APPENDIX A
COMMERCIAL FACILITIES BMPs PLAN

A.1 Enchanted Lakes Shopping Center

The Enchanted Lakes Shopping Center (ELSC) is located at 1090 Keolu Drive within the Enchanted Lakes Residential area, Kailua, Hawaii. The ELSC is bordered by Keolu Drive on the east, residential homes on the west and south, and Alahaki Drainage Channel on the north (see Figure A.1-1). The shopping center is a concrete, one story building with a flat roof, surrounded by asphalt concrete pavement parking lot totaling approximately 8 acres. ELSC tenants include a variety of attached and detached food service-type stores, gas station/car wash, and a grocery store.

Storm water runoff from the parking lot area generally sheet flows across asphalt concrete and is collected at grated inlets in the north and south parking lot area. It is transported to outfalls associated with the Alahaki Drainage Channel to the north or Alahaki Interceptor Ditch to the southwest.

Storm water runoff from the west side of the ELSC travels either north or south along the western property perimeter, with the apex being the grocery stores' western boundary. Storm water flowing north collects runoff from the back of assorted food tenants' shops and continues north until there is a break in the property curbing where it discharges directly into the Alakai Drainage Channel and eventually to WKIP 10. Runoff traveling south along the property perimeter collects near the movie theater at the southern-most end and sheet flows to a gravel-lined head wall. It flows through 150 feet of grass swales to a catch basin discharging to the Alahaki interceptor ditch, which merges with the larger Alahaki Ditch, eventually discharging at WKIP 14. The grass-lined swale is associated with three residential homes bordered by the movie theater on one side and Alahaki Street on the other.

A.1.1 Sources of Pollutants

Following is an inventory of potential sources associated with ELSC and pollutants that may be picked up:

A. Material Loading and Unloading Areas

Materials which are spilled, leaked or lost during loading or unloading may collect on paved surfaces and be carried away by storm runoff. The ELSC has the following material loading areas:

- Grocery store trailer truck unloading area on the southwest side of the building
- Outdoor commercial trash compactor; and

- Chevron Food Mart tanker truck refueling of UST; and
- self serve fueling of personal vehicles.

B. On-Site Material Storage and Disposal Practices

Leaks, drips or spills of materials (new and used) stored or disposed in areas exposed to rainfall can be carried away by storm runoff.

The Chevron Station has a 10,000 gallon UST that supports the four pumps for motor vehicle fueling. The UST is monitored by an automated Veeder-Root® system, and among other things (leak detection etc.) schedules fuel drops via tanker truck roughly every other day. The Chevron Station also has a self-serve carwash. There are two drains, one at the entrance of the wash facility and one within the wash tunnel. A contractor cleans the tunnel on a monthly basis, testing the overall washing operation for maintenance issues (drop in pressure, testing water recycler, oil water separator [OWS] inspection, etc.). The wash water is transported to the 1000 gallon OWS, which is serviced every six months by Unitek, or sooner depending upon cleaning subcontractor report. A vacuum truck transfers the contents of the OWS into 55-gallon drums and transports the drums off-site for testing and disposal. A trash can filled with absorbent material (kitty litter) and scoop are stored in doors for small spill response.

The assorted food tenants house assorted cooking oils and have the grease traps cleaned periodically with no set schedule. Based on field observations, the tenants located in C-1, D-1, and C-6 dispose of used cooking oil and grease in uncovered 55-gallon drums. Trash and garbage are also scattered about on the ground.

C. Outdoor Activities

There are some outdoor activities at ELSC, which use materials or create wastes that have the potential to pollute storm water runoff. Outdoor activities associated with ELSC include storage of used cooking oil in uncovered 55-gallon drums, loading/unloading activities, food preparation activities, uncovered garbage dumpsters, fueling activities, and drips and leaks from vehicles in the parking lot.

A commercial trash compactor associated with the grocery store is located on the southwest side of the building. The trash compactor is enclosed by a CMU wall on

three sides and is uncovered. An on-site employee reported that during rain events water sheet flows from the trash compactor site to a ponding area near the movie theaters, which can get relatively deep. Also, it should be noted that two of the three residents along the grass-lined swale behind the movie theaters keep dogs in the back yard and dog wastes litter the yard. Additionally, an illicit hose connection was observed at the catch basin to the Alahaki Interceptor Ditch from one of the resident's pool. The primary pollutant of concern in swimming pool water is chlorine or chloramine used as a disinfectant. This water, if discharged to the storm drain system, can be toxic to aquatic life.

D. Significant Materials Inventory

The following significant materials are located at ELSC:

- Gasoline
- Assorted oils (motor and cooking)
- Assorted fluids (transmission, brake, trash compacting, etc.)

A.1.2 Potential Storm Water Pollutants

Used cooking oils and grease, organic food materials, gasoline (spills from tanker truck and motor vehicle fueling operations), vehicle fluid residue (from parking lot), and animal waste associated with the grass-lined swale drainage system, can be potential storm water pollutants if not properly managed.

City personnel discussed the infraction of chlorinated water discharge with the resident and the hose was removed. Based on aerial photographs of the Enchanted Lake area and the number of pools associated with the stormwater system and lake, chemicals associated with swimming pool discharge (chorine, acids and bicarbonates), may be an issue that needs further investigation.

A.1.3 Best Management Practices (BMP)

A. Good Housekeeping Practices

In general, the ELSC employs good housekeeping practices throughout its operations. However, areas behind the food tenant in the northwest portion of the ELSC need improvement. Existing good housekeeping practices for the ELSC are

included in Table A.1-1, while recommended modified and new good housekeeping practices are included in Tables A.1-2 and A.1-3 respectively.

B. Preventive Maintenance

A preventive maintenance program involving regular inspections of equipment and storage systems should be implemented. The program should include a brief inspection of equipment, materials, or storage systems located at the ELSC and should be performed prior to or during normal business hours. Specifically, items which should be inspected and appear to have appropriate procedures in place are: gasoline tanker transfer pumping, wash water drains and oil water separator for the car wash, and food tenant grease traps and sump pump maintenance.

C. Visual Inspection

A recommended semi-annual site inspection will be an overall evaluation of how the storm water BMPs are performing at the ELSC. The evaluation will include visual observations of the ELSC for evidence of non-storm flows or discharges.

D. Spill Prevention and Response

Areas where significant material spills can occur are identified in Section A.1.1 and depicted in Figure A.1-1. The storm water systems and their accompanying drainage points are also shown in Figure A.1-1. For material handling procedures, storage requirements and equipment usage to prevent spills from occurring, ELSC management and tenants should refer to the BMPs listed in Tables A.1-1 through A.1-3. In the event of a hazardous or significant material spill or leak, the SPCC Plan and/or Oil and Hazardous Substance Spill Control Plan should be consulted, and the procedures carried out in strict accordance to the instructions described within.

E. Erosion and Sediment Controls

No areas at the ELSC have been identified as having high potential for significant soil erosion that would require erosion and sediment control measures.

A.1.4 Personnel Training

Management and tenants should be trained at least annually and initial training will be provided to all new personnel. Training to prevent pollutants from entering storm water discharges from the ELSC includes:

- spill prevention and response;
- BMPs;
- material management;
- inspections and recordkeeping; and
- tank inspection, repair and maintenance.

TABLE A.1-1 EXISTING BEST MANAGEMENT PRACTICES		
BMP No.	**BMP Title**	**Description**
006	Control Spills	The Chevron Station has absorbent material (kitty litter) stored in a plastic trash can on-site to contain small spills.
015	Recycle	Contaminated wash water is recycled at the Chevron Car Wash. Cardboard box receptacles are located at ELSC for recycling.
037	Park Vehicles on an Impervious Surface	Vehicles are parked on impervious surfaces.
041	Wash Equipment and Vehicles in Designated Area	The Chevron station is equipped with a vehicle car wash. The station also collects rinse water for reuse.
042	Discharge Wash Water to a Sanitary Sewer	The oil/water separator (BMP 098) at Chevron Car Wash discharges water to the sanitary sewer system.
052	Use Outside Contractor for Handling Used Solvents and Other Significant Materials	An outside contractor removes oil sludge from the oil/water separator on a regular basis.
064	Monitor Major Fueling Operations	Chevron's 10,000-gallon UST is monitored during transfer operations. Absorbent booms are also available (BMP 065) during this operation.
067	Install Leak Detection System	The 10,000-gallon UST is monitored 24/7 by an automated system.
100	Use Grassed Swales	Runoff from the southwestern portion of ELSC is collected by a curbed headwall that drains to a privately owned grass-lined swale. The swale transports the storm water to the Alahaki interceptor ditch and eventually WKIP 14. See BMP 110.

Refer to Appendix A-1 for BMP descriptions and additional information.

TABLE A.1-2 MODIFICATIONS TO EXISTING BEST MANAGEMENT PRACTICES				
BMP No.	**BMP Title**	**Description**	**Implementation Category(1)**	**Implementation Schedule**
003	Perform Regular Cleaning	Scheduled cleaning operations are performed throughout the ELSC; however, the northwest side of ELSC, behind the tenant food vendors, needs a focused cleaning effort. Litter, trash, food scraps, and waste oil/grease were observed in this area.	NS	6 months
007	Place Trash Receptacles at Appropriate Locations	Trash receptacles do not appear appropriately located at the ELSC and the ratio of dumpsters to tenants seems insufficient as shown by overflowing dumpsters with open lids.	NS	6 months
016	Store Wastes and Recycling Materials in Proper Containers	Open dumpsters located adjacent to the Alahaki drainage channel could discharge pollutants. Miscellaneous trash and debris that have been observed in the drainage channel include tires, wood pallets, paint cans, trash bags and green waste.	NS	6 months
026	Routinely Clean Catch Basins	Reevaluate cleaning schedule for catch basins in this area. Cleanings should be performed at least quarterly with one of the cleanings taking place prior to the rainy season and/or before large storms. See BMP 024 also.	NS	6 months
061B	Store Liquids and Significant Materials within a Building or Covered Area	Two 55-gallon drums of waste cooking oil/grease are stored uncovered in the northwest portion of the ELSC. The surrounding walls and asphalt concrete surfaces are soiled. The following other BMPs could also apply: - 018, Provide Rood to Cover Source Area - 055, Use Containment Pallets - 056, Use “doghouse” design for outdoor storage containers.	NS	6 months

Notes: (1) NS Non-Structural
S Structural

Refer to Appendix A-1 for BMP descriptions and additional information.

TABLE A.1-3 NEW BEST MANAGEMENT PRACTICES				
BMP No.	**BMP Title**	**Description**	**Implementation Category(1)**	**Implementation Schedule**
019	Control Roof Downspout Discharge	Direct connection to the storm sewer or discharge to landscaped/pervious areas for percolation and groundwater recharge will decrease pollutant transport to the storm drain system.	NS	6 months
024	Insert Filter in Catch Basin	Use a catch basin filter to trap sediments, oil and other storm water contaminants in high pollutant areas.		
027	Stencil Signs on Storm Drain Inlets	Clearly mark all storm drain inlets to warn against illegal discharges.		
066	Eliminate Topping Off Tanks	Post signs stating policy.	NS	6 months
110	Regularly Inspect and Maintain Storm Water Conveyance System	During a storm water investigation, it was observed that organic dog wastes, illicit pool connections, and trash/debris were identified in the swale. Educate Enchanted Lake residents that are directly associated with storm drain system and water environment and develop inspection intervals for these critical areas.	NS	6 months

Notes: (1) NS Non-Structural
S Structural

Refer to Appendix A-1 for BMP descriptions and additional information.

Figure A.1-1
Enchanted Lakes Shopping Center

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Figure A.2-1
Tenn's Auto

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A.2 Tenn's Enchanted Lakes Auto Center

Tenn's Enchanted Lakes Auto Center (Tenn's Auto) is located at 1025 Keolu Drive, across the street from the Enchanted Lake Shopping Center, within Enchanted Lakes Residential area, Kailua, Hawaii. Tenn's Auto is bordered by Keolu Drive on the West, residential homes and the Alahaki Drainage Channel on the east and north, and Hele Street on the south (see Figure A.2-1). Tenn's Auto is a single-story concrete structure with a noticeably increased 8-foot roof overhang. A separate covered structure on the west side of the building, which was a former fueling island, houses a hydraulic lift for vehicle maintenance. The former gas station, has been converted into a vehicle maintenance facility, no fueling activities are performed. The building is surrounded by asphalt concrete pavement and fenced on all four sides.

Storm water runoff from Tenn's Auto generally flows away from the building on all sides. A swale located on the east side of the facility generally flows south to north toward the Alahaki Drainage Channel. The swale travels through a vehicle storage yard and past a covered oil storage area. It appears that most stormwater is retained on site in ponding areas in the northeastern and northwestern corner of the facility. As water levels rise, storm water may slowly be transported to the Alahaki Drainage Channel via a low point in the northwest corner of the parking lot and a headwall in the northeast corner.

A.2.1 Sources of Pollutants

Materials spilled, leaked or lost may collect on paved surfaces and be carried away by storm runoff. Following is an inventory of potential sources associated with Tenn's Auto:

A. Material Loading and Unloading Areas

A tanker truck unloading area is located on the north side of the main office building. Trucks transfer assorted fluids (oil, transmission, antifreeze, lube oil and brake) via hose through the office to the main service bay. The main service bay also receives hand carried items (e.g. batteries [new and used], parts etc.).

The used oil storage area receives hand carried transfers on a daily basis. Tenn's Auto personnel transfer the used oil by buckets into two 200-gallon used oil containers and/or 55-gallons drums in overpack containers for storage. A vacuum truck removes the used oil every 6-8 months.

B. On-Site Material Storage and Disposal Practices

The Main Service Bay stores new and used batteries on shelves. Assorted vehicle fluids (oil, lube, antifreeze, transmission and brake fluid) are stored in segregated 60-gallon stacked storage/dispensing units. Paint cans were stored on the ground without a pallet.

The used oil storage area is a 15x25-foot outdoor area underneath the roof overhang. Used materials (oil, lube oil, and solvents) are hand carried and transferred here on a daily basis. The materials are stored in multiple 55-gallon drums within overpack containers and two 200-gallon square plastic containers. Empty 55-gallon drums are stored directly on the ground. A vacuum truck removes the used oil every 6-8 months.

C. Outdoor Activities

Vehicle maintenance activities are performed outdoors, and small spills and stains are scattered throughout the maintenance yard. Materials used and wastes created during these activities have the potential to pollute storm water runoff.

Vehicles, a trash dumpster, tires, engine parts and a motor are stored outdoors, uncovered, on the ground. Vehicle maintenance activities are performed outdoors and associated with these areas are small spills and stains scattered throughout the maintenance yard. Leaking vehicles, forklifts, and hydraulic jimmy lift were also observed.

D. Significant Materials Inventory

The following significant materials are located at Tenn's Auto:

- assorted solvents;
- motor and lubricating oils;
- Assorted fluids (transmission, brake, antifreeze, etc.);
- grease; and
- paint

A.2.2 Potential Storm Water Pollutants

Used oils and grease, paint, and vehicle fluid residue (drips and leaks from vehicle and equipment), are potential pollutants if not properly managed.

A.2.3 Best Management Practices

A. Good Housekeeping Practices

In general, Tenn's Auto employs some good housekeeping practices throughout its operations. Existing good housekeeping practices are included in Table A.2-1; recommended modified and new good housekeeping practices are included in Tables A.2-2 and A.2-3 respectively.

Items stored outside should be covered to isolate a potential source of pollution, and placed on a pallet to facilitate leak detection.

B. Preventive Maintenance

A preventive maintenance program involving regular inspections of equipment and storage systems should be implemented. The program should include a brief inspection of equipment, materials, or storage systems and should be performed prior to or during normal use. Specifically, items which should be inspected are storage containers (place on pallets and check for leaks), and vehicles and equipment stored in the yard (check for leaks and change drip pans).

C. Visual Inspection

Recommended semi-annual site inspections will evaluate of the overall efficacy of the storm water BMPs. The evaluation will include visual observations for evidence of non-storm flows or discharges.

D. Spill Prevention and Response

Areas where significant material spills can occur are identified in Section A.2.1 and depicted in Figure A.2-1. The storm water systems and their accompanying drainage points are also shown in Figure A.2-1. For material handling procedures, storage requirements and equipment usage to prevent spills from occurring, management personnel should refer to the BMPs listed in Tables A.2-1 through A.2-3. In the event of a hazardous or significant material spill or leak, the SPCC Plan and/or Oil and Hazardous Substance Spill Control Plan should be consulted, and the procedures carried out in strict accordance with the instructions described within.

E. Erosion and Sediment Controls

No areas have been identified as having high potential for significant soil erosion that would require erosion and sediment control measures.

A.2.4 Personnel Training

Tenn's Auto personnel should be trained at least annually and initial training will be provided to all new personnel. Training to prevent pollutants from entering storm water discharges from the Tenn's Auto includes:

- spill prevention and response;
- BMPs;
- material management;
- inspections and recordkeeping; and
- vehicle inspection, repair and maintenance.

TABLE A.2-1 EXISTING BEST MANAGEMENT PRACTICES		
BMP No.	**BMP Title**	**Description**
002	Restrict Access to Area and Equipment	The facility is provided with fencing, gates, and security cameras to discourage trespassing. Vandalism of vehicles, the used oil storage containers, and facility property may result in the release of significant materials to the environment.
003	Perform Regular Cleaning	Tenn's Auto maintains a regular general sweeping and dry (no hosing) cleaning schedule to minimize the amount of significant materials exposed to storm water.
006	Control Spills	Absorbent material (kitty litter) is readily available on-site to contain small spills. Spills with fresh absorbent material were observed outdoor around the facility. The material is reportedly swept up throughout the day.
033	Check Vehicles and Equipment for Leaks	It is apparent that Tenn's Auto personnel check vehicles daily for leaks and drips due to the number of drip pans (BMP 44) placed accordingly under leaking vehicles and equipment.
037	Park Vehicles on an Impervious Surface	Vehicles are parked on impervious surfaces.
044	Use Drip Pans Under Leaking Equipment	This temporary BMP is and will be utilized until the equipment is properly repaired or replaced.
052	Use Outside Contractor for Handling Used Solvents and Other Significant Materials	An outside private contractor is used to handle the disposal and removes used batteries and used oil from the facility.
055	Use Overpack Containers or Containment pallets to Store 55-gallon Drums Outside of Storage Areas.	Tenn's Auto readily uses this BMP on-site. These containers storing significant materials are housed under the roof overhang (see BMP 061B).

Refer to Appendix A-1 for BMP descriptions and additional information.

TABLE A.2-2 MODIFICATIONS TO EXISTING BEST MANAGEMENT PRACTICES				
BMP No.	**BMP Title**	**Description**	**Implementation Category(1)**	**Implementation Schedule**
003	Perform Regular Cleaning	Scheduled cleaning operations are performed throughout the Tenn's Auto However, the northwest side of Tenn's Auto	NS	6 months
029	Maintain Equipment in Good Condition	Keep Tenn's Auto equipment and vehicles in good working condition and inspect regularly for fluid leaks (i.e. forklift and Tommy gate that are leaking). Equipment which is leaking or in poor working condition will be repaired or replaced.	NS	6 months
038	Designate Special Areas for Draining or Replacing Fluids	Drain and replace motor oil, coolants, and other fluids at designated maintenance facilities to reduce the potential for improper handling activities. If this is not possible, special areas will be designated for these activities. Consideration will be given to placing these areas indoors or using bermed concrete pads if outdoors. See also BMP 47.	NS	6 months
040	Completely Drain Oil Filters Before Disposal	Completely drain filters into collection drums before recycling or disposal.		

Notes: (1) NS Non-Structural
S Structural

Refer to Appendix A-1 for BMP descriptions and additional information.

TABLE A.2-3 NEW BEST MANAGEMENT PRACTICES				
BMP No.	**BMP Title**	**Description**	**Implementation Category(1)**	**Implementation Schedule**
016	Store Waste and Recycling Materials in Proper Containers	Label dumpster appropriately "trash only no liquids." Close dumpster lids when not in use.	NS	6 months
045	Perform Equipment Maintenance at Designated Areas	Maintenance activities are performed throughout the facility (indoors and outdoors) at miscellaneous locations due to lack of indoor space. Efforts will be made to designate areas and cover maintenance operations to reduce exposure to storm water.	NS	6 months
057	Do Not Store Used Parts or Containers Directly on Ground	Miscellaneous equipment, drums and parts are stored directly on the ground. If outdoor storage is necessary, these items will be properly contained and placed on a wood pallet and covered.	NS	6 months

Notes: (1) NS Non-Structural
S Structural

Refer to Appendix A-1 for BMP descriptions and additional information.

APPENDIX B
LABORATORY ANALYTICAL REPORTS

ESN
PACIFIC

October 18, 2006

Shawn MacMillan
TEC, Inc.
1001 Bishop St., Suite 1400 ASB

Honolulu, HI 96813

SUBJECT: DATA REPORT – Kalelepulu Pond, PO# 5992-22592

ESN Project #D609210239

Mr. MacMillan:

Please find enclosed a data report for the samples analyzed from the above referenced project for TEC, Inc. The samples were received intact. ESN Pacific analyzed the samples and conducted the following tests:

- 3 analyses for organochlorine pesticides by EPA 8081 mod.
- 3 analyses for Total RCRA 8 by EPA 7000 series.

The results of the analyses are summarized in the enclosed table. Applicable detection limits and QA/QC data are included on the table. An explanation of abbreviations, data qualifiers, and a summary of our analytical procedures are also included for your convenience. Additionally, 2 samples were sent to Analytical Resources Inc. in Tukwila, WA for the following analyses:

- 2 analyses for total Kjeldahl Nitrogen by EPA 351.4.
- 2 analyses for total Phosphorus by EPA 365.2.
- 2 grain size analyses according to Puget Sound Estuary Protocols (PSEP) methodology.

Their QA/QC are also included in this report. ESN appreciates the opportunity to have provided analytical services to TEC, Inc. on this project. If you have any further questions relating to the data or report, please do not hesitate to contact us.

