on collapsed trickling filter media at a food processor. The study required knowledge of the food processing industry as well as a knowledge of plastic materials and their application as modules for fixed film reactors. Findings were that the filter media geometry and an extremely high solids load to the TF's led to premature plugging followed by a complete collapse.

Kansas City, MO. Analysis of a failed 150 ft dia. plastic media trickling filter at the 65 mgd Blue River Wastewater Treatment Plant. Oversight of temperature monitoring on a 150-foot diameter plastic media trickling filter. Established in situ tests to determine heat buildup and develop strategies to avoid media problems upon shutdown.