Sincerely,

Dave Davis
General Manager
ESN Pacific

ESN PACIFIC

TEC - The Environmental Company PROJECT #5992
Kaelepulu Pond

ESN Project #D609210239

ORGANOCHLORINE PESTICIDES ANALYSES OF SOILS BY EPA 8081A MODIFIED

SAMPLE NUMBER	Method Blank	WKIP 52	WKIP 52 Dup	WKIP 14	WKIP 10	PQL	MDL
DATE SAMPLED	-	9/20/2006	9/20/2006	9/20/2006	9/20/2006		
DATE EXTRACTED	9/21/2006	9/21/2006	9/21/2006	9/21/2006	9/21/2006		
DATE ANALYZED	9/25/2006	9/25/2006	9/25/2006	9/25/2006	9/25/2006		
Alpha-BHC	nd	nd	nd	nd	nd	0.005	0.002
Beta-BHC	nd	nd	nd	nd	nd	0.005	0.005
Gamma-BHC (Lindane)	nd	nd	nd	nd	nd	0.005	0.002
Delta-BHC	nd	nd	nd	nd	nd	0.005	0.004
Heptachlor	nd	nd	nd	nd	nd	0.005	0.002
Aldrin	nd	nd	nd	nd	nd	0.005	0.003
Heptachlor epoxide	nd	nd	nd	nd	nd	0.005	0.003
Gamma-Chlordane	nd	nd	nd	nd	nd	0.005	0.003
Endosulfan I	nd	nd	nd	nd	nd	0.005	0.004
Alpha-Chlordane	nd	nd	nd	nd	nd	0.005	0.003
Dieldrin	nd	nd	nd	nd	nd	0.010	0.003
p,p'-DDE	nd	nd	nd	nd	nd	0.010	0.005
Endrin	nd	nd	nd	nd	nd	0.010	0.003
Endosulfan II	nd	nd	nd	nd	nd	0.010	0.005
p,p'-DDD	nd	nd	nd	nd	nd	0.010	0.003
Endrin aldehyde	nd	nd	nd	nd	nd	0.010	0.005
Endosulfan sulfate	nd	nd	nd	nd	nd	0.010	0.005
p,p'-DDT	nd	nd	nd	nd	nd	0.010	0.005
Endrin ketone	nd	nd	nd	nd	nd	0.010	0.005
Methoxychlor	nd	nd	nd	nd	nd	0.010	0.009
Chlordane (technical)	nd	nd	nd	nd	nd	0.050	0.005
Toxaphene	nd	nd	nd	nd	nd	0.250	0.100
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
FLAGS							
SURROGATE RECOVERY (%)	123%	128%	77%	96%	106%		

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE (TCMX): 65%- 135%

QA/QC DATA - LABORATORY CONTROL SPIKE ANALYSES

	Laboratory Control Spike			
	Spiked Conc. (mg/kg)	Measured Conc. (mg/kg)	Spike Recovery (%)	FLAGS
Beta-BHC	0.050	0.053	106.4%	
p,p'-DDE	0.100	0.107	106.5%	
Endrin aldehyde	0.100	0.109	109.4%	

QA/QC DATA - MATRIX SPIKE ANALYSES

Sample Name: 0239 WKIP 52
*Any hits in sample spiked for MS/MSD are subtracted before reported as measured concentration.

	Matrix Spike			Matrix Spike Duplicate				
	Spiked Conc. (mg/kg)	Measured Conc. (mg/kg)	Spike Recovery (%)	Spiked Conc. (mg/kg)	Measured Conc. (mg/kg)	Spike Recovery (%)	RPD (%)	FLAGS
Beta-BHC	0.050	0.044	88.4%	0.050	0.045	90.6%	2.5%	
p,p'-DDE	0.100	0.093	93.3%	0.100	0.095	94.5%	1.3%	
Endrin aldehyde	0.100	0.091	90.7%	0.100	0.106	106.1%	15.7%	

% Recovery LIMITS: 85% TO 115%
RPD LIMIT: 20%

ANALYSES PERFORMED BY : B. Capps
DATA REVIEWED BY: K. Carvallo KC

TEC - The Environmental Company PROJECT #5992
Kaelepulu Pond

ESN Project #D609210239

TOTAL METAL ANALYSES OF SOILS BY ATOMIC ABSORPTION

SAMPLE NUMBER	DATE SAMPLED	DATE DIGESTED	DATE ANALYZED	Lead (Pb) EPA 7420 (mg/kg)	Cadmium (Cd) EPA 7130 (mg/kg)	Chromium (Cr) EPA 7190 (mg/kg)	Arsenic (As) EPA 7061M (mg/kg)	Silver (Ag) EPA 7760 (mg/kg)	Barium (Ba) EPA 7080 (mg/kg)	Selenium (Se) EPA 7741M (mg/kg)	Mercury (Hg) EPA 7471 (mg/kg)	FLAGS
Method Blank	-	9/26/2006	9/26/2006	nd	nd	nd	nd	nd	nd	nd	nd	
WKIP 52	9/20/2006	9/26/2006	9/26/2006	15	nd	11*	nd	nd	nd	nd	nd	*J
WKIP 52 Dup	9/20/2006	9/26/2006	9/26/2006	11	nd	9.1*	nd	nd	nd	nd	nd	*J
WKIP 14	9/20/2006	9/26/2006	9/26/2006	20	nd	30	nd	nd	nd	nd	nd	
WKIP 10	9/20/2006	9/26/2006	9/26/2006	35	nd	53	nd	nd	nd	nd	nd	
PQL				5.0	1.25	12.5	5.0	1.25	25	12.5	0.50	
MDL				3.5	0.5	5.0	2.0	1.5	21	7.5	0.10	
2005 HI DOH EAL (Lead action level based on direct exposure to humans.				400	12	210	22	20	750	10	10	

***Hg analyzed on 9-27-06.**
***J: The analyte was positively identified, but the associated numerical value is an estimate (below PQL).**

QA/QC DATA - LABORATORY CONTROL SPIKE ANALYSES

Spike Added	125	25	125	250	25	250	125	2.5
Measured Conc.	121	24	160	216	25	214	140	3.0
% Recovery	97.0%	97.3%	128.4%	86.3%	100.8%	85.6%	112.2%	119.2%

QA/QC DATA - MATRIX SPIKE ANALYSES

Sample Name: 0239 WKIP 52
*Any hits in sample spiked for MS/MSD are subtracted before reported as measured concentration

Spike Added	125	25	125	250	25	250	125	2.5
Measured Conc.	135	25	98	189	22	249	118	3.2
% Recovery	107.7%	99.3%	78.3%	75.5%	87.9%	99.5%	94.6%	127.5%
Spike Added	125	25	125	250	25	250	125	2.5
Measured Conc.	136	23	96	184	22	237	124	3.1
% Recovery	108.6%	90.7%	77.0%	73.5%	89.0%	94.9%	99.3%	123.4%
RPD	0.9%	9.1%	1.6%	2.8%	1.2%	4.8%	4.9%	3.3%

% Recovery LIMITS: 65% TO 135%
RPD LIMIT: 20%

ANALYSES PERFORMED BY : B. Capps, K. Carvallo
DATA REVIEWED BY: D. Davis

Analytical Resources, Incorporated
Analytical Chemists and Consultants

October 13, 2006

Dave Davis
ESN Pacific
1818 Kahai Street
Honolulu, HI 96819

RE: Client Project: D609210239 Kaelepulu Pond
ARI Job No. JX98

Dear Dave:

Please find enclosed the chain of custody documentation and the final data report for one three samples from the project referenced above.

Three soil samples were received in good condition at 6.5°C on 09/22/06. Two samples were analyzed for grainsize and conventional parameters, with the other sample on hold.

Laboratory QA met all requirements. There were no items of note.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Samples will be discarded 90 days after receipt. Please contact us if other arrangements are required.

Sincerely,

ANALYTICAL RESOURCES, INC.

Susan Dunnihoo
Client Service Manager
sue@arilabs.com
206/695-6207

Enclosures

cc: eFile JX98

SD/sdrd

SK98 06-17496 to 06-17498

6.5°c Ice-Melted

CHAIN-OF-CUSTODY RECORD

CLIENT: ESN Pacific
ADDRESS: 1818 Kalai St. Honolulu, HI 96819
PHONE: 808-847-0067 FAX: 808-847-0917
EMAIL: esn@esnpacific.com
CLIENT PROJECT #: Project Manager: D. Davis

TAT (circle one): 24-hr. 48-hr. (5-day) or Other: STANDARD
DATE: 9/21/06 PAGE 1 OF 1
ESN PROJECT #: D0609210239
LOCATION/PROJECT NAME: Kaelepulu Pond
COLLECTOR: S. MacMillan DATE COLLECTED: 9/20

	Sample ID#	Depth	Time	Sample Type	Container Type	8021b HVOC	8021b VOC	8021b BTEX	8021b MtBE	8015 Fuel Scan	8015 TPH-Gas	8015 TPH-Diesel	8015 TPH-Oil	8081 Pest.	8082 PCB	8100 PAH	8270 PAH	1010 FlashPoint	RCRA 8 Metals	Total: Pb Cd Cr As Hg or TCLP	Grain Size	Total N_2	Total P	Comments	# of Containers
1	WKIP 10																				X	X	X	Hold!	3
2																						/			
3	WKIP 14																				X	X	X		3
4																									
5	WKIP 52																				X	X	X		3
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									

RELINQUISHED BY:(Signature) DATE/TIME RECIEVED BY (Signa DATE/TIME
Dave Davis 9/21/06 11:29am B-Zyl 9/22/06 1030

RELINQUISHED BY:(Signature) DATE/TIME RECIEVED BY (Signa DATE/TIME

SAMPLE DISPOSAL INSTRUCTIONS: ____ ESN Dispose @ ~~$2.00~~ 3.50/sample or ____ Return to Client

SAMPLE RECEIPT:
TOTAL # OF CONTAINERS 9
COC SEALS Y / N / NA
SEALS INTACT Y / N / NA
RECEIVED TEMP: 4°C

LABORATORY NOTES: Hold running WKIP 10 until further notice.
TDD

CHAIN-OF-CUSTODY RECORD

CLIENT: TEC Inc.
ADDRESS: 1001 Bishop St.
PHONE: 808-528-1445 FAX:
EMAIL:
CLIENT PROJECT #: 5992 Project Manager: Karl Bromwell

TAT (circle one): 24-hr. 48-hr. (5-day) or Other:
DATE: 9/21/06 PAGE 1 OF 1
ESN PROJECT #: D609210239
LOCATION/PROJECT NAME: Kaelepulu Pond
COLLECTOR: Shawn MacMillan DATE COLLECTED: 9/20/06

	Sample ID#	Depth	Time	Sample Type	Container Type	8021b HVOC	8021b VOC	8021b BTEX	8021b MtBE	8015 Fuel Scan	8015 TPH-Gas	8015 TPH-Diesel	8015 TPH-Oil	8081 Pest.	8082 PCB	8100 PAH	8270 PAH	1010 FlashPoint	RCRA 8 Metals	Total: Pb Cd Cr As Hg or TCLP		Grain Size	Tot. Nitrogen	T. Phosphorus	Comments	# of Containers
1	WKIP52		0736	Sed	500mL Poly									X					X			X	X	X		4
2					4oz Jar																					
3	WKIP 14		0834	Sed	"									X					X			X	X	X		4
4					"																					
5	WKIP10		0908	Sed	"									(X)					X			(X)	(X)	(*)	Hold Grain size, Pest Tot. Nitrogen & Phosphorus for WKIP10 only.	4
6					"																					
7																										
8																										
9																										
10																										
11																										
12																										
13																										
14																										
15																										
16																										
17																										
18																										
19																										
20																										

Gravel, Sand, Silt, Clay Fractions

RELINQUISHED BY:(Signature) DATE/TIME RECIEVED BY (Signa DATE/TIME
9/21/06 1050 Dave Dawin 9/21/06 10:57

RELINQUISHED BY:(Signature) DATE/TIME RECIEVED BY (Signa DATE/TIME

SAMPLE DISPOSAL INSTRUCTIONS: (X) ESN Dispose @ $3.50/sample or ___ Return to Client

SAMPLE RECEIPT:
TOTAL # OF CONTAINERS 12
COC SEALS Y / N / NA
SEALS INTACT Y / N / NA
RECEIVED TEMP: 4°C

LABORATORY NOTES:

Cooler Receipt Form

ANALYTICAL RESOURCES INCORPORATED

ARI Client: ESN Pacific — Project Name: Kaelepulu Pond

COC NO.: _____ — Delivered By: Fed Ex

Tracking NO.: 7990 0712 5407 — Date: 9/22/06

ARI Job No.: JXQ8 — Lims NO.: 06-17496 to 06-17498

Preliminary Examination Phase:

1. Were intact, properly signed and dated custody seals attached To the outside of the cooler? ..... YES (NO)
2. Were custody papers included with the cooler ..... (YES) NO
3. Were custody papers properly filled out (ink, signed etc.)? ..... (YES) NO
4. Complete custody forms and attach all shipping documents ..... (OK) NA

Cooler Accepted BY: B. Rigl Date: 9/22/06 Time: 1030

Log-IN Phase:

5. Was a temperature blank include in the cooler? ..... YES NO
6. Record Cooler Temperature ..... 6.5 °C
7. What kind of packing material was used? ..... G
8. Was sufficient ice used (if appropriate)? ..... YES NO
9. Were all bottles sealed in separate plastic bags? ..... YES (NO)
10. Did all bottles arrive in good condition (unbroken)? ..... (YES) NO
11. Were all bottle labels complete and legible? ..... (YES) NO please see below 9/25/06
12. Did all bottle labels and tags agree with custody papers? ..... (YES) NO
13. Were all bottles used correct for the requested analyses? ..... (YES) NO
14. Do any of the analyses (bottles) require preservative? (If so, Preservation checklist must be attached) ..... YES (NO)
15. Were all VOA vials free of air bubbles? ..... YES NA NO
16. Was sufficient amount of sample sent in each bottle? ..... (YES) NO
17. Notify Project Manager of any discrepancies or concerns ..... (OK) NA

Cooler Opened By: B. Rigl Date: 9/22/06 Time 1030

Explain any discrepancies or negative responses:

WKIP 10 9/20/06 0908 No date or time on COC
WKIP 14 9/20/06 0834
WKIP 52 9/20/06 0736

QA SUMMARY

ANALYTICAL RESOURCES INCORPORATED

PROJECT:	ESN	Project No.:	Kaelepulu Pond D609210239
ARI Triplicate Sample ID:	JY18 H	Batch No.:	JX98 -1
Client Triplicate Sample ID:	NP-02-U-2006	Page:	1 of 1

Relative Standard Deviation, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
NP-02-U-2006	100.0	99.1	97.1	94.9	85.7	40.1	15.7	11.9	7.7	5.9	4.8	3.9	3.0	2.2
NP-02-U-2006	100.0	97.5	95.3	92.9	82.8	38.3	14.4	11.0	7.6	5.7	4.7	3.9	3.0	2.3
NP-02-U-2006	100.0	97.1	94.5	92.5	83.4	38.3	14.2	10.5	7.7	5.8	4.7	4.0	3.3	2.5
AVE	NA	97.92	95.63	93.44	83.92	38.92	14.74	11.15	7.68	5.81	4.76	3.90	3.10	2.33
STDEV	NA	1.06	1.34	1.31	1.53	1.06	0.82	0.72	0.08	0.06	0.04	0.06	0.16	0.16
%RSD	NA	1.09	1.40	1.40	1.83	2.73	5.55	6.49	1.08	1.09	0.82	1.48	5.27	6.80

The Triplicate Applies To The Following Samples

Client ID	Date Sampled	Date Extracted	Date Complete	QA Ratio (95-105)	Data Qualifiers	Pipette Portion (5.0-25.0g)
NP-02-U-2006	9/20/2006	9/27/2006	10/4/2006	101.1		13.1
NP-02-U-2006	9/20/2006	9/28/2006	10/4/2006	100.5		12.4
NP-02-U-2006	9/20/2006	9/28/2006	10/4/2006	99.7		11.7
WKIP14	9/20/2006	10/3/2006	10/6/2006	98.5		10.0
WKIP52	9/20/2006	10/3/2006	10/6/2006	98.2		12.5

* ARI Internal QA limits = 95-105%

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

SAMPLE RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: 09/20/06
Date Received: 09/22/06

Client ID: WKIP14
ARI ID: 06-17497 JX98B

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/27/06 092706#1	EPA 160.3	Percent	0.01	40.10
Total Kjeldahl Nitrogen	10/06/06 100606#1	EPA 351.4	mg-N/kg	343	1,300
Total Phosphorus	10/11/06 101106#1	EPA 365.2	mg/kg	268	987

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: 09/20/06
Date Received: 09/22/06

Client ID: WKIP52
ARI ID: 06-17498 JX98C

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/27/06 092706#1	EPA 160.3	Percent	0.01	55.50
Total Kjeldahl Nitrogen	10/06/06 100606#1	EPA 351.4	mg-N/kg	257	1,060
Total Phosphorus	10/11/06 101106#1	EPA 365.2	mg/kg	130	1,050

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	09/27/06	Percent	< 0.01 U
Total Kjeldahl Nitrogen	10/06/06	mg-N/kg	< 1.0 U
Total Phosphorus	10/11/06	mg/kg	< 0.04 U

LAB CONTROL RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	LCS	Spike Added	Recovery
Total Kjeldahl Nitrogen	10/06/06	mg-N/kg	4.3	5.0	86.0%

STANDARD REFERENCE RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
Total Phosphorus ERA #35064.1	10/11/06	mg/kg	4.51	4.99	90.3%

REPLICATE RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: 09/20/06
Date Received: 09/22/06

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: JX98B Client ID: WKIP14					
Total Solids	09/27/06	Percent	40.10	37.90 37.00	4.2%
ARI ID: JX98C Client ID: WKIP52					
Total Kjeldahl Nitrogen	10/06/06	mg-N/kg	1,060	925 1,070	8.0%
Total Phosphorus	10/11/06	mg/kg	1,050	1,200	13.3%

MS/MSD RESULTS-CONVENTIONALS
JX98-ESN

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 10/12/06

Project: Kaelepulu Pond
Event: D609210239
Date Sampled: 09/20/06
Date Received: 09/22/06

Analyte	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: JX98C Client ID: WKIP52						
Total Kjeldahl Nitrogen	10/06/06	mg-N/kg	1,060	4,590	4,080	86.6%
Total Phosphorus	10/11/06	mg/kg	1,050	1,550	538	93.0%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: ESN	Project No.: JX98
Client Project: D609210239 / Kaelepulu Pond	

Case Narrative

1. Two samples were received on September 22, 2006, and were in good condition.
2. The samples were submitted for grain size analysis according to Puget Sound Estuary Protocols (PSEP) methodology.
3. The triplicate was chosen on one sample from another job, which is reported in the attached QA summary.
4. PSEP methodology calls for between 5 to 25 grams of sediment passing the #230 sieve for the pipette portion of the analysis.
5. The data is provided in summary tables and plots.
6. There were no other noted anomalies in the samples or methods on this project.

Approved by: Christina Santos Date: 10/7/06
Title: Lead Technician

ANALYTICAL RESOURCES INCORPORATED

ESN
Kaelepulu Pond D609210239

Apparent Grain Size Distribution Summary
Percent Finer Than Indicated Size

Sample No.	Gravel			Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt				Clay	
Phi Size	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Sieve Size (microns)	3/8"	#4	#10 (2000)	#18 (1000)	#35 (500)	#60 (250)	#120 (125)	#230 (62)	31.00	15.60	7.80	3.90	2.00	1.00
NP-02-U-2006	100.0	99.1	97.1	94.9	85.7	40.1	15.7	11.9	7.7	5.9	4.8	3.9	3.0	2.2
NP-02-U-2006	100.0	97.5	95.3	92.9	82.8	38.3	14.4	11.0	7.6	5.7	4.7	3.9	3.0	2.3
NP-02-U-2006	100.0	97.1	94.5	92.5	83.4	38.3	14.2	10.5	7.7	5.8	4.7	4.0	3.3	2.5
WKIP14	100.0	72.9	71.1	67.6	63.7	59.4	54.7	50.1	46.5	39.1	33.1	27.7	22.4	18.3
WKIP52	100.0	87.7	78.7	66.7	52.6	37.7	30.4	27.4	16.0	13.5	11.3	9.3	7.6	6.3

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

JX98

ANALYTICAL RESOURCES INCORPORATED

ESN
Kaelepulu Pond D609210239

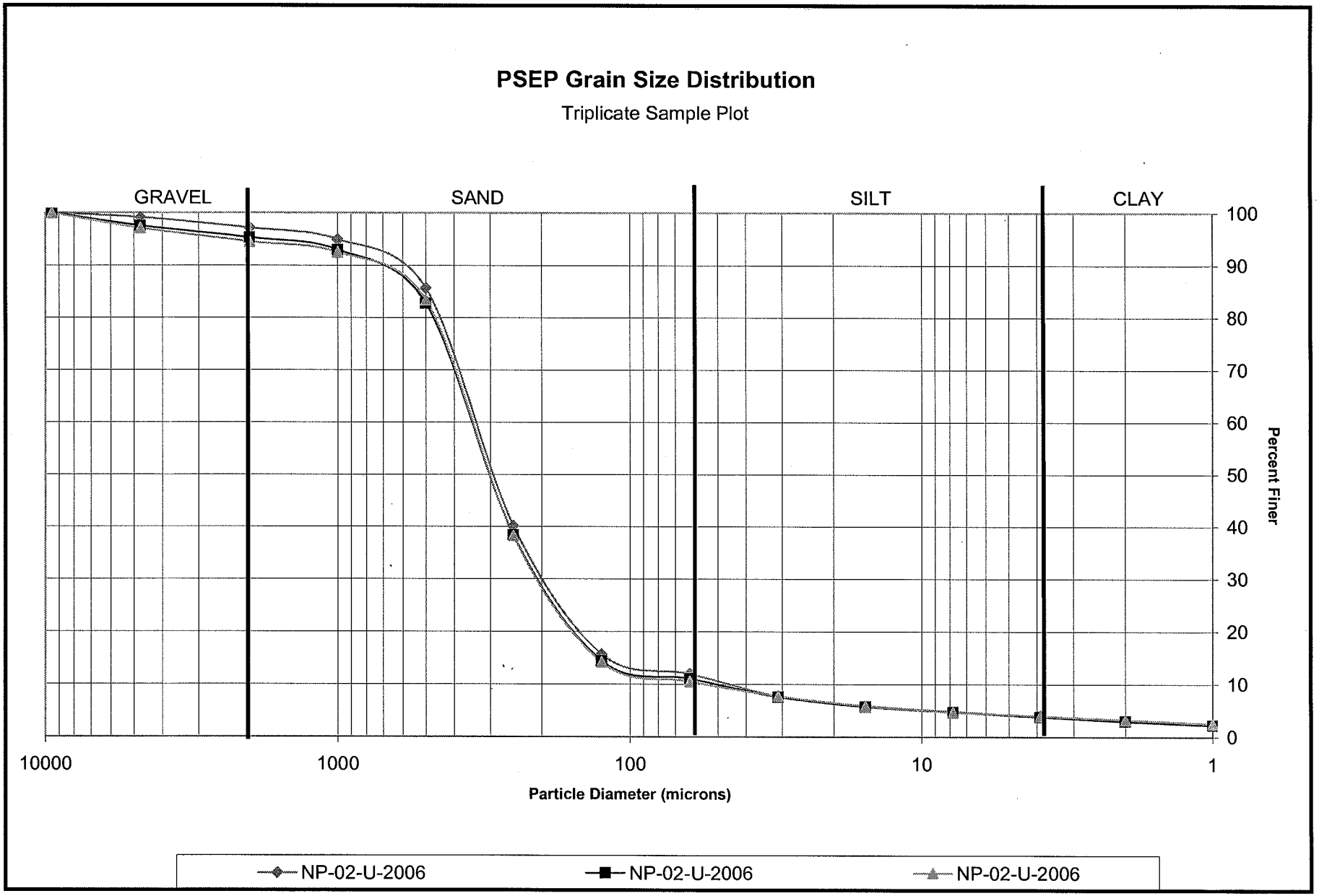
Apparent Grain Size Distribution Summary
Percent Retained in Each Size Fraction

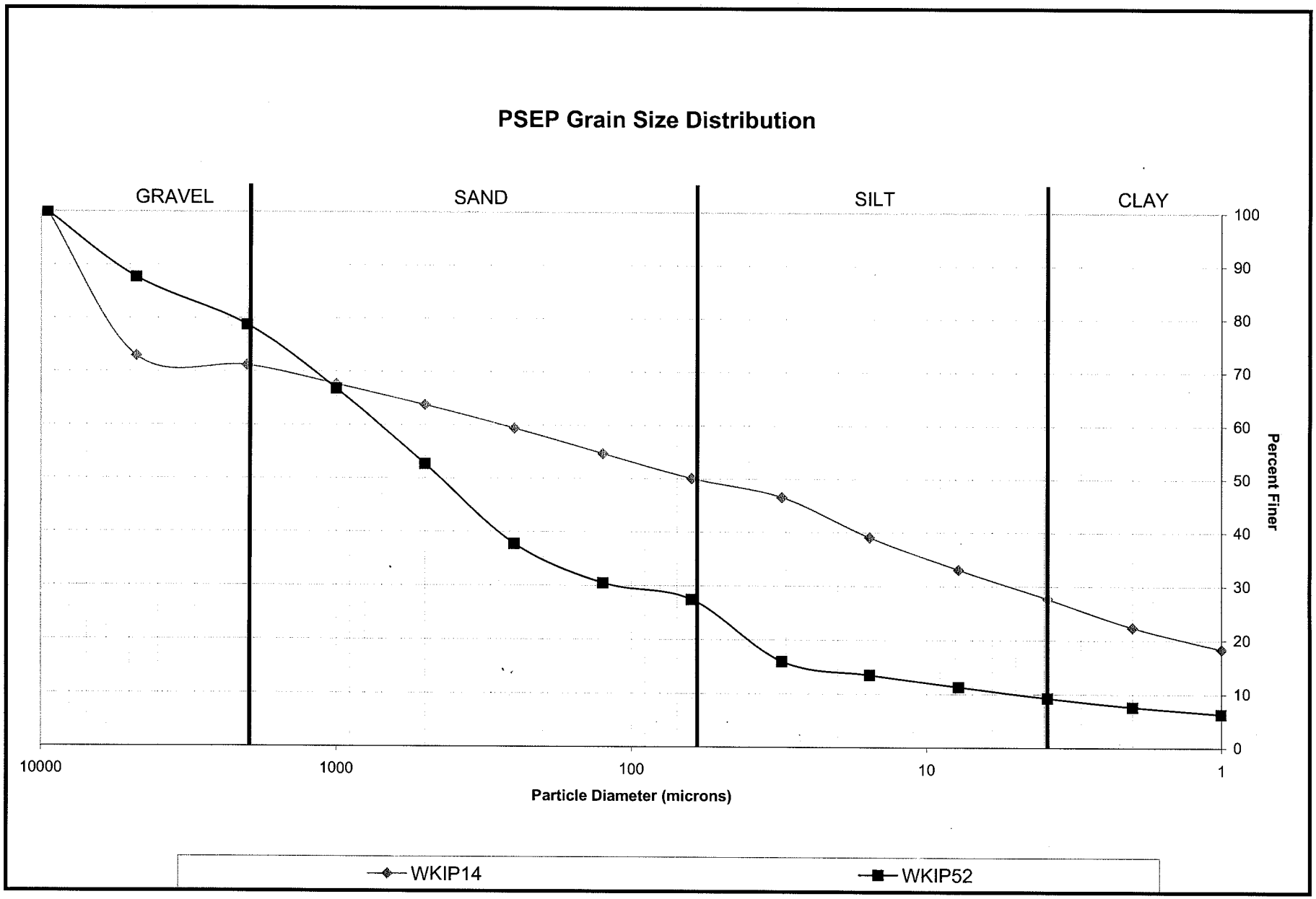
Sample No.	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay			Total Fines
Phi Size	> -1	-1 to 0	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	< 10	<4
Sieve Size (microns)	> #10 (2000)	10 to 18 (2000-1000)	18-35 (1000-500)	35-60 (500-250)	60-120 (250-125)	120-230 (125-62)	62.5-31.0	31.0-15.6	15.6-7.8	7.8-3.9	3.9-2.0	2.0-1.0	<1.0	<230 (<62)
NP-02-U-2006	2.9	2.2	9.3	45.5	24.5	3.7	4.2	1.9	1.1	0.9	0.9	0.8	2.2	11.9
NP-02-U-2006	4.7	2.3	10.2	44.4	24.0	3.4	3.4	1.8	1.0	0.9	0.8	0.8	2.3	11.0
NP-02-U-2006	5.5	2.0	9.1	45.1	24.1	3.7	2.8	1.9	1.1	0.8	0.7	0.8	2.5	10.5
WKIP14	28.9	3.5	3.9	4.3	4.7	4.6	3.5	7.5	6.0	5.4	5.3	4.0	18.3	50.1
WKIP52	21.3	12.0	14.1	14.9	7.3	3.0	11.4	2.5	2.2	2.0	1.7	1.3	6.3	27.4

Notes to the Testing:
1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

JX98

ANALYTICAL RESOURCES INCORPORATED




PSEP Grain Size Distribution
GRAVEL
SAND
SILT
CLAY
100
90
80
70
60
50
40
30
20
10
0
Percent Finer
10000
1000
100
10
1
Particle Diameter (microns)
WKIP14
WKIP52

FIELD SAMPLING REPORT (Sediment Samples)

Location: Kaelepulu Pond PROJECT: Kaelepulu Pond SWDS and CF BMP's

Description Six sub samples taken ~40, 50 and 60 feet from WKIP52.

Sediment Composition Clay 25 %, Silt 25 %, Sand 35 %, Gravel 15 %

Nearby Utilities None

Sediment Sample

Matrix: SED Sample ID: WKIP52

Sampling Method: 1.5"x48" or 1"x72" Acetate Tube DUP./REP. OF:

Composite: Yes Matrix Spike / Matrix Spike Duplicate

Yes: ____ No: X

Sample Date: 9/20/06 Sample Time: 0736

Sediment Parameters

CONTAINER			PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	CONSTITUENT DESCRIPTION	ANALYZE FOR? (Y/N)
SIZE	TYPE	#					
4 oz	Jar	1	None < 4°C		EPA 7000 / EPA 8081 mod	RCRA 8 Metals / Chlor. Pest.	✓
4 oz	Jar	1	None < 4°C		EPA 351.2 / SM4500-P B,C	Total Nitrogen / Total Phosphorus	✓
8 oz	Poly	2	None < 4°C		ASTM D422	Grain Size	✓

Notable Observations

PID READINGS	SAMPLE CHARACTERISTICS	MISCELLANEOUS
1st n/a	Color: Black	Pic.# 9 total
2nd n/a	Odor: H_2S	4 Sampling and 5 panorama
	Other: Outfall #2	

WEATHER: SUN/CLEAR ____ CLOUDY/RAIN X WIND DIRECTION ENE TEMPRATURE (°F) 70

SHIPMENT VIA: FED-X ____ HAND DELIVER X COURIER ____ OTHER ____

SHIPPED TO: ESN Pacific

COMMENTS:

SAMPLER: Shawn MacMillan OBSERVER: Karl Bromwell

Notes:
Subsamples
1&2 ~40' from WKIP52 in ~16" of water ~3'of core recovered.
3&4 ~50' from WKIP52 in ~24" of water ~2'of core recovered.
5&6 ~60' from WKIP52 in ~48" of water ~5'of core recovered.

RCRA 8 Metals: Ag, As, Ba, Cd, Cr, Hg, Pb, Se

FIELD SAMPLING REPORT (Sediment Samples)

Location: Kaelepulu Pond PROJECT: Kaelepulu Pond SWDS and CF BMP's

Description Six sub samples taken ~20, 30 and 40 feet from WKIP14.

Sediment Composition Clay 25 %, Silt 25 %, Sand 35 %, Gravel 15 %

Nearby Utilities None

Sediment Sample

Matrix: SED Sample ID: WKIP14

Sampling Method: 1.5"x48" or 1"x72" Acetate Tube DUP./REP. OF:

Composite: Yes Matrix Spike / Matrix Spike Duplicate

Yes: ____ No: X

Sample Date: 9/20/06 Sample Time: 0834

Sediment Parameters

CONTAINER			PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	CONSTITUENT DESCRIPTION	ANALYZE FOR? (Y/N)
SIZE	TYPE	#					
4 oz	Jar	1	None < 4°C		EPA 7000 / EPA 8081 mod	RCRA 8 Metals / Chlor. Pest.	✓
4 oz	Jar	1	None < 4°C		EPA 351.2 / SM4500-P B,C	Total Nitrogen / Total Phosphorus	✓
8 oz	Poly	2	None < 4°C		ASTM D422	Grain Size	✓

Notable Observations

PID READINGS	SAMPLE CHARACTERISTICS	MISCELLANEOUS
1st n/a	Color: Black	Pic.# 10 arriving at site
2nd n/a	Odor: H_2S	11 close up
	Other: Outfall #3	

WEATHER: SUN/CLEAR ____ CLOUDY/RAIN X WIND DIRECTION ENE TEMPRATURE (°F) 75

SHIPMENT VIA: FED-X ____ HAND DELIVER X COURIER ____ OTHER ____

SHIPPED TO: ESN Pacific

COMMENTS:

SAMPLER: Shawn MacMillan OBSERVER: Karl Bromwell

Notes:
Subsamples
1&2 ~20' from WKIP14 in ~18" of water ~3'of core recovered.
3&4 ~30' from WKIP14 in ~30" of water ~3'of core recovered.
5&6 ~40' from WKIP14 in ~38" of water ~3'of core recovered.

RCRA 8 Metals: Ag, As, Ba, Cd, Cr, Hg, Pb, Se

FIELD SAMPLING REPORT (Sediment Samples)

Location: Kaelepulu Pond PROJECT: Kaelepulu Pond SWDS and CF BMP's

Description Six sub samples taken ~50, 55 and 60 feet from WKIP10.

Sediment Composition Clay 20 %, Silt 20 %, Sand 50 %, Gravel 10 %

Nearby Utilities None

Sediment Sample

Matrix: SED Sample ID: WKIP10

Sampling Method: 1.5"x48" or 1"x72" Acetate Tube DUP./REP. OF:

Composite: Yes Matrix Spike / Matrix Spike Duplicate

Yes: ____ No: X

Sample Date: 9/20/06 Sample Time: 0908

Sediment Parameters

CONTAINER			PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	CONSTITUENT DESCRIPTION	ANALYZE FOR? (Y/N)
SIZE	TYPE	#					
4 oz	Jar	1	None < 4°C		EPA 7000 / EPA 8081 mod	RCRA 8 Metals / Chlor. Pest.	✓
4 oz	Jar	1	None < 4°C		EPA 351.2 / SM4500-P B,C	Total Nitrogen / Total Phosphorus	Hold
8 oz	Poly	2	None < 4°C		ASTM D422	Grain Size	Hold

Notable Observations

PID READINGS	SAMPLE CHARACTERISTICS	MISCELLANEOUS
1st n/a	Color: Black	Pic.# 12-16 pan
2nd n/a	Odor: H_2S	17-19 sampling
	Other: Outfall #4	20-21 composite bucket
		22 sample tube

WEATHER: SUN/CLEAR ____ CLOUDY/RAIN X WIND DIRECTION ENE TEMPRATURE (°F) 78

SHIPMENT VIA: FED-X ____ HAND DELIVER X COURIER ____ OTHER ____

SHIPPED TO: ESN Pacific

COMMENTS:

SAMPLER: Shawn MacMillan OBSERVER: Karl Bromwell

Notes:
Subsamples
1&2 ~50' from WKIP10 in ~18" of water at the sand bar between the signs ~3' of core recovered.
3&4 ~55' from WKIP10 in ~18" of water at the sand bar between the signs ~3' of core recovered.
5&6 ~60' from WKIP10 in ~20" of water at the sand bar between the signs ~3.5'of core recovered.

RCRA 8 Metals: Ag, As, Ba, Cd, Cr, Hg, Pb, Se

Screening Quick Reference Tables

This set of NOAA **Screening Quick Reference Tables**, or SQuiRTs, presents screening concentrations for inorganic and organic contaminants in various environmental media. Guidelines for sample preservation and options for laboratory analytical techniques are also included.

The SQuiRT cards were developed for internal use by the Coastal Protection & Restoration Division (CPR) of NOAA. The CPR Division identifies potential impacts to coastal resources and habitats likely to be affected by hazardous waste sites. To initially identify substances which may threaten resources of concern to NOAA, environmental concentrations are compared to these screening levels. These tables are intended for preliminary screening purposes only: they do not represent official NOAA policy and do not constitute criteria or clean-up levels. NOAA does not endorse their use for any other purposes. Screening levels are reported with the number of significant figures they were originally reported with.

Further guidance on the recommended application of various screening guidelines is provided in the supporting source documentation (listed on the last page of each section). Users of the SQuiRT cards are strongly encouraged to review supporting documentation to determine appropriateness for their specific use.

The SQuiRT card set is organized into the following sections:

- Inorganics in Solids (freshwater and marine sediment, plus soil)
- Inorganics in Water (groundwater and surface water)
- Organics in Water and Solids
- Analytical Methods for Inorganics
- Analytical Methods for Organics
- Guidelines for Sample Collection & Storage

For surface water samples, the CPR Division compares measured contaminant concentrations to their applicable, EPA Ambient Water Quality Criteria (AWQC) for the protection of aquatic organisms. Because releases from hazardous waste sites are often continuous and long-term, concentrations are compared directly with the chronic AWQC, when available. SQuiRTs for trace element AWQCs have been updated to show values for just filtered samples, as well as the formulae to calculate exact criteria for elements whose criteria are hardness-dependent. Groundwater concentrations are also screened against AWQC. However, given the dilution expected during migration and upon discharge of groundwater to surface water, CPRD uses 10 times the applicable AWQC for screening. If available, suitable site-specific dilution factors are used. Maximum Contaminant Levels (MCLs), applicable to drinking water sources and secondary MCLs applicable to groundwater, are also provided on the SQuiRT cards.

Promulgated criteria similar to the AWQC are generally not available for contaminated soils or sediments. For screening purposes, inorganic contaminant levels in soils are compared to the average concentrations found in natural soils of the United States. Organic compounds in soil are screened against risk-based Canadian soil standards. Soil standards for different land use categories are listed to provide perspective. Soil values are not used by NOAA to estimate aquatic exposures. NOAA screens soil concentrations only to estimate which contaminants may be elevated and thus represent potential contaminant sources to aquatic habitats of concern.

Multiple sediment screening values have been included in the NOAA SQuiRTs to help portray the entire spectrum of concentrations which have been associated with various probabilities of adverse biological effects. This spectrum ranges from presumably non-toxic e.g., trace metal levels reported to represent non-anthropogenically

CONTINUED ON LAST PAGE

noaa SQuiRTs™ Screening Quick Reference Table for Inorganics in Solids

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(values in ppb dry weight)

COMPOUND	FRESHWATER SEDIMENT					MARINE SEDIMENT					SOIL	
	"Background" [1]	Lowest ARCS *H. azteca* TEL	Threshold Effects Level (TEL)	Probable Effects Level (PEL)	Upper [2] Effects Threshold (UET)	Threshold Effects Level (TEL)	Effects Range-Low (ERL)	Probable Effects Level (PEL)	Effects Range Median (ERM)	Apparent [3] Effects Threshold (AET)	Background Geometric Mean	Background Range
Predicted Toxicity Gradient:	----------	Increasing →				Increasing →					----------	
ALUMINUM (Al) (%)	0.26%	2.55%								1.8% N	4.7%	0.5- >10%
ANTIMONY (Sb)	160				3,000 M					9,300 E	480	bd-8,800
ARSENIC (As)	1,100	10,798	5.900	17,000	17,000 I	7,240	8,200	41,600	70,000	35,000 B	5,200	bd-97,000
BARIUM (Ba)	700									48,000 A	440,000	10,000-0.5%
CADMIUM (Cd)	100-300	583	596	3,530	3,000 I	676	1,200	4,210	9,600	3,000 N		
CHROMIUM (Cr)	7,000-13,000	36,286	37,300	90,000	95,000 H	52,300	81,000	160,400	370,000	62,000 N	37,000	1000-0.2%
COBALT (Co)	10,000									10,000 N	6,700	bd-70,000
COPPER (Cu)	10,000-25,000	28,012	35,700	197,000	86,000 I	18,700	34,000	108,200	270,000	390,000 MO	17,000	bd-700,000
IRON (Fe) (%)	0.99-1.8 %	18.84%			4% I					22% N	1.8%	0.01- >10%
LEAD (Pb)	4,000-17,000	37,000	35,000	91,300	127,000 H	30,240	46,700	112,180	218,000	400,000 B	16,000	bd-700,000
MANGANESE (Mn)	400,000	630,000			1,100,000 I					260,000 N	330,000	bd-0.7%
MERCURY (Hg)	4-51		174	486	560 M	130	150	696	710	410 M	58	bd-4,600
NICKEL (Ni)	9,900	19,514	18,000	35,900	43,000 H	15,900	20,900	42,800	51,600	110,000 EL	13,000	bd-700,000
SELENIUM (Se)	290									1,000 A	260	bd-4,300
SILVER (Ag)	<500				4,500 H	730	1,000	1,770	3,700	3,100 B		
STRONTIUM (Sr)	49,000										120,000	bd-0.3%
TIN (Sn)	5,000					48 *				> 3,400 N as TBT	890	bd-10,000
VANADIUM (V)	50,000									57,000 N	58,000	bd-500,000
ZINC (Zn)	7,000-38,000	98,000	123,100	315,000	520,000 M	124,000	150,000	271,000	410,000	410,000 I	48,000	bd-0.29%
SULFIDES					130,000 M					4,500 MO		

1 "Background" values are derived from a compilation of sources, but come primarily from Int. Joint Comm. Sediment Subcommittee (1988).

2 Entry is lowest, reliable value among a compilation of AET levels: I - Infaunal community impacts; H - *Hyalella azteca* bioassay; M - Microtox bioassay

3 Entry is lowest value among AET levels: I - Infaunal community impacts; A-Amphipod; B-Bivalve; M-Microtox; O-Oyster larvae; E-Echinoderm larvae; L-Larval$_{max}$; or , N-Neanthes bioassays

* - Based upon EqP approach using currently proposed AWQC CCC.

SOURCES:

Sediment: PTI Environ. Serv., Contaminated Sediments Criteria Rpt., 1989; Wash. Dept. Ecol. Publ. 95-308, 1995 and 97-323a, 1997; J. Great Lakes Res. 22(3):624-638, 1996, Gries & Waldow, Puget Sound Dredged Disposal Analysis Rpt., 1996, Environ. Manage. 19(1):81-97, 1996; The AET Approach, Briefing Rpt. to the EPA SAB, Sept. 1988; Int. Joint Comm., Procedures for Assessment of Contaminated Sediment in the Great Lakes, 1988; Ecotox. (5):253-278, 1996; EPA Rpt. 905-R96-008, Sept. 1996.; WAC Chapter 173-204; J. Great Lakes Res. 22(3):602 - 623, 1996.

Soil: Shacklette and Boerngen 1984; USGS Prof. Paper 1270: bd denotes below detection limits.

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Screening Quick Reference Table for Inorganics in Water

These tables were developed for internal use for screening purposes only; they do not represent official NOAA policy nor constitute criteria or clean-up levels. All attempts have been made to ensure accuracy; however, NOAA is not liable for errors. Values are subject to changes as new data become available.

(values in ppb)

TRACE ELEMENT	GROUND WATER	SURFACE WATER Ambient Water Quality Criteria				NOTES
		Freshwater		*Marine*		
	Maximum Contaminant Levels (MCLs)	CMC "acute"	CCC "chronic"	CMC "acute"	CCC "chronic"	
ALUMINUM (Al)	50–200 *	pH 750	pH 87			For pH 6.5 to 9.0 and expressed as total recoverable.
ANTIMONY (Sb)	6	88 p	30 p	1500 p	500 p	
ARSENIC (As^{+5})		850 *		2319*		LOELs from 50 FR 30789.
ARSENIC, total	10	340	150	69	36	Toxicity values derived for arsenic III are now applied to total arsenic.
BARIUM (Ba)	2000	110	4.0			Tier II value for freshwater.
BERYLLIUM (Be)	4	130 *	5.3 *			LOELs from 45 FR 79326.
CADMIUM (Cd)	5	2.0 †	0.25 †	40	8.8	
CHROMIUM (Cr^{+3})	≤ 100	570 †	74 †	10300 *		
CHROMIUM (Cr^{+6})	≤ 100	16	11	1100	50	Marine values represent change to filtered basis.
CHROMIUM, total	100					
COPPER (Cu)	1300	13 †	9 †	4.8	3.1	
IRON (Fe)	300 *		1000			
LEAD (Pb)	15	65 †	2.5 †	210	8.1	Values represent change to filtered basis.
MANGANESE (Mn)	50 *	2,300	120			Tier II value for freshwater.
MERCURY (Hg)	2	1.4	0.77	1.8	0.94	Derived from inorganic, but applied to total mercury. Does not account for food web uptake.
NICKEL (Ni)		470 †	52 †	74	8.2	Marine values represent change to filtered basis.
PHOSPHORUS (P)					0.1	For elemental phosphorus.
SELENIUM (Se)	50	13-186 total	5 total	290	71	Freshwater CMC depends on ratio of selenite to selenate. Marine values represent change to filtered basis. Marine CCC does not account for food web uptake, so monitor fish community if > 5.0 µg/L.
SILVER (Ag)	100 *	1.6 (2) †		0.95 (2)		CMCs has been divided by two to be comparable to 1985 derivations.
THALLIUM (Tl)	2	1400 *	40 *	2130 *		LOELs from 45 FR 79340.
Tin as TBT		0.46	0.072	0.42	0.0074	
ZINC (Zn)	5000 *	120 †	120 †	90	81	Marine values represent change to filtered basis.
Hydrogen Sulfide		2.0		2.0		
Cyanide, free (CN)	200	22	5.2	1	1	

p - proposed

* - Lowest Observable Effect Level (not a criterion)

* - National Secondary Drinking Water Regulations

(2) - CMC has been halved to be comparable to criteria derived using 1985 Guidelines

† Hardness-dependent value with 400 mg/L as maximum calcium carbonate; value entered is for 100 mg/L calcium carbonate. Use equations to determine exact criteria.

Criteria are generally expressed as dissolved (passing through a 0.45 mm filter) and calculated from total recoverable by applying a conversion factor, except as noted.

For salinity between 1 and 10 ppt, use the more stringent of either fresh or marine values.

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Screening Quick Reference Table for Inorganics in Water

(values in ppb)

These tables were developed for internal use for screening purposes only: they do not represent official NOAA policy nor constitute criteria or clean-up levels. All attempts have been made to ensure accuracy; however, NOAA is not liable for errors. Values are subject to changes as new data become available..

TRACE ELEMENT	HARDNESS CALCULATIONS FOR UNFILTEREED FRESHWATER CRITERIA		UNFILTERED TO FILTERED CALCULATIONS CONVERSION FACTORS		
	CMC	CCC	Fresh CMC CMC/CCC	Fresh CCC	Marine
ARSENIC (AS)			CF = 1	CF = 1	CF = 1
CADMIUM (Cd)	$CMC = e^{1.0166\,[\ln(\text{hardness})] - 3.924}$	$CCC = e^{0.7409\,[\ln(\text{hardness})] - 4.719}$	CF = 1.136672 - 0.041838 [ln(hardness)]	CF = 1.101672 - 0.041838 [ln(hardness)]	CF = 0.994
CHROMIUM III (CR^{+3})	$CMC = e^{0.819\,[\ln(\text{hardness})] + 3.7256}$	$CCC = e^{0.819\,[\ln(\text{hardness})] + 0.6848}$	CF = 0.316	CF = 0.860	
CHROMIUM VI ($Cr.^{+6}$)			CF = 0.982	CF = 0.962	CF = 0.993
COPPER (Cu)	$CMC = e^{0.9422\,[\ln(\text{hardness})] - 1.7}$	$CCC = e^{0.8545\,[\ln(\text{hardness})] - 1.702}$	CF = 0.960	CF = 0.960	CF = 0.83
LEAD (Pb)	$CMC = e^{1.273\,[\ln(\text{hardness})] - 1.46}$	$CCC = e^{1.273\,[\ln(\text{hardness})] - 4.705}$	CF = 1.46203 - 0.145712 [ln(hardness)]	SAME AS CMC	CF = 0.951
MERCURY (Hg)			CF = 0.85	CF = 0.85	CF = 0.85
NICKEL (Ni)	$CMC = e^{0.846\,[\ln(\text{hardness})] + 2.255}$	$CCC = e^{0.846\,[\ln(\text{hardness})] + 0.0584}$	CF = 0.998	CF = 0.997	CF = 0.990
SELENIUM (Se)			The freshwater criteria are expressed as total recoverable; a CF of 0.922 may be used.		CF = 0.998
SILVER (Ag)	$CMC = e^{1.72\,[\ln(\text{hardness})] - 6.52}$	CCC — No criteria	CF = 0.85		CF = 0.85
ZINC (Zn)	$CMC = e^{0.8473\,[\ln(\text{hardness})] + 0.884}$	$CCC = e^{0.8473\,[\ln(\text{hardness})] + 0.884}$	CF = 0.978	CF = 0.986	CF = 0.946

Freshwater criterion for certain metals are expressed as a function of hardness (mg/L) in the water column. The values shown on page 3 assume 100 mg/L. Values for a different hardness may be calculated using the above equations to arrive at a CMC or CCC for ***filtered*** samples. Hardness may range up to 400 mg/L as calcium carbonate. For hardness above this range, use 400 mg/L as the maximum value allowed.

Criteria for most metals are expressed as standards for samples filtered through 0.45 μm filter (*i.e.*, "dissolved"). To convert unfiltered concentrations to filtered, multiply the unfiltered concentration value by the appropriate Conversion Factor (CF) above. For cadmium and lead, the conversion factor itself is hardness-dependent.

For salinity between 1 and 10 ppt, use the more stringent of either fresh or marine values.

CMC – Criteria Maximum Concentration is the highest level for a 1-hour average exposure not to be exceeded more than once every three years, and is synonymous with "acute."

CCC – Criteria Continuous Concentration is the highest level for a 4-day average exposure not to be exceeded more than once every three years, and is synonymous with "chronic."

Sources:

MCL	EPA 810-F-94-001A EPA 570/9-91-019FS
AWQC:	Fed. Reg. 4 May 1995, Vol. 60 (86): 22229-22237; Fed. Reg. 10 Dec 1998 Vol. 63(237:) 68353 - 68364 US EPA, Quality Criteria for Water Summary 1994, EPA Health and Ecological Criteria Division www.epa.gov/waterscience/criteria/wqcriteria.html; Tier II from ORNL ES/ER/TM/-96/R2.;

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(all values in ppb, dry weight for sediment and soil, except as noted)

Screening Quick Reference Table for Organics

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CHEMICAL	CAS No.	WATER: Maximum Contaminant Level	WATER: Ambient Water Quality Criteria [1] Freshwater CMC	WATER: Ambient Water Quality Criteria [1] Freshwater CCC	WATER: Ambient Water Quality Criteria [1] Marine CMC	WATER: Ambient Water Quality Criteria [1] Marine CCC	SEDIMENT: Freshwater Sediment: Lowest ARCS *H. azteca* TEL	SEDIMENT: Freshwater Sediment: Threshold Effects Level (TEL)	SEDIMENT: Freshwater Sediment: Probable Effects Level (PEL)	SEDIMENT: Freshwater Sediment: Upper [2] Effects Threshold (UET)	SEDIMENT: Marine Sediment: Threshold Effects Level (TEL)	SEDIMENT: Marine Sediment: Effects Range-Low (ERL)	SEDIMENT: Marine Sediment: Effects Range-Median (ERM)	SEDIMENT: Marine Sediment: Probable Effects Level (PEL)	SEDIMENT: Marine Sediment: Apparent [3] Effects Threshold (AET)	SOIL: Agri-cultural [4] Target	SOIL: Urban park / Residential [4] Target
CHLORINATED DIOXINS & PCBS																	
TCDD 2,3,7,8-	1746016	0.00003	<0.01*	<0.00001*						0.0088†H					0.0036 N	0.01	1
POLYCHLORINATED BIPHENYLS	1336363	0.5	2	0.014	10	0.03	31.62	34.1	277	26 M	21.55	22.7	180	188.79	130 M	500	5000
SEMIVOLATILES																	
BENZIDINE	92875		70 ~	3.9 ~													
BENZOIC ACID	65850		740 ~	42 ~											65 O		
BENZYL ALCOHOL	100516		150 ~	8.6 ~											52 B		
CHLOROANILINE 4-	106478		250*C	50*C	160*C	129*C											
DIBENZOFURAN	132649		66 ~	3.7 ~						5100 H					110 E		
DIPHENYLHYDRAZINE 1,2-	122667		270*														
ISOPHORONE	78591		117000*		12900*												
SEMIVOLATILE, NITROAROMATICS																	
DINITROTOLUENE 2,4-	121142		330*	230*	590* S	370*S											
NITROBENZENE	98953		27000*		6680*										21 N		
N-NITROSODIPHENYLAMINE	86306		5850C*	210 ~	3300000*C										28 I		
SEMIVOLATILE, ORGANOCHLORINES																	
ALDRIN	309002		1.5 (2)		0.65 (2)					40 I					9.5 AE		
CHLORDANE	57749	2	1.2 (2)	0.00215 (2)	0.045 (2)	0.002 (2)		4.5	8.9	30 I	2.26	0.5	6	4.79	2.8 A		
CHLORONAPHTHALENE 2-	91587		1600* C		7.5* C												
p,p-DDD (TDE)	72548		0.6*	0.011 ~	3.6*			3.54	8.51	<60 I	1.22	2	20	7.81	<16 I		
p,p-DDE	72559		1050*		14*			1.42	6.75	<50 I	2.07	2.2	27	374.17	<9 I		
p,p-DDT	50293		0.55 (2)	0.0005 (2)	0.065 (2)	0.0005 (2)				50 I	1.19	1	7	4.77	<12 E		
DDT, total								6.98	4450	50 I	3.89	1.58	46.1	51.7	11 B		
DIELDRIN ‡	60571		0.24	0.056	0.355 (2)	0.00095 (2)		2.85	6.67	300 I	0.715	0.02	8	4.3	1.9 E		
ENDOSULFAN (α + β)	115297		0.11 (2)	0.028 (2)	0.017 (2)	0.00435 (2)											
ENDRIN ‡	72208	2	0.086	0.036	0.0185 (2)	0.00115 (2)		2.67	62.4	500 I							
HEPTACHLOR	76448	0.4	0.26 (2)	0.0019 (2)	0.0265 (2)	0.0018 (2)				10 I					0.3 B		
HEPTACHLOR EPOXIDE	1024573	0.2	0.26 (2)	0.0019 (2)	0.0265 (2)	0.0018 (2)		0.6	2.74	30 I							
HEXACHLOROBENZENE	118741	1	6 p	3.68 p	160*C	129*C				100 I					6 B	50	2000
HEXACHLOROBUTADIENE	87683		90*	9.3*	32*										1.3 E		
HEXACHLOROCYCLOHEXANE (BHC)	608731		100*		0.34*					100 I						50	2000

‡ — EPA Proposed Criteria, based on Equilibrium Partitioning, for Dieldrin are 11,000 and 20,000, and for Endrin are 4,200 and 760 µg/kg O.C. in freshwater and marine sediment, respectively.

1 p - proposed; * - Lowest Observable Effect Level; C - value for chemical class; S - value for summation of isomers; (2) - CMC has been halved to be comparable to criteria derived by 1985 Guidelines. ~Tier II value.

2 Entry is lowest, reliable value among AET tests, on 1% TOC basis: I - Infaunal community impacts; M - Microtox bioassay; H - *Hyalella azteca* bioassay ; † - value on dry weight basis.

3 Entry is lowest value among AET tests: I - Infaunal community impacts; A-Amphipod ; B-Bivalve ; M-Microtox ; O-Oyster larvae ; E-Echinoderm larvae; L-Larval$_{max}$; or , N-Neanthes bioassays.

4 Residues greater than target require remediation to levels below target for applicable land use in British Columbia: 'A' denotes a soil value intended to protect adjacent, aquatic habitat.

noaa SQuiRTs™

(all values in ppb, dry weight for sediment and soil, except as noted)

Screening Quick Reference Table for Organics

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CHEMICAL	CAS No.	WATER: Maximum Contaminant Level	WATER: Ambient Water Quality Criteria [1] Freshwater CMC	WATER: Freshwater CCC	WATER: Marine CMC	WATER: Marine CCC	SEDIMENT: Freshwater Sediment: Lowest ARCS *H. azteca* TEL	SEDIMENT: Freshwater Sediment: Threshold Effects Level (TEL)	SEDIMENT: Freshwater Sediment: Probable Effects Level (PEL)	SEDIMENT: Freshwater Sediment: Upper [2] Effects Threshold (UET)	SEDIMENT: Marine Sediment: Threshold Effects Level (TEL)	SEDIMENT: Marine Sediment: Effects Range-Low (ERL)	SEDIMENT: Marine Sediment: Effects Range-Median (ERM)	SEDIMENT: Marine Sediment: Probable Effects Level (PEL)	SEDIMENT: Marine Sediment: Apparent [3] Effects Threshold (AET)	SOIL: Agricultural [4] Target	SOIL: Urban [4] park / Residential Target
HEXACHLOROCYCLOPENTADIENE	77474	50	7*	5.2*	7*										73 BL		
HEXACHLOROETHANE	67721		980*	540*	940*										> 4.6 N		
LINDANE	58899	0.2	0.95	0.08	0.08 (2)			0.94	1.38	9 I	0.32			0.99			
METHOXYCHLOR	72435	40		0.03		0.03											
MIREX	2385855			0.001		0.001				800 I							
PENTACHLOROBENZENE	608935		250*C	50*C	160*C	129*C										100	1000
TETRACHLOROBENZENE 1,2,4,5-	95943		250*C	50*C	160*C	129*C										100	1000
TOXAPHENE	8001352	3	0.73	0.0002	0.21	0.0002											
SEMIVOLATILE, ORGANOPHOSPHATES																	
ATRAZINE	1912249		1500	Special	760	17											
CHLORPYRIFOS	2921882		0.083	0.041	0.011	0.0056											
DIAZINON	333415		0.1	0.1	0.82	0.4											
MALATHION	121755			0.1		0.1											
PARATHION MIXTURE	56382		0.065	0.013													
SEMIVOLATILE, PHENOLICS																	
CHLOROPHENOL 2-	95578		4380*												8 A	50	500
DICHLOROPHENOL 2,4-	120832		2020*	365*											5 A	50	500
DIMETHYLPHENOL 2,4-	105679		2120*												18 N	100	1000
DINITROPHENOL	51285		230*C	150*C	4850*C											100	1000
METHYL PHENOL 2- [O-CRESOL]	95487		230 ~	13 ~											8 B	100	1000
METHYL PHENOL 4- [p-CRESOL]	106445														100 B	100	1000
NITROPHENOL 4-	100027		230*C	150*C	4850*C											100	1000
NONYLPHENOL	25154523		27.9	5.9	5.7	1.4											
PENTACHLOROPHENOL[at pH 7.8‡]	87865	1.0 p	19 pH	15 pH	13	7.9									17 B	35 A pH	35 A pH
PHENOL	108952		10200*	2560*	5800*					48 †H					130 E	100	1000
TETRACHLOROPHENOL 2,3,4,5-	58902				440*											50	500
TRICHLOROPHENOL 2,4,5-	95954		100 p	63 p	240 p	11 p									3 I	50	500
TRICHLOROPHENOL 2,4,6-	88062			970*											6 I	50	500
SEMIVOLATILE, PHTHALATES																	
BUTYL BENZYL PHTHALATE	85687		940*C	3*C	2944*C	3.4*C									63 M		
DI[2-ETHYLHEXYL] PHTHALATE	117817	6	400 p	360 p	400 p	360 p				750 †M	182.16			2646.51	1300 I		
DIETHYL PHTHALATE	84662		940*C	3*C	2944*C	3.4*C									6 BL		
DIMETHYL PHTHALATE	131113		940*C	3*C	2944*C	3.4*C									6 B		
DI-N-OCTYL PHTHALATE	117840		940*C	3*C	2944*C	3.4*C									61 BL		
DI-N-BUTYL PHTHALATE	84742		940*C	3*C	2944*C	3.4*C				110 H					58 BL		

‡ — For PCP, freshwater CMC = $e^{1.005pH - 4.869}$ and CCC = $e^{1.005pH - 5.134}$

1 p - proposed; * - Lowest Observable Effect Level; C - value for chemical class; S - value for summation of isomers; (2) - CMC has been halved to be comparable to criteria derived by 1985 Guidelines; ~ Tier II value.

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(all values in ppb, dry weight for sediment and soil, except as noted)

Screening Quick Reference Table for Organics

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CHEMICAL	CAS No.	WATER: Maximum Contaminant Level	WATER: Ambient Water Quality Criteria [1] Freshwater CMC	WATER: Freshwater CCC	WATER: Marine CMC	WATER: Marine CCC	SEDIMENT: Freshwater Sediment: Lowest ARCS *H. azteca* TEL	Freshwater Sediment: Threshold Effects Level (TEL)	Freshwater Sediment: Probable Effects Level (PEL)	Marine Sediment: Upper [2] Effects Threshold (UET)	Marine Sediment: Threshold Effects Level (TEL)	Marine Sediment: Effects Range-Low (ERL)	Marine Sediment: Effects Range-Median (ERM)	Marine Sediment: Probable Effects Level (PEL)	Marine Sediment: Apparent [3] Effects Threshold (AET)	SOIL: Agricultural [4] Target	SOIL: Urban [4] park / Residential Target
SEMIVOLATILE, PAHs																	
ACENAPHTHENE	83329		1700*	520*	970*	710*				290 M	6.71	16	500	88.9	130 E		
ACENAPHTHYLENE	208968				300*C					150 M	5.87	44	640	127.87	71 E		
ANTHRACENE	120127		13 ~	0.73 ~	300*C		10			250 M	46.85	85.3	1100	245	280 E		
BENZO[K]FLUORANTHENE	207089				300*C		27.2			13,400B					1800 EI	100	1000
BENZO[A]PYRENE	50328	0.2	0.24 ~	0.014 ~	300*C		32.4	31.9	782	700 I	88.81	430	1600	763.22	1100 E	100	1000
BENZO[B]FLUORANTHENE	205992				300*C										1800 EI	100	1000
BENZO[GHI]PERYLENE	191242				300*C					300 M					670 M		
BENZ[A]ANTHRACENE	56553		0.49 ~	0.027 ~	300*C		15.72	31.7	385	500 I	74.83	261	1600	692.53	960 E	100	1000
CHRYSENE	218019				300*C		26.83	57.1	862	800 I	107.77	384	2800	845.98	950 E		
DIBENZ[A,H]ANTHRACENE	53703				300*C		10			100 M	6.22	63.4	260	134.61	230 OM	100	1000
FLUORANTHENE	206440		3980*		40*	16 *	31.46	111	2355	1,500 M	112.82	600	5100	1493.54	1300 E		
FLUORENE	86737		70 ~	3.9 ~	300*C		10			300 M	21.17	19	540	144.35	120 E		
INDENO[1,2,3-CD]PYRENE	193395				300*C		17.32			330 M					600 M	100	1000
METHYLNAPHTHALENE, 2-	91576				300*C						20.21	70	670	201.28	64 E		
NAPHTHALENE	91203		2300*	620*	2350*		14.65			600 I	34.57	160	2100	390.64	230 E	100	5000
PHENANTHRENE	85018		30 p	6.3 p	7.7 p	4.6 p	18.73	41.9	515	800 I	86.68	240	1500	543.53	660 E	100	5000
PYRENE	129000				300*C		44.27	53	875	1,000 I	152.66	665	2600	1397.6	2400 E	100	10000
LMW PAHs					300*C		76.42			5,300 M	311.7	552	3160	1442.00	1200 E		
HMW PAHs					300*C		192.95			6,500 M	655.34	1700	9600	6676.14	7900 E		
Total PAHs					300*C		264.05			12,000M	1684.06	4022	44792	16770.4			
VOLATILE, AROMATIC & HALOGENATED																	
BENZENE	71432	5	5300*	130 ~	5100*	700*										8 A	8 A
BIS[2-CHLOROETHOXY]METHANE	111911		11000*C		12000*C	6400*C											
CARBON TETRACHLORIDE	56235	5	35200*	9.8 ~	50000*											100	5000
CHLOROBENZENE	108907	100	250*C	50*C	160*C	129*C										100	1000
CHLORODIBROMOMETHANE	124481	100C	11000*C		12000*C	6400*C											
CHLOROFORM	67663	5	28900*	1240*												100	5000
DIBROMOMETHANE	74953	0.05	11000*C		12000*C	6400*C											
DICHLOROBENZENE 1,2-	95501	600	1120*S	763*S	1970*S	129*C									13 N	100	1000
DICHLOROBENZENE 1,4-	106467	75	1120*S	763*S	1970*S	129*C									1101 M	100	1000
DICHLOROBROMOMETHANE	75274	100C	11000*C		12000*C	6400*C											
DICHLORODIFLUOROMETHANE	75718		11000*C		12000*C	6400*C											

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(all values in ppb, dry weight for sediment and soil, except as noted)

		WATER					SEDIMENT									SOIL	
							Freshwater Sediment				Marine Sediment						
CHEMICAL	CAS No.	Maximum Contaminant Level	Ambient Water Quality Criteria [1] Freshwater CMC	Freshwater CCC	Marine CMC	Marine CCC	Lowest ARCS *H. azteca* TEL	Threshold Effects Level (TEL)	Probable Effects Level (PEL)	Upper [2] Effects Threshold (UET)	Threshold Effects Level (TEL)	Effects Range-Low (ERL)	Effects Range-Median (ERM)	Probable Effects Level (PEL)	Apparent [3] Effects Threshold (AET)	Agricultural [4] Target	Urban [4] park / Residential Target
DICHLOROETHANE 1,2-	107062		118000*	20000*	113000*											100	5000
DICHLOROETHYLENE 1,2-cis	540590	70	11600*S		224000*S											100	5000
DICHLOROETHYLENE 1,2-trans	156605	100	11600*S		224000*S											100	5000
DICHLOROPROPENE	542756		6060*S	244*S	790*S											100	5000
ETHYL BENZENE	100414	700	32000*	7.3 ~	430*										4 EL	0.1 % A	0.1 % A
ETHYLENE DICHLORIDE	107062	5	118000*	20000*	113000*											100	5000
METHYLENE CHLORIDE	75092	5	11000*C	2200 ~	12000*C	6400*C											
PENTACHLOROETHANE	76017		7240*	1100*	390*	281*											
PROPYLENE DICHLORIDE	78875	5	23000*S	5700*S	10300*S	3040*S											
STYRENE	100425	100														100	5000
TETRACHLOROETHANE	79345		9320*S													100	5000
TETRACHLOROETHANE 1,1,2,2-	79345		9320*S	2400*	9020*											100	5000
TETRACHLOROETHYLENE	127184	5	5280*	840*	10200*	450*									57 I	5000 A	5000 A
TOLUENE	108883	1000	17500*	9.8 ~	6300*	5000*										300000A	300000A
TRICHLOROBENZENE 1,2,4-	120821	70	250*C	50*C	160*C	129*C									> 4.8 E	100	1000
TRICHLOROETHANE 1,1,1-	71556	200	18000*S	11 ~	31200*											100	5000
TRICHLOROETHANE 1,1,2-	79005	5	18000*S	9400*												100	5000
TRICHLOROETHYLENE	79016	5	45000*	21900*	2000*										41 N	65 A	65 A
TRICHLOROFLUOROMETHANE	75694		11000*C		12000*C	6400*C											
VINYLIDENE CHLORIDE	75354	7	11600* S		224000*S												
XYLENE	1330207	10000	230 ~	13 ~											4 BL	100	5000
VOLATILES, NITRILES																	
ACROLEIN	107028		68*	21*	55*												
ACRYLONITRILE	107131		7550*	2600*													

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Sources

Water: EPA 810-F-94-001A; EPA 570/9-91-019FS; Fed. Reg. 4 May 1995, Vol. 60 (86): 22229-22237.; Fed. Reg. 10 Dec 1998 Vol. 63(237:) 68353 - 68364; EPA, Quality Criteria for Water Summary 1994, EPA Health and Ecological Criteria Div. Tier II from ORNL ES/ER/TM/-96/R2

Sediment: EPA 905-R96-008, Sept. 1996; J. Great Lakes Res. 22(3):624-638, 1996; Wash. Dep. Ecol. Publ. 95-308, 1995 and 97-323a, 1997; Environ. Manage. 19(1): 81 - 97, 1996; The AET Approach: Briefing Rpt. to the EPA SAB, September 1988; Gries & Waldow, Puget Sound Dredged Disposal Analysis Rept., 1996; Ecotox. (5):253-278, 1996: WAC Chapter 173-204

Soil: British Columbia Regulation 375/96, Contaminated Sites Regulation, June 13, 1997.

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Options For Selection of Analytical Methods: Inorganics

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TRACE ELEMENT	OTHER[1]	FLAME AA	FURNACE AA	ICP	EXTRACTION METHODS	
		7000B[2]	7010[2]		Water	Soil / Sediment
ALUMINUM (Al)	6800	7020		6010B 6020A	3005A 3010A 3015A	3050B 3051A
ANTIMONY (Sb)	6200(55) 6800	7040	7041 7062[3]	6010B 6020A	3005A 3015A	3050B 3051A
ARSENIC (As)	6200(60) 7063 7061A[3]		7060 7062[3]	6010B 6020A	3005A 3010A 3015A 7063	3050B 3051A
BARIUM (Ba)	6200(60) 6800	7080A	7081[3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
BERYLLIUM (Be)		7090	7091	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
CADMIUM (Cd)	6200 6800	7130	7131A	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
CALCIUM (Ca)	6200 6800	7140		6010B 6020A	3005A 3010A 3015A	3050B 3051A
CHROMIUM (CR), total	6200(200) 6800	7190	7191	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
CHROMIUM^{+6} (Cr^{+6})	7195 — 7199[3]				7195 - 7199	3060A
COBALT (Co)	6200(330)	7200	7201	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
COPPER (Cu)	6200(85) 6800	7210	7211[3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
IRON (Fe)	6200 6800	7380	7381[3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
LEAD (Pb)	6200(45) 6800	7420	7421	6010B 6020A	3005A 3010A 3015A 3020A	3051A
MAGNESIUM (Mg)	6800	7450		6010B 6020A	3005A 3010A 3015A	3050B 3051A
MANGANESE (Mn)	6200(240)	7460	7461	6010B 6020A	3005A 3010A 3015A	3050B 3051A
MERCURY (Hg)	4500(0.5) 6200 6800 7470A 7471B 7472 7473 7474[3]			6020A	7470A 7472 3015A	3051A 7471B 7473 7474
MOLYBDENUM (Mo)	6200(25) 6800	7480	7481	6010B	3005A 3010A 3015A 3020A	3050B 3051A
NICKEL (Ni)	6200(100) 6800	7520	7521	6010B 6020A	3005A 3010A 3015A	3050B 3051A
POTASSIUM (K)	6200 6800	7610		6010B 6020A	3005A 3010A 3015A	3050B 3051A
SELENIUM (Se)	6200 6800 7741A 7742[3]		7740	6010B 6020A	3005A 3010A 3015A	3050B 3051A
SILVER (Ag)	6200 6800	7760A	7761[3]	6010B 6020A	3005A 3015A	3051A 7760 7761
SODIUM (Na)		7770		6010B 6020A	3005A 3010A 3015A	3050B 3051A
STRONTIUM (Sr)	6200(30) 6800	7780		6010B	3015A	3050B 3051A
THALLIUM (Tl)	6200 6800	7840	7841	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
TIN (Sn)	6200(35)	7870				
VANADIUM (V)	6200 6800	7910	7911	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
ZINC (Zn)	6200(80) 6800	7950	7951[3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
CYANIDE (HCN)	9010B — 9014[3]					

1 Method 6200 is Portable X-Ray; 6800 is Elemental/Isotope Mass Spec.; 4500 is Immunoassay; 7063 is ASV; where available, soil detection limits in ppm are in parentheses.

2 Except as noted, most individual procedures are proposed to be integrated into Method 7000B or 7010.

3 Includes various methods. Follow the extraction procedure detailed in the individual determinative method.

Sources:

All method numbers refer to EPA SW-846, Volume III with changes as proposed for Volume IV.

ICP's advantage is that it allows simultaneous or rapid sequential determination of many elements, but suffers from interferences. AA determinations are normally completed as single element analyses. ICP and Flame AA have comparable detection limits (within a factor of 4), but ICP-MS (6020A) can drastically improve the detection limits (e.g., an order of magnitude lower). Furnace AA generally exhibits lower detection limits than ICP or Flame-AA, and offers more control over unwanted matrix components. X-RAY and immunoassays allow field determinations.

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Options For Selection of Analytical Methods: Organics

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COMPOUNDS	FIELD METHODS [1]	GC/MS METHOD	SPECIFIC DETECTION METHOD	HPLC METHOD	EXTRACTION METHODS		CLEANUP METHOD
					Water	Soil / Sediment	
AROMATIC and HALOGENATED VOLATILES		8260B	8021B		5021 5030B 5032	5021 5032 5035	
CARBAMATES				8318 8321B	8318 8321B	8318 8321B	8318
CHLORINATED DIOXINS and FURANS			8280B 8290A		8280B 8290A	8280B 8290A 3545A	8280B 8290A
CHLORINATED HYDROCARBONS		8270D	8121		3510C 3520C 3535A	3540C 3550B	3620B 3640A
CHLORINATED PHENOXYACIDS	4015 (0.1 ppm)	8270D [2]	8151A	8321B	8151A 8321B 3535A	8321B 8151A 3545A 3580A	8151A 3620B
HALOETHERS		8270D	8111		3510C 3520C	3540C 3545 3550B	3620B 3640A
NITRILES and AMIDES		8260B	8031 8032A 8033	8315 8316	5030B — 5032 8031 8032A 8316	5031 5032 5035	8032A
NITROAROMATICS and KETONES		8270D	8091	8330A	3510C 3520C 3535A	3540C 3545 3550B	3620B 3640A
NITROAROMATICS (Explosives)	4050 (0.5 ppm) 4051 8515 (1 ppm)			8330A - 8332	8330A — 8332	8330A — 8332	8330A — 8332 3620B
NITROSAMINES		8270D	8070A		3510C 3520C 8070A	3540C 3545 3550B 8070A	3610B 3620B 3640A 8070A
NON-HALOGENATED VOLATILES		8260B	8015B		5030B — 5032	5021 5031 5032 5035	
ORGANOCHLORINES	4040 — 4042 (0.2 to 20 ppm)	8270D [2]	8081B 8275A		3510C 3520C 3535A	3540C 3545A 3550B 3562	3620B 3630C 3640A 3660
ORGANOPHOSPHATES		8270D [2]	8141B	8321B	3510C 3520C 3535A	3540C 3545A 3550B	3620B
PAHS	4035 (1 ppm)	8270D	8100 8275A	8310	3510C 3520C	3540C 3545 3550B 3561	3610B 3630 3640A 3650B
PCBS	4020 (5 ppm) 9078 (2 ppm)	8270D [2]	8082A 8275A		3510C 3520C 3535A	3540C 3545A 3550B 3665A 3562	3620B 3630C 3640A 3660 3665A
PHENOLICS	4010A (0.5 ppm)	8270D	8041		3510C 3520C	3540C 3545 3550B	3630 3640A 3650B 8041
PHTHALATES		8270D	8061A		3510C 3520C 3535A	3540C 3545 3550B	3610B 3620B 3640A
SEMI-VOLATILE ORGANICS		8270D			3510C 3520C 3535A	3540C 3545A 3550B	3640A 3650B 3660
TOTAL ORGANIC HALIDES (TOX)			9020B 9022		9020B 9022		
TOTAL PETROLEUM HYDROCARBONS	4030 (5 ppm) 9074		8015B				
VOLATILE ORGANICS		8260B	8015B 8021B		5030B — 5032	5021 5031 5032 5035	

1 Series 9000 are immunoassays and are for specific compounds within these classes (i.e., 2,4D, TNT, RDX and PCP). Soil detection limits are in parentheses.

2 This is not a method of choice, but rather a confirmatory method.

SOURCES:

All method numbers refer to EPA SW-846 Update III, with changes as proposed in Update IV

Options shown are generally for chemical classes; more detailed information may be available for specific compounds

GC/MS methods allow for scanning a broad range of volatile and semi-volatile compounds, but suffer from interference and higher detection limits. Specific determination methods and HPLC methods allow for more precise determinations of specific compounds of interest.

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Guidelines for Sample Collection & Storage

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MATERIAL	CONTAINER [1]	PRESERVATION	MAXIMUM HOLDING TIME	SAMPLE SIZE
INORGANICS				
CHROMIUM^{6} (Cr^{6})	P,G	Cool, 4°C	24 hours	400 mL/200 g
MERCURY(Hg)	P,G	HNO_3, to pH <2	28 days	400 mL/200 g
METALS, except Cr^{6} and Hg	P,G	HNO_3, to pH <2	6 months	600 mL/200 g
CYANIDE by method no. 9010	P,G	Cool 4°C, pH >12 See method 9010	14 days	1000 mL
ALPHA, BETA, AND RADIUM RADIATION	P,G	HNO_3 to pH <2	6 months	1000 mL
ORGANICS				
BENZIDINES	G, TLC	Cool, 4°C	7 days until extraction, 40 days after extraction	1000 mL
CHLORINATED HYDROCARBONS	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
DIOXINS AND FURANS	G, TLC	Cool, 4°C[3]	30 days until extraction, 45 days after extraction	1000 mL
HALOETHERS	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
NITRITES	G, TLC	Cool, 4°C[3]	14 days	
NITROSAMINES	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
NITROAROMATICS AND CYCLIC KETONES	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
OIL and GREASE	G	Cool, 4°C[2]	28 days	1000 mL
TOTAL ORGANIC CARBON, by method no. 906	P,G	Cool, 4°C[2] store in the dark	28 days	100 mL
TOTAL ORGANIC HALIDES by method no. 9020/9021	G, TLC	Cool, 4°C[2]	28 days	500 mL
PCBs	G, TLC	Cool, 4°C	7 days until extraction, 40 days after extraction	1000 mL/250 mL
PESTICIDES	G, TLC	Cool 4°C,	7 days until extraction, 40 days after extraction	1000 mL/250 mL
PHENOLS	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
PHTHALATE ESTERS	G, TLC	Cool, 4°C	7 days until extraction, 40 days after extraction	1000 mL
POLYNUCLEAR AROMATIC HYDROCARBONS	G, TLC	Cool, 4°C[3] store in the dark	7 days until extraction, 40 days after extraction	1000 mL/250 mL
PURGEABLE AROMATIC HYDROCARBONS	VOA	Cool, 4°C[2,3]	14 days	40 mL
PURGEABLE HALOCARBONS	VOA	Cool, 4°C[3]	14 days	40 mL

1 P - Polyethylene; G Amber glass containers; TLC - Teflon- lined cap; VOA - Volatile organic analyte vial of amber glass with teflon-lined septum.

2 Adjust to pH 2 with H_2SO_4, HCl, or solid $NaHSO_4$

3 Free chlorine must be removed before addition of HCl by exact addition of $Na_2S_2O_3$

SOURCES:

EPA SW846

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impacted, background) to toxic levels. Screening with conservative, lower-threshold values (e.g., TELs) ensures, with a high degree of confidence, that any contaminant sources eliminated from future consideration pose no potential threat. Conversely, it does not necessarily predict toxicity. Upper thresholds(e.g., PELs) identify compounds which are more probably elevated to toxic levels.

Sediment quality benchmarks have been derived in a variety of ways for varying predictive goals. They are not interchangeable. Nor should they be applied without a reasonable understanding of their development, their performance, and their limitations.

For sediment-associated contaminants, dry weight concentrations are screened against published sediment quality benchmarks. Some benchmarks are available only on a TOC normalized basis, and are footnoted as such. Separate values are provided for either freshwater or estuarine and marine sediments.

The Effects Range-Low (ERLs) and Effects Range-Median (ERMs) plus the marine Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) are based upon a similar data compilations, but use different calculations. The ERL is calculated as the lower 10^{th} percentile concentration of the available sediment toxicity data which has been screened for only those samples which were identified as toxic by original investigators. It is not an LC_{10}. Since the ERL is at the low end of a range of levels at which effects were observed in the studies compiled, it represents the value at which toxicity may begin to be observed in sensitive species. The ERM is simply the median concentration of the compilation of just toxic samples. It is not an LC_{50}.

The TEL is calculated as the geometric mean of the 15^{th} percentile concentration of the toxic effects data set and the median of the no-effect data set; as such, it represents the concentration below which adverse effects are expected to occur only rarely. The PEL, as the geometric mean of the 50% of impacted, toxic samples and the 85% of the non-impacted samples, is the level above which adverse effects are frequently expected. Freshwater TEL/PELs are based on benthic community metrics and toxicity tests results.

Apparent Effect Thresholds (AETs) relate chemical concentrations in sediments to synoptic biological indicators of injury (i.e., sediment bioassays or diminished benthic infaunal abundance). Individual AETs are essentially equivalent to the concentration observed in the highest non-toxic sample. As such, they represent the concentration above which adverse biological impacts would always be expected by that biological indicator due to exposure to that contaminant alone. Conversely, adverse impacts are known to occur at levels below the AET. Only the lowest of the potential AETs is listed. AET values were developed for use in Puget Sound (Washington) and are not easily compared directly to other benchmarks based on single-chemical models and broader data sources. SQuiRT cards have been updated with *interim* AET values *which are subject to change*.

For freshwater sediments, the Upper Effects Threshold (UET) was derived by NOAA as the lowest AET from a compilation of endpoint analogous to the marine AET endpoints. The UETs for organic contaminants are generally listed for a sediment containing 1% TOC.

Every effort has been made to ensure accuracy in these SQuiRT cards. However, NOAA is not liable for errors in transcription, in the original sources, or revision of values. These screening values are subject to change as new data become available. These cards may be freely reproduced and distributed, if they are distributed in their entirety, without modification, and properly credited to NOAA. The SQuiRT cards should be cited as:

"Buchman, M. F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages."

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APPENDIX C
HYDROLOGIC CALCULATIONS

Appendix C-1. Existing Drainage Flows - WKIP 14, Kaelepulu Pond, Kailua, Hawaii

Storm Recurrence Interval (T_m)	10-year 1-hour
Area (acres)	87.4
C-factor	0.7
$RV_{1\text{-hour}}$ (in/hr)	2
T_c (minutes)	22.5
$CF_{1\text{-hour}}$	1.7
Corrected Rainfall Intensity	3.4
Q (cfs)	208

$$Q = C \times I \times A$$

Appendix C-1. Existing Drainage Flows - WKIP 14, Kaelepulu Pond, Kailua, Hawaii

Storm Recurrence Interval (T_m)	50-year 1-hour
Area (acres)	87.4
C-factor	0.7
$RV_{1\text{-hour}}$ (in/hr)	3
T_c (minutes)	22.5
$CF_{1\text{-hour}}$	1.7
Corrected Rainfall Intensity	5.1
Q (cfs)	312

$$Q = C \times I \times A$$

1

Appendix C-1. Existing Drainage Flows - WKIP 44, Kaelepulu Pond, Kailua, Hawaii

Storm Recurrence Interval (T_m)	10-year 1-hour
Area (acres)	4.7
C-factor	0.2
$RV_{1\text{-hour}}$ (in/hr)	2
T_c (minutes)	12.6
$CF_{1\text{-hour}}$	2.5
Corrected Rainfall Intensity	5
Q (cfs)	4.7

$$Q = C \times I \times A$$

Appendix C-1. Existing Drainage Flows - WKIP 44, Kaelepulu Pond, Kailua, Hawaii

Storm Recurrence Interval (T_m)	50-year 1-hour
Area (acres)	4.7
C-factor	0.2
$RV_{1\text{-hour}}$ (in/hr)	3
T_c (minutes)	12.6
$CF_{1\text{-hour}}$	2.5
Corrected Rainfall Intensity	7.5
Q (cfs)	7.1

$$Q = C \times I \times A$$

Appendix C-2. Running Total of Storm Water Flows through WKIP 14

Inlet ID #	Area (acres)	Flow (cfs)	Running Total of Area	Running Total of Flows
Storm water at the end of the drainage ditch				
14-6-16	3.50	7.61	3.50	7.61
14-6-15	5.03	11.50	8.53	19.11
14-6-19	0.82	2.16	9.35	21.27
14-6-18	2.47	6.09	11.82	27.36
		Total	**11.82**	**27.36**
Storm water off south end of Paako Street				
14-6-25	0.81	3.08	0.81	3.08
14-6-24	1.94	4.92	2.75	8.00
		Total	**2.75**	**8.00**
Storm water off south end of Alahaki Street				
14-6-27	1.64	3.96	1.64	3.96
14-6-26	2.60	6.51	4.24	10.47
		Total	**4.24**	**10.47**
Keolu Drive & Streets Above				
Manulani Street (south)				
14-8-4	2.02	9.34	2.02	9.34
		Total	*2.02*	*9.34*
Aulepe Street, Aupapaohe Street, Aupupu Street →Keolu Drive				
14-30	1.05	4.36	1.05	4.36
14-29	0.92	2.31	1.97	6.67
14-28-1	0.49	2.50	2.46	9.17
14-25-1	0.24	1.40	2.7	10.57
14-25	0.99	4.56	3.69	15.13
14-23-1	0.96	4.59	4.65	19.72
14-23	0.37	1.81	5.02	21.53
14-22	0.53	2.54	5.55	24.07
14-21-1	0.54	2.53	6.09	26.60
14-21	0.51	2.43	6.6	29.03
Intake	1.27	6.08	7.87	35.11
14-19-1	0.83	3.85	8.7	38.96
14-19	0.40	1.95	9.1	40.91
14-17	0.92	4.43	10.02	45.34
14-16	0.57	2.68	10.59	48.02
14-16-1	0.39	2.81	10.98	50.83
14-15-1	0.85	3.61	11.83	54.44
14-12-1	0.91	4.05	12.74	58.49
14-13	0.29	1.70	13.03	60.19
Inlet	0.82	3.48	13.85	63.67

		Total	*13.85*	*63.67*
Akalani Loop →Keolu Drive				
14-9-11	0.22	1.15	0.22	1.15
14-9-10	0.54	2.20	0.76	3.35
14-9-8	1.31	5.77	2.07	9.12
		Total	*2.07*	*9.12*
Keolu Drive				
14-7	67.4	160.0	67.4	160.0
		Total	*67.4*	*160.0*
Inlet 14-6 (total of above storm flows)				
		Total	**85.34**	**242.13**
Alahaki Street				
14-5-2	2.66	4.03	2.66	4.03
14-5-1	2.68	6.72	5.34	10.75
		Total	**5.34**	**10.75**
Alahaki Street, intake				
14-4-14	2.43	10.62	2.43	10.62
		Total	**2.43**	**10.62**
Paako Street, north				
14-3-2	1.15	2.81	1.15	2.81
14-3-1	2.50	6.34	3.65	9.15
		Total	**3.65**	**9.15**
Alahaki Street				
14-2-2	1.45	3.46	1.45	3.46
14-2-1	1.26	3.07	2.71	6.53
		Total	**2.71**	**6.53**
Drainage inlet, Alahaki Street				
Catchment	1.69	4.08	1.69	4.08
Catchment	1.93	4.57	3.62	8.65
14-1-3	0.53	1.51	4.15	10.16
14-1-40	0.53	1.51	4.68	11.67
14-1-1	3.62	8.65	8.30	20.32
		Total	**8.30**	**20.32**
Storm water flow to WKIP 14 outlet to Kaelepulu Pond				
		Total	**126.58**	**345.33**

Appendix C-2. Running Total of Storm Water Flows through WKIP 52

Inlet ID #	Area (acres)	Flow (cfs)	Running Total of Area	Running Total of Flows
Storm water at the end of the drainage ditch				
52-4-9	68.5	499.0	68.5	499.0
52-4-8	0.89	3.66	69.39	502.66
52-4-7	5.02	32.68	74.41	535.34
		Total	**74.41**	**535.34**
Concrete ditch				
	8.6	54.18	8.6	54.18
		Total	**8.6**	**54.18**
Inlet 52-4				
52-4-15	0.65	2.68	0.65	2.68
52-4-14	0.83	3.44	1.48	6.12
		Total	*1.48*	*6.12*
Inlet 52-5				
52-13	0.54	3.08	0.54	3.08
Intake	4.70	29.61	5.24	32.69
52-10-1	0.16	1.45	5.40	34.14
52-9	0.76	2.99	6.16	37.13
52-8-1	0.82	3.00	6.98	40.13
52-7	0.72	2.67	7.70	42.80
52-6-1	0.82	3.17	8.52	45.97
52-5-1	0.99	4.07	9.51	50.04
52-5	0.95	3.91	10.46	53.95
		Total	*10.46*	*53.95*
Total Inlet 52-4 & Inlet 52-5				
		Total	**11.94**	**60.07**
Akiohala Place				
Intake	1.45	7.92	1.45	7.92
Catchment	0.14	0.68	1.59	8.60
Catchment	0.70	2.72	2.29	11.32
Catchment	0.69	2.63	2.98	13.95
Intake	2.57	13.48	5.55	27.43
Catchment	0.18	1.02	5.73	28.45
Intake	2.07	13.04	7.80	41.49
52-3-3	1.16	4.81	8.96	46.30
52-3-12	0.91	3.50	9.87	49.80
52-3-14	0.76	3.01	10.63	52.81
52-3-13	0.66	2.75	11.29	55.56
		Total	**11.29**	**55.56**
Keolu Drive, north side of drainage ditch				
Catchment	0.76	2.99	0.76	2.99

Catchment	1.18	4.20	1.94	7.19
Catchment	0.64	2.34	2.58	9.53
Catchment	0.23	1.14	2.81	10.67
Catchment	0.66	2.87	3.47	13.54
52-1-6	0.56	2.17	4.03	15.71
52-1-7	0.53	3.11	4.56	18.82
52-1-4	0.10	0.60	4.66	19.42
52-1-8	0.44	2.37	5.10	21.79
52-1-9	0.32	1.91	5.42	23.70
51-1-2	0.95	3.52	6.37	27.22
51-1-12	1.02	3.71	7.39	30.93
52-1-11	0.74	3.50	8.13	34.43
52-1-10	0.60	2.41	8.73	36.84
		Total	**8.73**	**36.84**
Keolu Drive, south side of drainage ditch				
52-2-3	3.34	10.56	3.34	10.56
52-2-2	3.81	11.81	7.15	22.37
52-2-1	5.15	1.13	12.30	23.50
		Total	**12.30**	**23.50**
Storm water flow to WKIP 52 outlet to Kaelepulu Pond				
		Total	**127.27**	**765.49**

Table B-1

WKIP #	Area	Flow	Destination	Total Area	Total Flow
31	36.3	189.2	Kapaa Silt Basin		
32	76.7	373.7	Kapaa Silt Basin		
33	11.2	60.0	Kapaa Silt Basin	**318.5**	**2565.9**
34	167.4	1830.0	Kapaa Silt Basin		
35	26.9	113.0	Kapaa Silt Basin		
36	8.2	28.7	Keolu Lined Channel		
37	21.6	95.0	Keolu Lined Channel		
38	33.6	193.2	Keolu Lined Channel		
39	21.7	89.2	Keolu Lined Channel	**106.4**	**503.8**
40	4.4	20.6	Keolu Lined Channel		
41	2.4	10.0	Keolu Lined Channel		
42	9.8	57.2	Keolu Lined Channel		
44	4.7	9.9	Keolu Lined Channel		
Total				**424.9**	**3069.7**

43	52.8	359.6	Keolu Lined Channel

APPENDIX D

COMMERCIALLY AVAILABLE BMPs-PREFFERED BMPs AND CONSIDERED ALTERNATIVES

University of Massachusetts Amherst
MASTEP Database Documentation - Technology Performance Data Review

MASTEP staff reviews reports provided by the BMP manufacturers and others, including verification studies. Studies are compared with the *TARP* Tier 2 Protocol to determine if study design and quality assurance/quality control measures are sufficient to produce a valid data set.
Initially, all technologies are considered unrated with regards to existence of reliable performance data. Once information from verification studies is reviewed, a technology is rated as shown in table below. If a product claims to treat TSS, the TSS rating is shown. For all other products, the highest rating a product has received is shown.

0	Unrated. Data review not yet conducted by MASTEP
1	There is sufficient TARP-compliant or similar reliable data on this technology to be able to evaluate pollution removal efficiency claims
2	Studies are underway that offer promise for reliable data in the near future
3	There is at present insufficient reliable data to evaluate claims

It is important to note that a technology's category only reflects the availability of reliable studies. A rating of "1" does not imply that the vendor's performance claims are validated, only that the BMP has been tested in a scientifically credible manner. For those technologies in category 1, a comparison of vendors' performance claims vs. verified performance is made based on MASTEP review of the study results.

Status rating above describes the availability of reliable *data* on product performance. For the Kaelepulu Pond BMPs evaluation only the highlighted columns were carried forward for preliminary engineering evaluation after initial overall review.

#	Status	Rated By	Model	Technology | Vendor
1	2	TSS, SSC	STC 1200	**In-Line Stormceptor**: **BMP Type:** Oil/sediment separator *(Sedimentation Unit)*. **Pollutants Addressed:** Mercury; Cadmium; Ammonium; Hydrocarbons; Total Keldhal Nitrogen; Total Phosphorus; Suspended sediment concentration; Total suspended solids; Oil and grease; Zinc; Copper; Lead; Iron; Chromium] **Product of** Stormceptor
2	2	TSS	4-FT	**Downstream Defender**: **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Total solids; Oil and grease; Debris - floatables] **Product of** Hydro International
3	3	TSS, TKN, TP, Pb	Not specified	**StormTreat System (TM), Inc.**: **BMP Type:** Oil/sediment separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Zinc; Lead; Chromium; Fecal coliform; Total Keldhal Nitrogen; Total Phosphorus] **Product of** StormTreat Systems
4	3	TSS	Module II	**Hancor Storm Water Quality Unit**: **BMP Type:** Oil/sediment separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables; Hydrocarbons] **Product of** Hancor Inc.
5	3	TSS	n/a	**Cultec Stormfilter**: **BMP Type:** Screen separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids] **Product of** Cultec

6	3	TSS, TKN, TP, Floatables	not specified	**Grate Inlet Skimmer Box** :: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total Keldhal Nitrogen; Total Phosphorus; Total suspended solids; Debris - floatables] **Product of** Suntree Technologies Inc.
7	2	TSS, SSC	1K	**BaySaver Separation System**: **BMP Type:** Oil/sediment separator *(Sedimentation Unit)*. **Pollutants Addressed:** Debris - floatables; Suspended sediment concentration; Total suspended solids; Oil and grease; Debris- sinking] **Product of** Baysaver
8	3	TSS	Several	**Cultec Contactor and Cultec Recharger**: **BMP Type:** Chamber - Plastic *(Infiltration)*. **Pollutants Addressed:** Total suspended solids] **Product of** Cultec
9	3	TSS, O/G	4105-L	**Hydrocartridge**: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Oil and grease] **Product of** Advanced Aquatic Products
10	3	Floatables	Floating	**Netting Trash Trap**: **BMP Type:** Advance inlet structure *(Pretreatment Technology)*. **Pollutants Addressed:** Debris - floatables] **Product of** Fresh Creek Technologies Inc.
11	3	TSS, O/G, TPH	Drop Inlet	**DrainPac**: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Hydrocarbons] **Product of** United Stormwater Inc.
12	3	TSS, O/G	Oil and Sediment Model # 9217	**UltraDrainguard®** : **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris- sinking] **Product of** UltraTech International
13	3	TSS, O/G, SSC, TPH	HG 6	**Hydroworks HG (Hydroguard) Separator**: **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Suspended sediment concentration; Total suspended solids; Oil and grease; Debris - floatables; Debris- sinking; Hydrocarbons] **Product of** Hydroworks LLC
14	3	TSS, TPH	n/a	**Hydro-Kleen™ Filtration System**: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Hydrocarbons] **Product of** Hydro Compliance Management Inc.
15	3	O/G, Floatables, SSC, DS	Drop In	**Enviropod**: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Suspended sediment concentration; Oil and grease; Debris - floatables; Debris- sinking] **Product of** Contech Construction Products Inc.
16	3	TSS	StarFilter disks + Arkal Media Filters AGF	**Arkal Pressurized Stormwater Filtration System**: **BMP Type:** Synthetic Filter *(Filtration - Media filter)*. **Pollutants Addressed:** Total suspended solids] **Product of** Arkal Filtration Systems
17	3	TSS, TS	4 cartridge 6 x 12 vault	**Storm Screen**: **BMP Type:** Synthetic Filter *(Filtration - Media filter)*. **Pollutants Addressed:** Total suspended solids; Total solids; Debris - floatables; Debris- sinking] **Product of** Stormwater Management Inc.
18	3	TSS, NO3/NO2, Floatables, TS, SSC	1056	**Crystal Stream Water Quality Vault**: **BMP Type:** Hydrodynamic device - other *(Sedimentation Unit)*. **Pollutants Addressed:** Suspended sediment concentration; Total suspended solids; Total solids; Debris - floatables; Debris- sinking; Nitrate-nitrite] **Product of** CrystalStream Technologies
19	2	TSS, Zn,	StormFilter	**Stormwater Management Storm Filter**: **BMP Type:** Inorganic Filter

		Cu		*(Filtration - Media filter)*. **Pollutants Addressed:** Total suspended solids; Zinc; Copper; Hydrocarbons] **Product of** Stormwater Management Inc.
20	3	EC, TN, TP, FC, Ent	7000 and 1000	**Vortechs System**: **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Suspended sediment concentration; Total suspended solids; Total dissolved solids; Total volatile solids; Total solids; Oil and grease; Debris - floatables; Debris- sinking; Zinc; Copper; Lead; Iron; Chromium; Mercury; Cadmium; Hydrocarbons; Organic contaminants; Salt; Fecal coliform; E. coli; Enterococcus; Total nitrogen; Total Phosphorus] **Product of** Vortechnics Inc.
21	3	SSC	Various (AS-2 to AS-12)	**Aqua-Swirl Concentrator**: **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Suspended sediment concentration] **Product of** AquaShield
22	2	TSS	FGP-24F	**FloGard+Plus**: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Total Phosphorus] **Product of** Kristar Enterprises, Inc.
23	3	TSS, O/G, Floatables, DS	DVS (Dual Vortex Separator)	**FloGard Dual Vortex Hydrodynamic Separator** :: **BMP Type:** Hydrodynamic device - other *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables; Debris- sinking; Hydrocarbons] **Product of** Kristar Enterprises, Inc.
24	3	SSC	VF4r	**VortFilter**: **BMP Type:** Inorganic Filter *(Filtration - Media filter)*. **Pollutants Addressed:** Suspended sediment concentration; Total suspended solids; Total solids; Oil and grease; Debris - floatables; Debris- sinking; Zinc; Copper; Lead; Iron; Chromium; Mercury; Cadmium; Hydrocarbons; Organic contaminants; Salt; Fecal coliform; E. coli; Enterococcus; Nitrate-nitrite; Total nitrogen; Total Phosphorus; Temperature] **Product of** Vortechnics Inc.
25	3	TSS, O/G, Floatables, DS	TK18	**Terre Kleen** : **BMP Type:** Hydrodynamic device - other *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables; Debris- sinking] **Product of** Terre Hill Concrete Products
26	3	TSS, EC, TN, TP, NH4+	VS40	**VortSentry**: **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total solids; Debris- sinking; Iron; Chromium; Oil and grease; Debris - floatables; Zinc; Copper; Lead; Mercury; Cadmium; Ammonium; Hydrocarbons; Suspended sediment concentration; Enterococcus; Total nitrogen; Total Phosphorus; Temperature; Total suspended solids; Organic contaminants; Salt; Fecal coliform; E. coli] **Product of** Vortechnics Inc.
27	3	Floatables, DS	FG-TDG42	**FloGard Trash & Debris Guard** :: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Debris - floatables; Debris-sinking] **Product of** Kristar Enterprises, Inc.
28	2	EC, Ent	Models DI and CO	**Ultra-Urban® Filter with Smart Sponge Plus 4 Antimicrobial** :: **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables; E. coli; Enterococcus] **Product of** Abtech Industries
29	3	TSS	PMSU20_20_5	**CDS Inline Unit** : **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables] **Product of** CDS Technologies, Inc.
30	3	TSS, TP	Several	**V2B1** : **BMP Type:** Swirl or vortex separator *(Sedimentation Unit)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables; Total

				Phosphorus] **Product of** Environment21 LLC
31	3	TSS, TP, O/G, Zn, Cu	BMP01	**Clearwater Solutions BMP01** : **BMP Type:** Catch Basin Insert *(Pretreatment Technology)*. **Pollutants Addressed:** Total suspended solids; Oil and grease; Debris - floatables; Debris- sinking; Zinc; Copper; Lead; Total Phosphorus] **Product of** Clearwater Solutions
32	2	TSS	AF - 3.2	**AquaFilter Stormwater Filtration System** : **BMP Type:** Inorganic Filter *(Filtration - Media filter)*. **Pollutants Addressed:** Total suspended solids] **Product of** AquaShield

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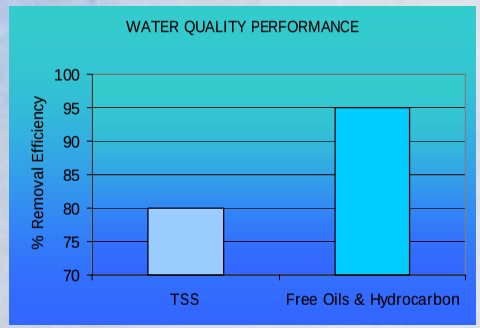
Appendix D. Commercially Available List of Structural BMPs, Kaelepulu Pond, Kailua, Hawaii

Technology	BMP Type	Model	Pollutants Addressed	Product of/On-line Link
First Cut - Recommended BMPs				
In-Line Stormceptor	Oil/Sediment Separator	STC 1200	Mercury, Cadmium, Ammonium, Hydrocarbons, Total Keldhal Nitrogen, Total Phosphorus, Suspended Sediment Concentration, TSS, Oil and Grease, Zinc, Copper, Lead, Iron and Chromium	Stormceptor
Downstream Defender	Swirl or Vortex Separator	4-FT	TSS, Total Solids, Oil and Grease, Debris-Floatables	Hydro International
BaySaver Separation System	Oil/Sediment Separator	1K	Debris-Floatables, Suspended Sediment Concentration, TSS, Oil and Grease, Debris-Sinking	Baysaver
Stormwater Management StormFilter	Inorganic Filter	StormFilter	TSS, Zinc, Copper, Hydrocarbons	Stormwater Management Inc.
FloGard+Plus	Catch Basin Insert	FGP-24F	TSS, Oil and Grease, Total Phosphorus	Kristar Enterprises, Inc.
Ultra-Urban® Filter w/ Smart Sponge Plus 4 Antimicrobial	Catch Basin Insert	Models DI and CO	TSS, Oil and Grease, Debris-Floatables, E. Coli, Enterococcus	Abtech Industries
AquaFilter Stormwater Filtration System	Inorganic Filter	AF-3.2	TSS	AquaShield
Vortechs System	Swirl or Vortex Separator	7000 and 1000	Suspended Sediment Concentration, TSS, TDS, TVS, Total Solids, Oil and Grease, Debris-Floatables, Debris-Sinking, Zinc, Copper, Lead, Iron, Chromium, Mercury, Cadmium, Hydrocarbons, Organic Contaminants, Salt, Fecal Coliform, E. Coli, Enterococcus, Total Nitrogen, Total Phosphorus	Vortechnics Inc.
VortSentry	Swirl or Vortex Separator	VS40	Total Solids, Debris-Sinking, Iron, Chromium, Oil and Grease, Debris-Floatables, Zinc, Copper, Lead, Mercury, Cadmium, Ammonium, Hydrocarbons, Suspended Sediment Concentration, Enterococcus, Total Nitrogen, Total Phosphorus, Temperature, TSS, Organic Contaminants, Salt, Fecal Coliform, E. Coli	Vortechnics Inc.
CDS Inline Unit	Swirl or Vortex Separator	PMSU20_20_5	TSS, Oil and Grease, Debris-Floatables	CDS Technologies, Inc.
Swale	Physical Treatment	n/a	TSS, Oil and Grease, Debris-All	n/a
Recommended Manufacturaer for BMP Installation				
Grate Inlet Skimmer Box	Catch Basin Insert	Not Specified	TSS, Total N, Total P, Debris-Floatables, Zinc, Lead, Copper, TKN, FC, Cadmium, Hydrocarbons, COD	Suntree Technologies Inc.
Bio Clean NSBB	Nutrient Separating Baffle Box	NSBB 8-14-97	Sediment (TSS), Foliage, Litter, Total P, Total N, Zinc, Lead, Copper, BOD, and Hydrocarbons	Suntree Technologies Inc.
Other Reviewed/Researched BMPs				
StormTreat System ™, Inc.	Oil/Sediment Separator	Not Specified	TSS, Zinc, Lead, Chromium, Fecal Coliform, Total Keldhal Nitrogen, Total Phosphorus	StormTreat Systems
Hancor Storm Water Quality Unit	Oil/Sediment Separator	Module II	TSS, Oil and Grease, Debris-Floatables, Hydrocarbons	Hancor Inc.

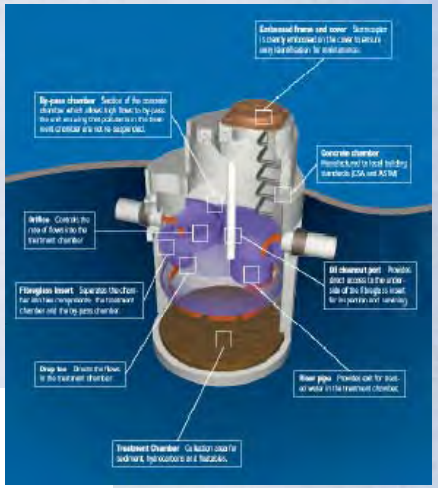
Technology	BMP Type	Model	Pollutants Addressed	Product of/On-line Link
Cultec Stormfilter	Screen Separator	n/a	TSS	Cultec
Cultec Contactor and Cultec Recharger	Chamber-Plastic	Several	TSS	Cultec
Hydrocartridge	Catch Basin Insert	4105-L	TSS, Oil and Grease	Advanced Aquatic Products
Netting Trash Trap	Advance Inlet Structure	Floating	Debris-Floatables	Fresh Creek Technologies Inc.
DrainPac	Catch Basin Insert	Drop Inlet	TSS, Oil and Grease, Hydrocarbons	United Stormwater Inc.
UltraDrainguard®	Catch Basin Insert	Oil and Sediment Model #9217	TSS, Oil and Grease, Debris-Sinking	UltraTech International
Hydroworks HG (Hydroguard) Separator	Swirl or Vortex Separator	HG 6	Suspended Sediment Concentration, TSS, Oil and Grease, Debris-Floatables, Debris-Sinking, Hydrocarbons	Hydroworks LLC
Hydro-Kleen ™ Filtration System	Catch Basin Insert	n/a	TSS, Hydrocarbons	Hydro Compliance Management Inc.
Enviropod	Catch Basin Insert	Drop In	Suspended Sediment Concentration, Oil and Grease, Debris-Floatables, Debris-Sinking	Contech Construction Products Inc.
Arkal Pressurized Stormwater Filtration System	Synthetic Filter	StarFilter disks + Arkal Media Filters AGF	TSS	Arkal Filtration Systems
StormScreen	Synthetic Filter	4 cartridge 6 ×12 vault	TSS, Total Solids, Debris-Floatables, Debris-Sinking	Stormwater Management Inc.
CrystalStream Water Quality Vault	Hydrodynamic Device-Other	1056	Suspended Sediment Concentration, TSS, Total Solids, Debris-Floatables, Debris-Sinking, Nitrate-Nitrite	CrystalStream Technologies
Aqua-Swirl Concentrator	Swirl or Vortex Separator	Various(AS-2 to AS-12)	Suspended Sediment Concentration	AquaShield
FloGard Dual Vortex Hydrodynamic Separator	Hydrodynamic Device-Other	DVS(Dual Vortex Separator)	TSS, Oil and Grease, Debris-Floatables, Debris-Sinking, Hydrocarbons	Kristar Enterprises, Inc.
VortFilter	Inorganic Filter	VF4r	Suspended Sediment Concentration, TSS, Total Solids, Oil and Grease, Debris-Floatables, Debris-Sinking, Zinc, Copper, Lead, Iron, Chromium, Mercury, Cadmium, Hydrocarbons, Organic Contaminants, Salt, Fecal Coliform, E. Coli, Enterococcus, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, Temperature	Vortechnics Inc.
Terre Kleen	Hydrodynamic Device-Other	TK18	TSS, Oil and Grease, Debris-Floatables, Debris-Sinking	Terre Hill Concrete Products
FloGard Trash & Debris Guard	Catch Basin Insert	FG-TDG42	Debris-Floatables, Debris-Sinking	Kristar Enterprises, Inc.
V2B1	Swirl or Vortex Separator	Several	TSS, Oil and Grease, Debris-Floatables, Total Phosphorus	Environment21 LLC
Clearwater Solutions BMP01	Catch Basin Insert	BMP01	TSS, Oil and Grease, Debris-Floatables, Debris-Sinking, Zinc, Copper, Lead, Total Phosphorus	Clearwater Solutions

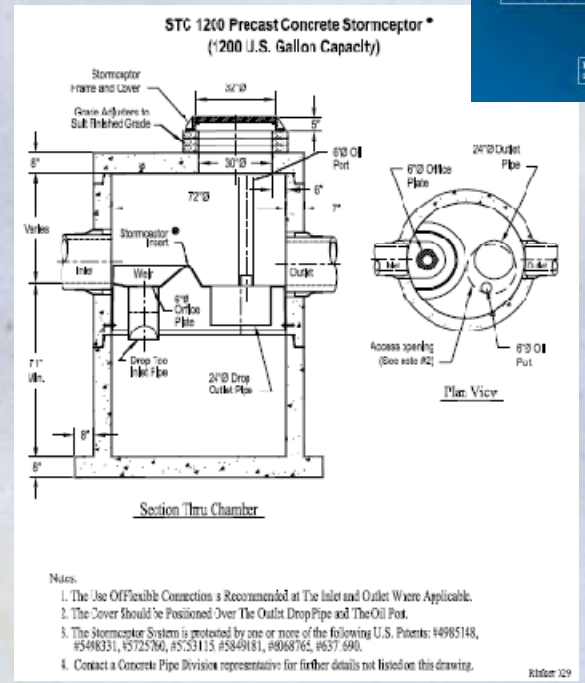
The In-Line Stormceptor is a oil/sediment separator implementing a fiberglass insert that separates a by-pass chamber and treatment chamber. Ideal for areas such as industrial properties, gas stations and parking lots where there is potential for oil or chemical spills. Also efficiently removes grit and fine sediment. These pollutants are stored inside the treatment chamber for safe and easy removal. The patented internal bypass prevents the re-suspension and scouring of trapped pollutants during infrequent high flow periods. Maintenance requirements include the periodic removal of solids by a vacuum truck.

The In-Line Stormceptor oil/sediment separator encased in a concrete storm drain.



Based upon StormCeptor® claim





Information from StormCeptor ®, 2006

Fact Sheet

Category Type:
Manhole Retrofit

BMP Type:
Manufactured Device

Basic Dimensions:
Depth Below Invert-5.5-13.1 ft
Diameter-5-14 ft

Specifications:
Peak Flow-0.28-4.95 cfs
Volume-45-1,800 cf

Cost per Unit:
$7,600-$33,560

Treatment Function:
Physical Treatment,
Hydrodynamic Separation

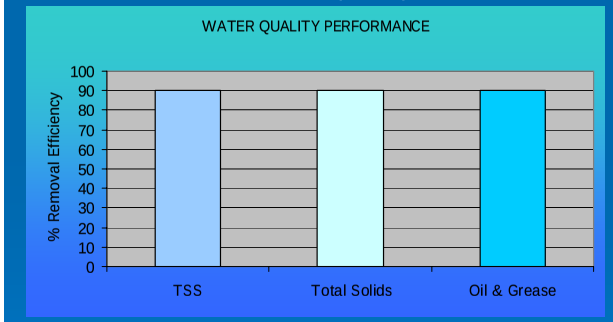
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
Stormceptor®
www.stormceptor.com

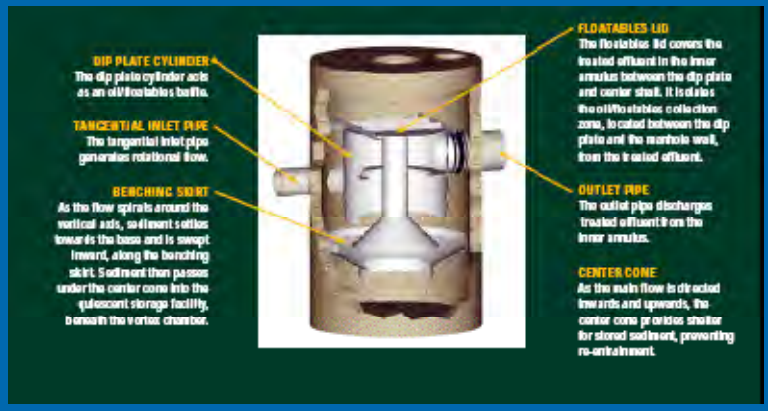
Life Expectancy:
50-100 yrs

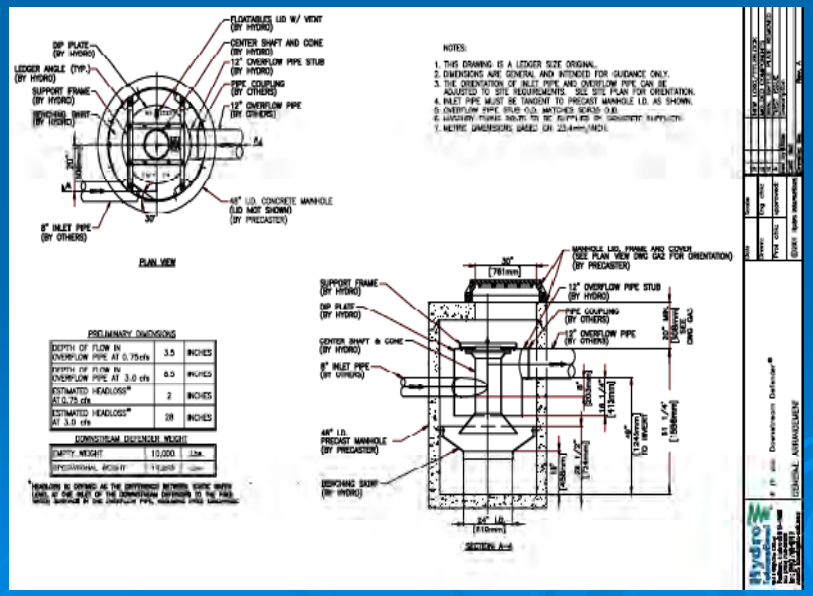
The Downstream Defender is a hydrodynamic separator using vortex settling to remove sediment, trap debris and trash and separate floatable oil and grease. Suitable for space constraints and urban sites.
The Downstream Defender is comprised of two concentric hollow cylinders, an inverted cone, a benching skirt and a floatables lid mounted internally in a four-Ten (4-10)-foot diameter concrete storm drain.
Maintenance requirements include the periodic removal of solids by a vacuum truck.

The Downstream Defender submerged inlet w/out weir or orfices encased in a Concrete storm drain (insert).



Based upon Hydro International® claim





Information from Hydro International ®, 2006

Fact Sheet

Category Type:
Manhole Retrofit

BMP Type:
Manufactured Device

Basic Dimensions:
Diameter-4-10 ft

Specifications:
Peak Flow-3.0-25 cfs
Volume-20.1-190.7 cf

Cost per Unit:
$10,200-$30,000
+installation

Treatment Function:
Physical Treatment,
Hydrodynamic Separation

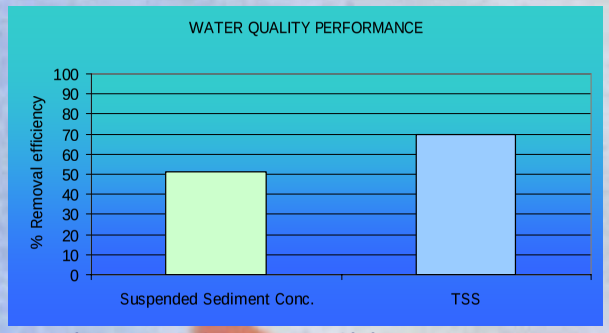
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
Hydro International®
www.hydrointernational.biz

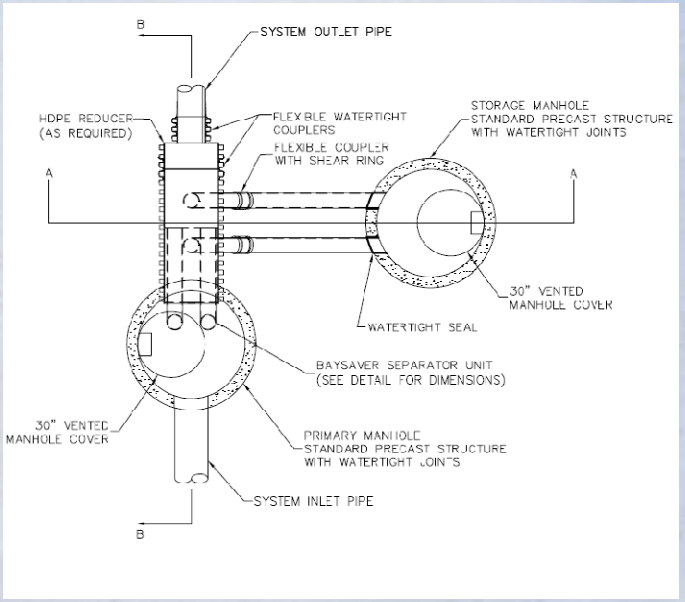
Life Expectancy:
30 yrs +

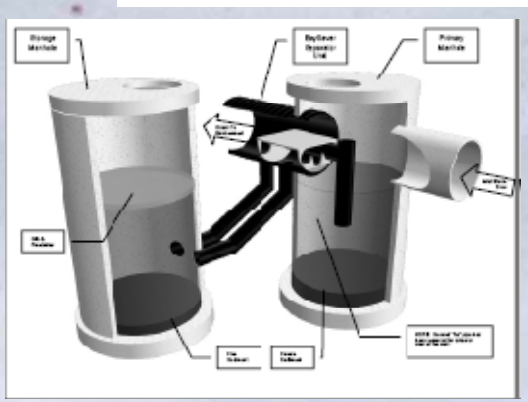
The BaySaver Separation Sytem is a oil/sediment separator implementing the BaySaver® Separator Unit and weir plate that control influent flow. Ideal for areas such as industrial properties, gas stations and parking lots where there is potential for oil or chemical spills. Also efficiently removes grit and fine sediment. These pollutants are stored inside the storage manhole for safe and easy removal. The patented internal flow control made entirely of High Density Polyethylene prevents the re-suspension of trapped pollutants during infrequent high flow periods. Maintenance requirements include the periodic removal of solids by a vacuum truck.

The BaySaver® emplements two (2) manholes for controlling storm water quality.



Based upon BaySaver, Inc. Claim





Information from BaySaver, inc., 1997-2005

Fact Sheet

Category Type:
Manhole Retrofit

BMP Type:
Manufactured Device

Basic Dimensions:
Diameter-4-10 ft

Specifications:
Catchment-0.5-11.25 acre
Peak Flow-1.1-21.8 cfs
Volume-150-1,255 cf

Cost per Acre:
$16,000-$18,000/unit+ installation

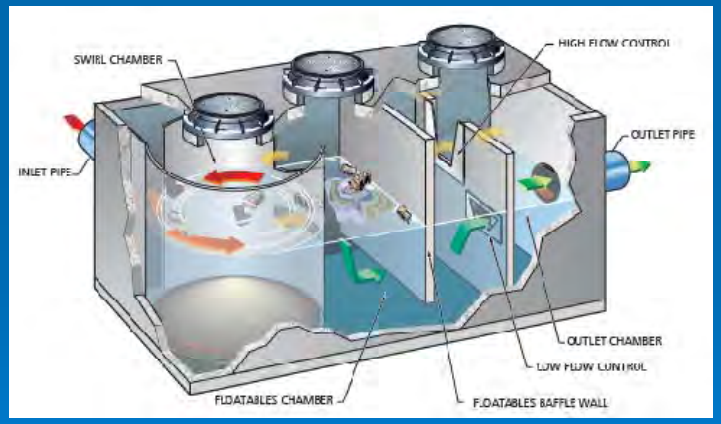
Treatment Function:
Physical Treatment,
Hydrodynamic Separation

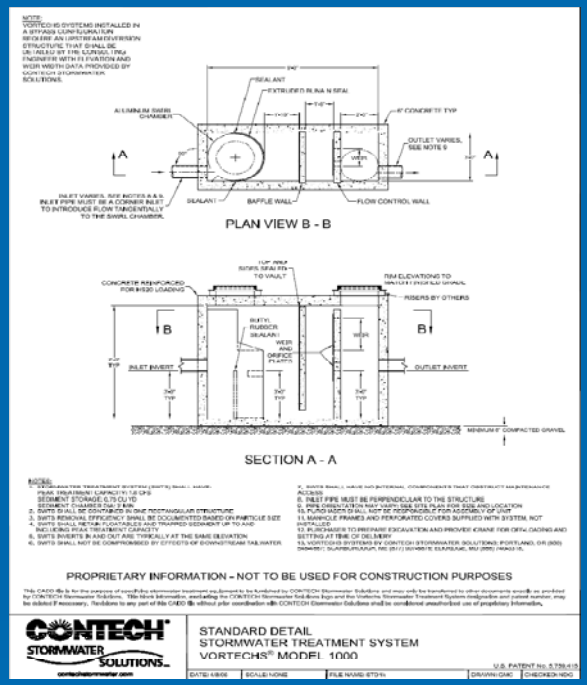
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

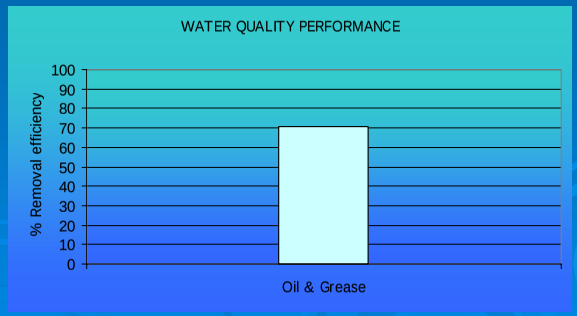
Manufacturer Information:
BaySaver®
www.baysaver.com

The Vortechs™ Stormwater Treatment System uses a combination of swirl-concentrator and flow-control technologies to abate forces that encourage resuspension and washout. Recommended for urban areas with impervious surfaces that threaten to drain pollutants into watersheds and other ecologically sensitive areas.
Maintenance requirements include seasonal inspections during the first year of operation and cleanings once per year. There are no moving parts, filters, bags, or other components that need to be replaced.

The Vortechs Stormwater treatment system.







Based upon CONTECH Construction Products claim

Fact Sheet

Category Type:
Swirl or Vortex Separator

BMP Type:
Manufactured Device

Basic Dimensions:
Diminsion-9.1'×3'×6' To 18.1' ×12' ×8'

Specifications:
Peak Flow-1.6-25 cfs

Cost per Unit:
$8,900-$40,000

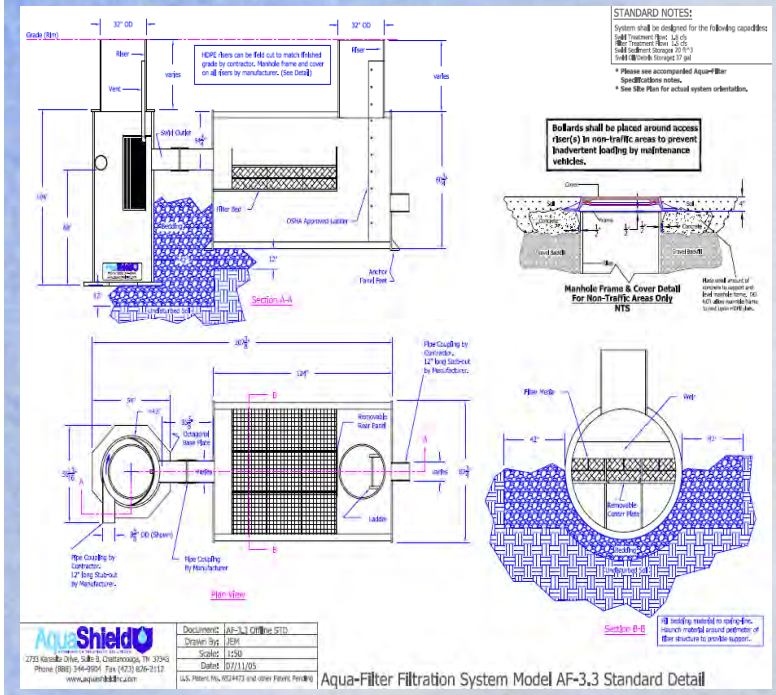
Treatment Function:
Vortex & hydrodynamic separation

Maintenance Data:
Maintenance Sensitivity-High
Inspections-Mid
Sediment Removal-High

Manufacturer Information:
Vortechnics, Inc
www.vortechnics.com

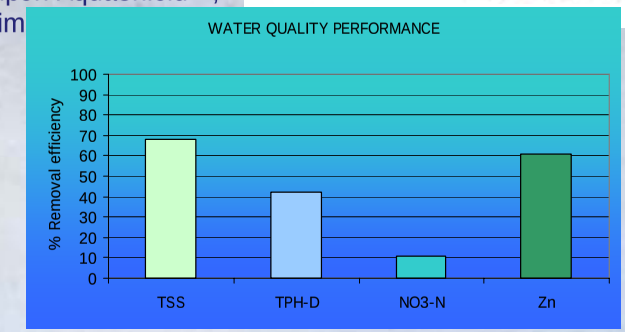
Information from CONTECH Construction Products, Inc., 2006

The Aqua-Filter™ is a filtration system comprised of a Swirl Concentrator, followed by a Filtration Chamber. The Swirl Concentrator removes gross pollutants and the Filtration Chamber removes fine sediments and water-borne pollutants. Designed for areas that require advanced treatment of runoff stormwater that may discharge into sensitive receiving water. Works on the principles of combining a vortex-removal system using the Swirl Concentrator and a filtration chamber. Maintenance requirements include the periodic removal of solids by a vacuum truck and replacement of the filter.



The Aqua-Swirl and Aqua-Filter, using the process of vortex and filtration to remove contaminants from storm water.

Based upon AquaShield™, Inc. claim



Information from AquaShield™, Inc.

Fact Sheet

Category Type:
Manhole Retrofit & Filtration

BMP Type:
Manufactured Device

Basic Dimensions:
AF-4.2 Component Sizes
Aqua-Swirl(vertical)-
4.5 ft diameter, 8 ft tall
Aqua-Filter(horizontal)-
6.75 ft diameter, 12 ft long

Specifications:
Catchment-1 acre
Peak Flow-1 cfs

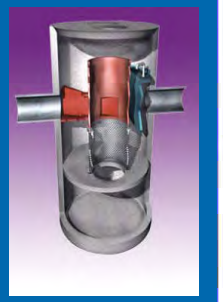
Cost per Unit:
$25,000 - $69,000+
Replacement filter bags

Treatment Function:
Physical Treatment,
Physical/Chemical

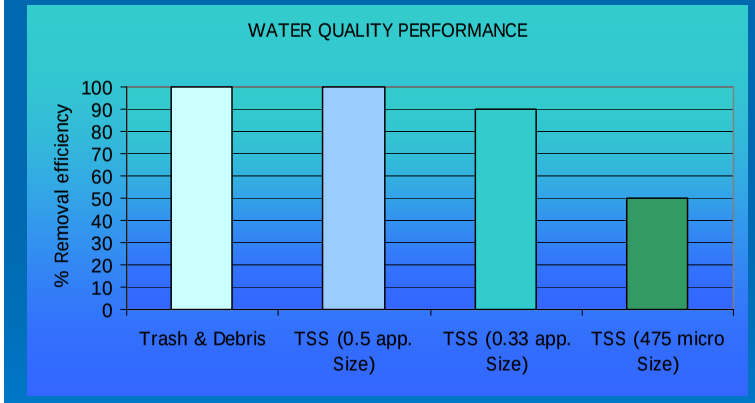
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
AquaShield, Inc.
www.aquashieldinc.com

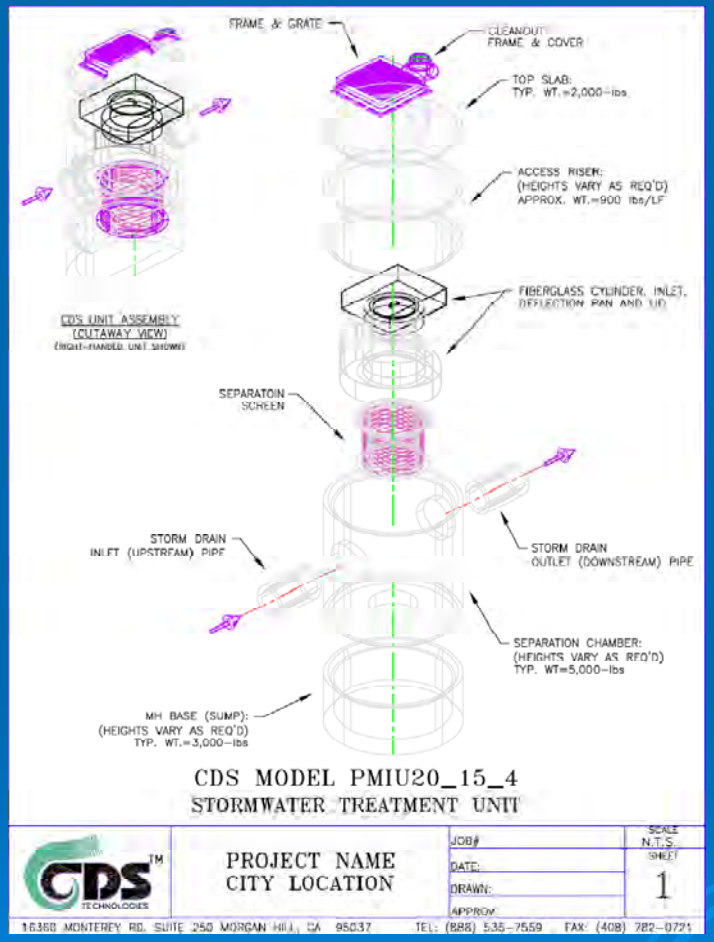
The Continuous Deflective Separation (CDS) technology uses fluid dynamics to separate solids from liquids. A continual flow of stormwater enters the unit, liquid passes over the face of a screen while solids are continually captured and retained in a central chamber. Suitable for space constraints and urban sites, such as Kaelepulu pond.
Maintenance requirements may include the periodic inspection of the unit and removal of solids by a vacuum truck.



A CDS Unit, implementing fluid dynamics to deflect water pollutants.



Based upon CDS Technologies, Inc. claim



Fact Sheet

Category Type:
Manhole Retrofit

BMP Type:
Manufactured Device

Basic Dimensions:
P30 (3' diameter); P70 (7' Diameter); P100 (10' diameter); P150 (15' diameter)

Specifications:
Peak Flow-0.7-300 cfs

Cost per Unit:
$15,700 - $61,800

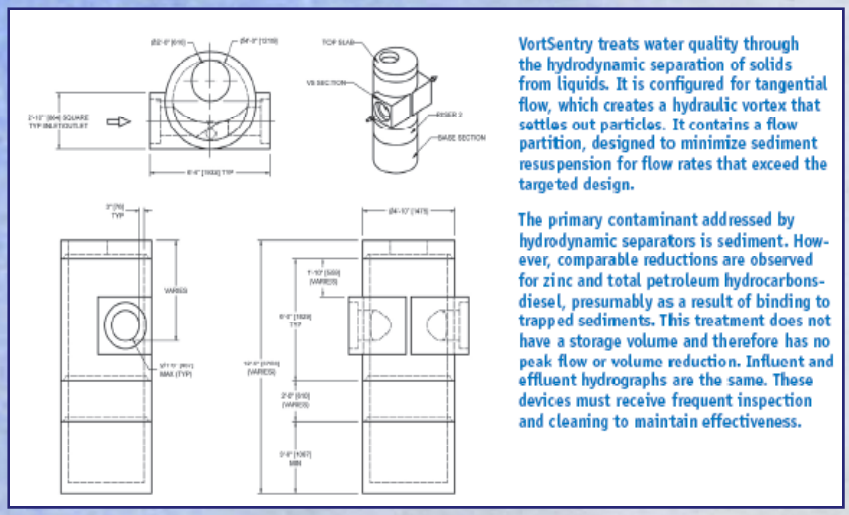
Treatment Function:
Hydrodynamic separation

Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
CDS Technologies
www.CDStech.com

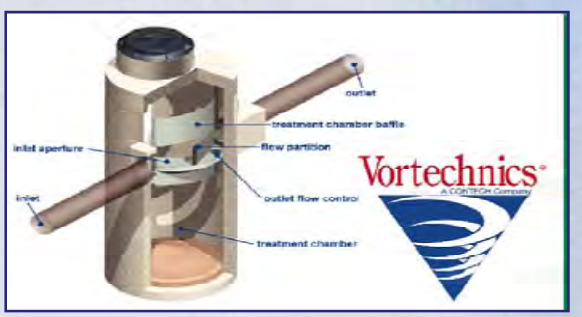
Information from CDS Technologies, Inc., 2004-5

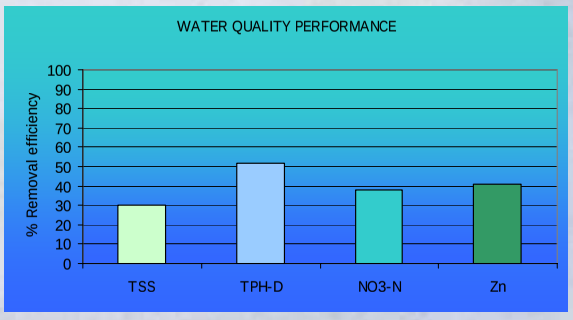
VortSentry is a hydrodynamic separator using vortex settling to remove sediment, trap debris and trash and separate floatable oil and grease. Suitable for space constraints and urban sites, such as Kaelepulu pond.
The prefabricated system is online with an internal bypass. The VortSentry is comprised of weir and baffle mounted internally in a four(4)-foot diameter concrete storm drain. Maintenance requirements include the periodic removal of solids by a vacuum truck.



VortSentry treats water quality through the hydrodynamic separation of solids from liquids. It is configured for tangential flow, which creates a hydraulic vortex that settles out particles. It contains a flow partition, designed to minimize sediment resuspension for flow rates that exceed the targeted design.

The primary contaminant addressed by hydrodynamic separators is sediment. However, comparable reductions are observed for zinc and total petroleum hydrocarbons-diesel, presumably as a result of binding to trapped sediments. This treatment does not have a storage volume and therefore has no peak flow or volume reduction. Influent and effluent hydrographs are the same. These devices must receive frequent inspection and cleaning to maintain effectiveness.





Based upon UNH Stormwater Center Data

The VortSentry weir & baffle encased in a Concrete storm drain (insert).

Information from UNH Stormwater Center, 2005

Fact Sheet

Category Type:
Manhole Retrofit

BMP Type:
Manufactured Device

Basic Dimensions:
Depth Below Invert-6.5 ft
Diameter-4 ft

Specifications:
Catchment-1/3 acre
Peak Flow-0.6 cfs
Volume-327 cf

Cost per Acre:
$18,000

Treatment Function:
Physical Treatment,
Hydrodynamic Seperation

Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
Vortechnics, Inc
www.vortechnics.com

The Nutrient Separating Baffle Box (NSBB) is highly effective and has been in use since 1994. This filtration system has proven effective in capturing and retaining the following pollutants: litter, organics, sediments, TSS, heavy metals, nutrients and hydrocarbons. This system also has the unique and patented ability to store organics and gross solids in a dry state. This has many advantages. The NSBB is more cost effective when compared to other systems (vortex/swirl type). The NSBB 10-14-96 has a Q(t) of 46 for 80% removal of TSS and a Q(t) of 168 for gross solids and sediment. Eight standard models are offered with custom sizes and configurations available upon request. Our system's fair price will help engineers, developers, cities and counties meet their stormwater regulation objectives by allowing them to get more treatment per dollar.

Nutrient Separating Baffle Box - Removal Efficiencies

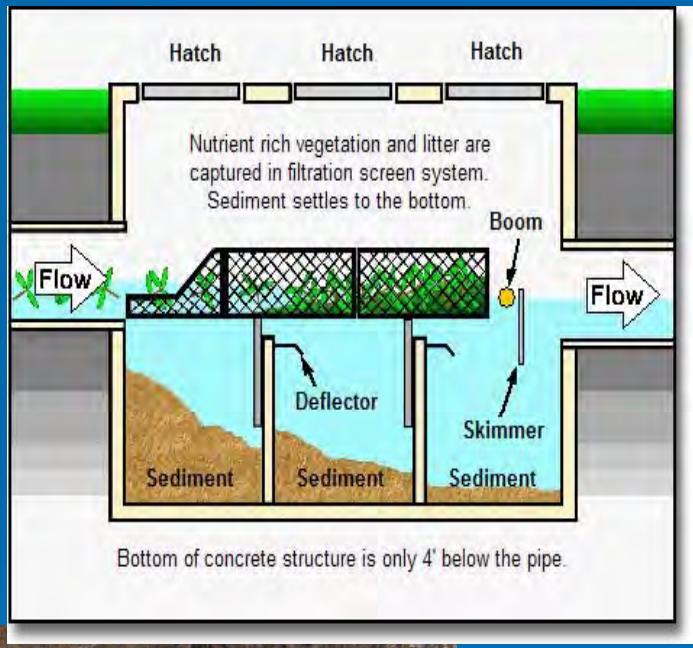
Numeric Reductions (mg/L)

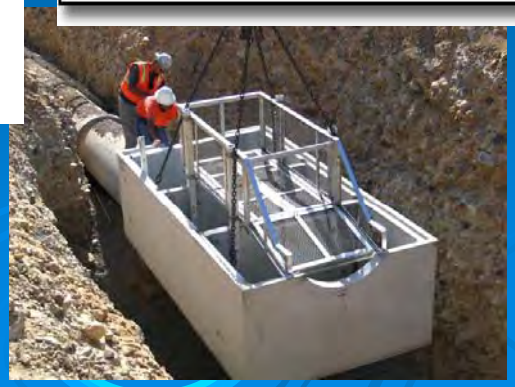
	Total Suspended Solids mg/L			Total Phosphorus mg/L			Total Nitrogen mg/L		
Study	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency
Dillard & Associates - Field Test	N/A	N/A	93.3%						
Pandit - Physical Modeling	N/A	N/A	89.8%						
Sunset Park Baffle Box	81.16	26.9	66.9%	1.909	1.022	46%			
Lubnow - Harvey's Lake	918	126	86.3%	0.47	0.32	32%			
Royal - Indialantic	32.9	7.6	76.9%	1.49	0.44	70%			
Royal - Micco	16.66	8.825	47.9%	0.056	0.0425	23%			
Pastore - Pine St	110	31	71.8%	0.38	0.19	42%	3.5	1.3	63%
Pastore - 6th St	86	27	68.2%	0.31	0.21	32%	1.6	0.98	38%
Pastore - 7th St	44	27	38.6%	0.22	0.18	18%	2.3	1.3	43%

	Zinc mg/L			Lead mg/L			Copper mg/L		
Study	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency
Pastore - Pine St	0.072	0.044	39%	0.0085	0.0062	27%	0.012	0.0094	22%
Pastore - 6th St	0.088	0.038	57%	0.014	0.0065	54%	0.017	0.01	41%
Pastore - 7th St	0.057	0.041	28%	0.0066	0.0051	23%	0.014	0.011	21%

	BOD (mg/L)		
Study	Influent	Effluent	Removal Efficiency
Sunset Park Baffle Box	16.391	4.125	75%
Royal - Indialantic	1.88	1.4	26%
Royal - Micco	1.69	1.7	-7%

Dillard & Associates Consulting Engineers - Field Test for Suntree Nutrient Separating Baffle Box - Test Report - Feb 2006
Pandit & Gopalakrishnan - Florida Institute of Technology - Physical Modeling of a Stormwater Sediment Box - 1996 - Independent Test
Sunset Park Baffle Box - Brevard County Surface Water Improvement - St. John's River Water Management District - 1998 - Independent Test
Lubnow & Miller - Princeton Hydro - The Design, Installation, and Effectiveness of a Structural BMP for Harveys Lake - 2003 - Independent Test
Royal & Vanderbiesk - Brevard County Surface Water Improvement Div - Sediment Control Project, Indialantic/Micco - 1994 - Independent Test
Pastore - Blue Water Environmental - Atlantic Beach Monitoring Study: Pine St, 6th St, 7th St - 2004





BIO CLEAN
ENVIRONMENTAL SERVICES, INC

Information from Bio Clean and Suntree Technologies Inc., 2004-5

Fact Sheet

Category Type:
Manhole or Street Ditch Retrofit

BMP Type:
Manufactured Device

Basic Dimensions:
NSBB 10-14-96 (4' – 6 diameter)
NSBB 8-14-97 w/ Hatches (15' d

Specifications:
Peak Flow-0.7-300 cfs

Cost per Unit:
$34,000 - $61,800

Treatment Function:
Hydrodynamic separation

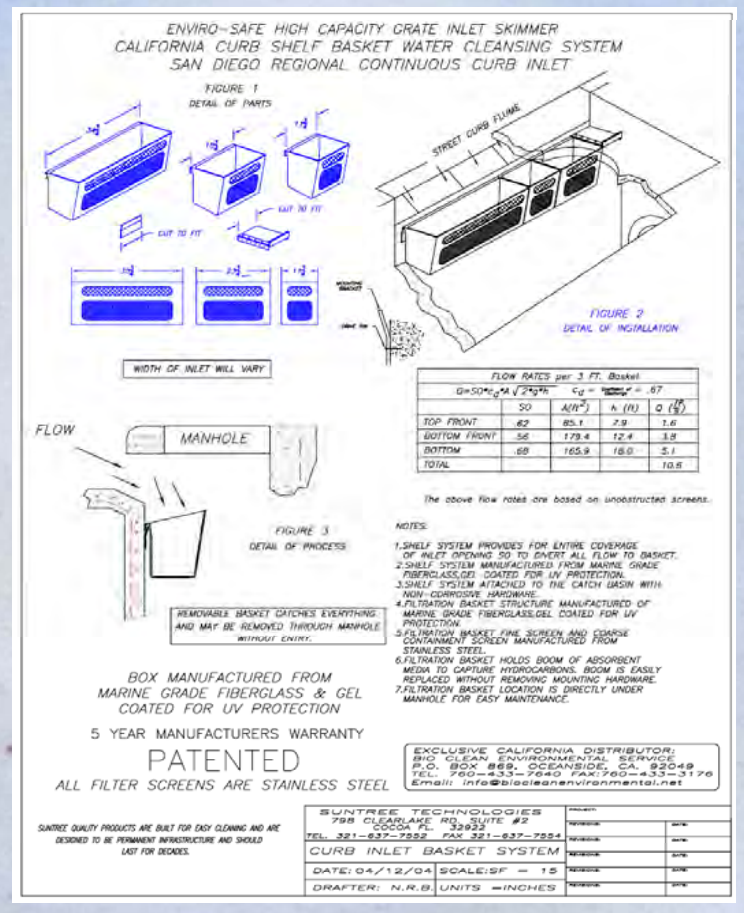
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
Bio Clean/Suntree Technologies
www.suntreetech.com

Bio Clean® has Grated Inlet, Round Curb and Curb Inlet Baskets that are high capacity, multi-stage filtration units incorporating a hydrocarbon boom with coarse, medium and fine screening to capture oils/grease, trash, leaves, yard clippings, and sediment, from low (first flush) flows. The basket is located directly under the manhole for easy cleaning.

BIO CLEAN
ENVIRONMENTAL SERVICES, INC

Bio Clean (Suntree Technologies, Inc.) Grate Inlet Skimmer Box. Hydrocarbon insert is easily removable.



Curb Inlet Basket - Removal Efficiencies

Removal Efficiencies (mg/L)

	Turbidity (NTU)			Total Nitrates mg/L			Total Iron mg/L			Zinc mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
University of Southern California			84%			85%	24.3	19.4	64%	23.5	19.4	79%

University of Southern California - Civil and Environmental Engineering: HYDRAULIC PERFORMANCE, POLLUTANT REMOVAL EFFICIENCIES, AND ECONOMIC EVALUATION OF CATCH BASIN INSERT DEVICES 2003 - Independent Test

Information from Bio Clean Environmental Services, Inc.

Fact Sheet

Category Type:
Catch Basin Curb Inlet

BMP Type:
Manufactured Device

Basic Dimensions:
Depth Below Invert-1-1.67 ft
Dimensions(interior)-1×1 ft to 1.5×4

Specifications:
Peak Flow- 8.6. cfs/ 3 ft basket

Cost per Unit:
$120 per foot, $1,200 per unit

Treatment Function:
Catch Basin

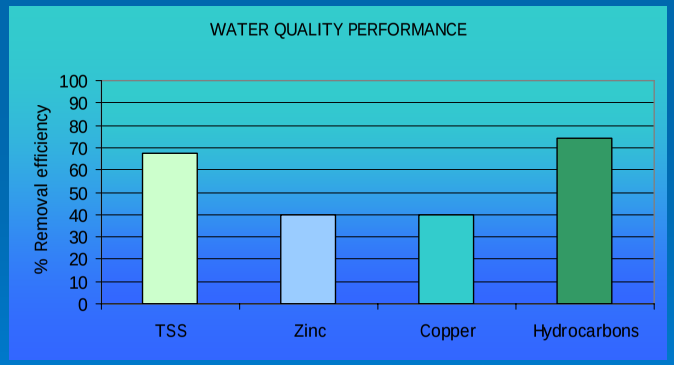
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

Manufacturer Information:
Bio Clean
www.biocleanenvrionmetnal.com

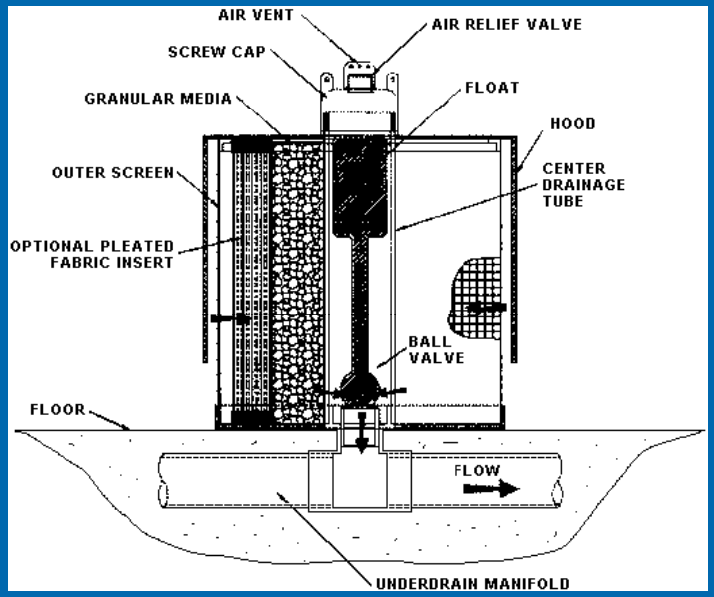
Life Expectancy:
25 yrs

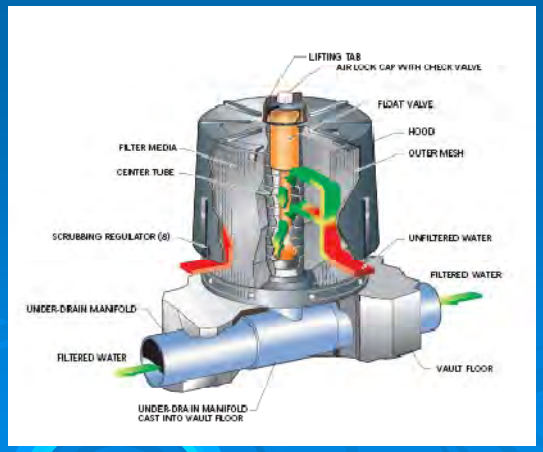
The StormFilter is an inorganic filtration system housed in six different configurations. These configurations include vault/manhole, high flow, drywell, catch basin, volume or curb inlet. Suitable for space constraints and urban sites.
The patented StormFilter cartridge is filled with an array of media, selected to treat the specific pollutant loadings at each site. The Stormfilter system utilizes a siphon-actuated self-cleaning mechanism to avoid clogging and optimize the use of the filter media.
Maintenance requirements may include the periodic replacement of StormFilter cartridges.

The StormFilter manhole/vault configuration.



Based upon CONTEC Construction Products, Inc claim





Information from CONTECH Construction Products, Inc., 2006

Fact Sheet

Category Type:
Filtration Device

BMP Type:
Manufactured Device

Basic Dimensions:
Diminsion-72-128 ft^2

Specifications:
Peak Flow-0.3-8 cfs

Cost per Unit:
$15,500 for 9-cartridge unit

Treatment Function:
Filtration Treatment

Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-Mid

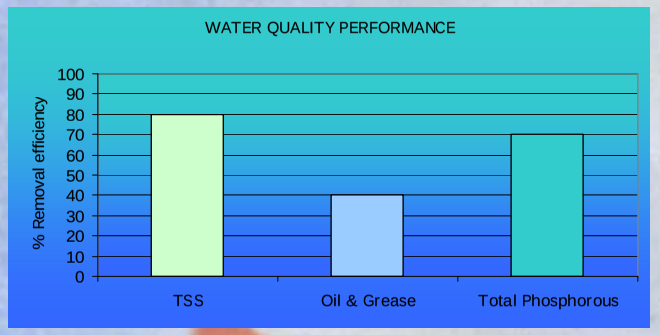
Manufacturer Information:
Vortechnics, Inc
www.vortechnics.com

Life Expectancy:
1 yr (cartridges)

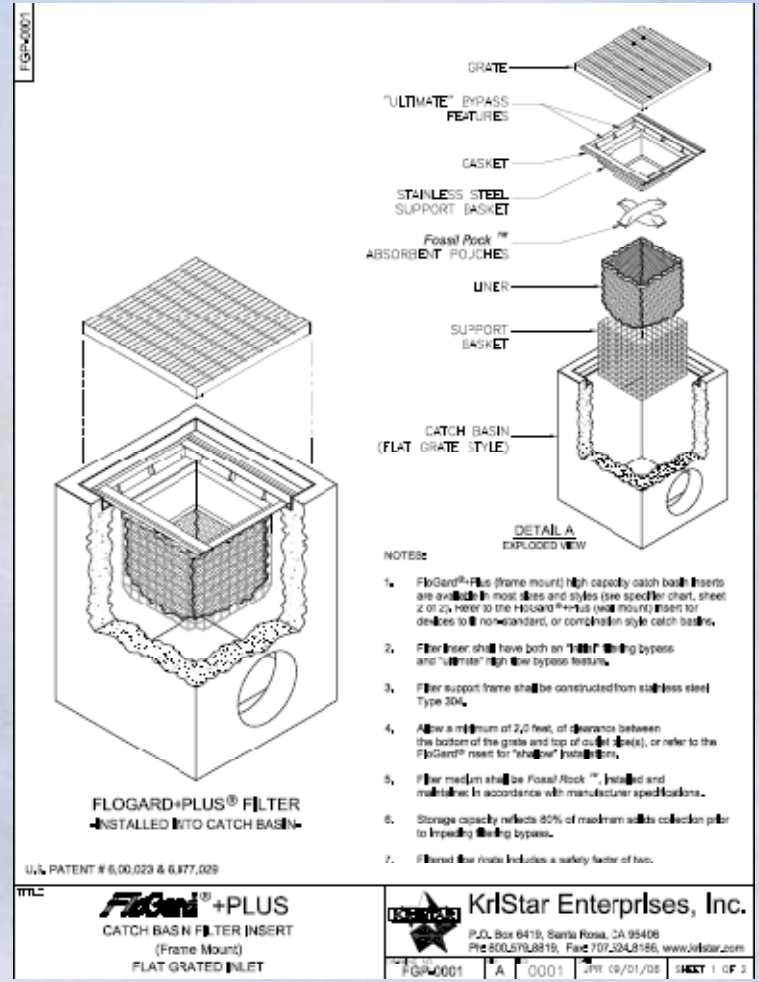
The FloGard+Plus® is a catch basin insert designed to capture sediment, debris, trash and oils/grease from low (first flush) flows. Recommended for areas subject to silt and debris as well as low-to-moderate levels of petroleum hydrocarbons.

Maintenance requirements Plan 3:3:1 (Annual): Three (3) system inspections; Three (3) filter cleanings; One (1) change and disposal of filter medium.

FloGard+Plus catch basin insert.



Based Upon KriStar Claim



Information from KriStar

Fact Sheet

Category Type:
Catch Basin Insert

BMP Type:
Manufactured Device

Basic Dimensions:
Depth Below Invert-1-1.67 ft
Dimensions(interior)-1×1 ft to 1.5×4

Specifications:
Peak Flow-0.4-3.5 cfs

Cost per Unit:
$350, Cost per Sediment Removed $9, Installation $20, Maintenance $275

Treatment Function:
Catch Basin

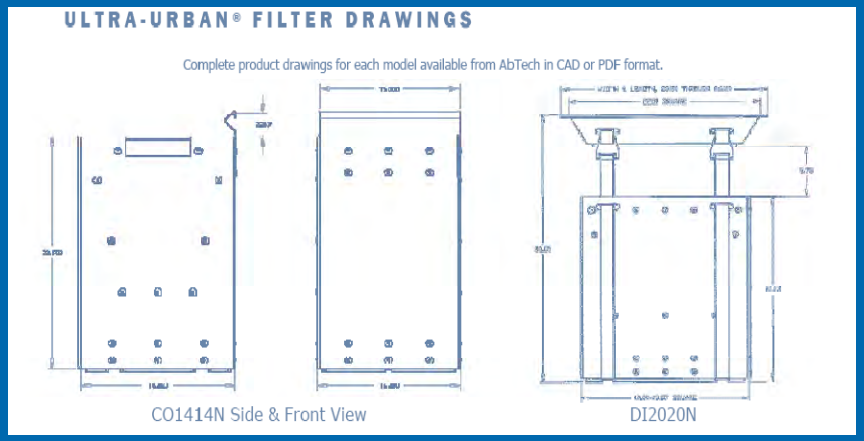
Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

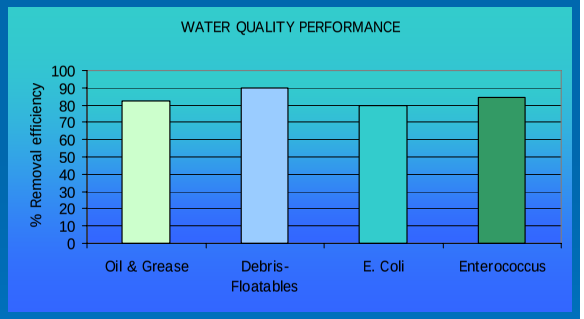
Manufacturer Information:
KriStar
www.kristar.com

Life Expectancy:
25 yrs

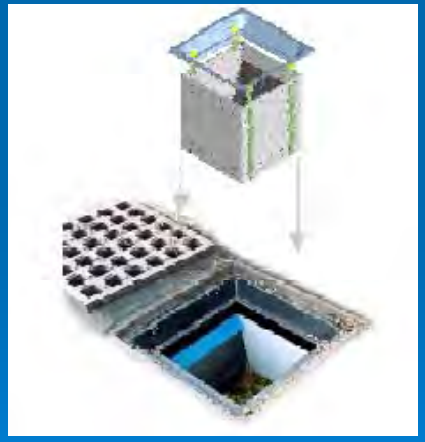
The Ultra-Urban® Filter with Smart Sponge ® Plus is a catch basin insert that uses the patented Smart Sponge ® filtration. Trash and sediment accumulate in the upper basket chamber while oil and grease are absorbed in the filtration media. Recommended for municipal, industrial and construction applications, as well as areas that experience oil and Grease pollution accompanied by sediment and debris.
Maintenance requirements include the periodic replacement of the Ultra-Urban Filter every 1-3 years.

Installation of the Ultra-Urban Filter with Smart Sponge ®.





Based Upon AbTech Industries, Inc. claim



Information from AbTech Industries, Inc., 2006

Fact Sheet

Category Type:
Catch Basin Insert w/ Filtration Device

BMP Type:
Manufactured Device

Basic Dimensions:
Diminsion-1.1'×1.2'×1.9' To 1.6' ×1.6' ×1.8'

Specifications:
Peak Flow-0.39-1.11 cfs

Cost per Unit:
$600-$825 +installation & maintenance

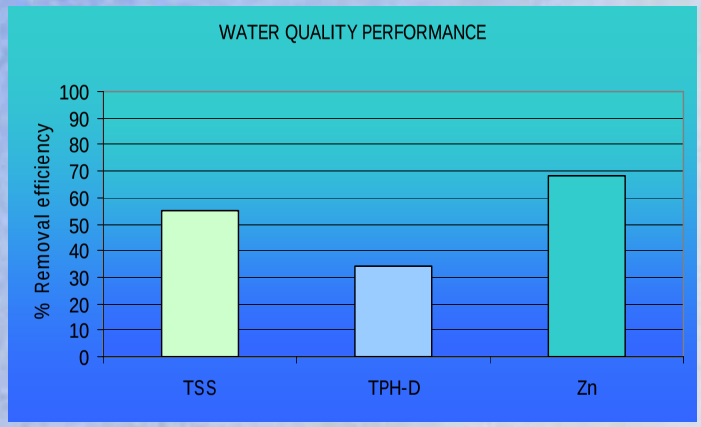
Treatment Function:
Catch Basin, Filtration Media

Maintenance Data:
Maintenance Sensitivity-High
Inspections-High
Sediment Removal-High

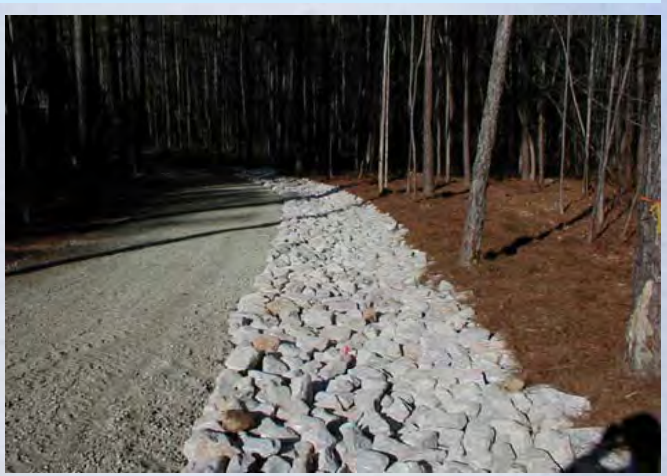
Manufacturer Information:
AbTech Industries
www.abtechindustries.com

Life Expectancy:
1-3 yrs (filter)

A Swale is one of the most common BMPs in the world. Swales are catagorized as stone-lined, vegetated and vegetated retrofit w/ engineered filter berms. A layer of riprap protects the swale from erosion and geotextile filter fabric typically is laid beneath the swale for groundwater protection. A swale is appropriate for both commercial and residential developments or runoff situations such as from Mount Olomana into WKIP 52. Maintenance requirements include standard landscaping, primarily periodic mowing.



Based upon UNH Stormwater Center Data



Riprap can be used to filter stormwater from residential, commercial or runoff areas.

Vegative swale, can be implemented to retain sediment and decrease velocity of stormwater runoff.

Pictures and Information from UNH Stormwater Center, 2005

Fact Sheet

Category Type:
Open Channel System

BMP Type:
Conventional Structural

Basic Dimensions:
Fit to Individual Areas

Specifications:
Catchment-Any acreage
Peak Flow-Any cfs

Cost per Unit:
Labor and up keep costs

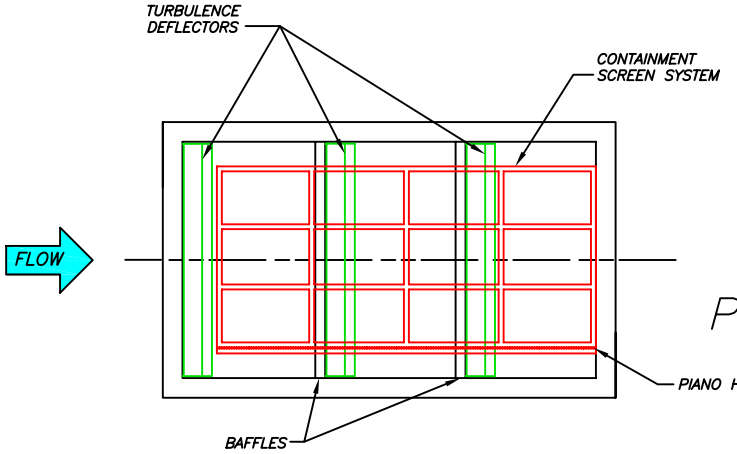
Treatment Function:
Physical Treatment

Maintenance Data:
Maintenance Sensitivity-Low
Inspections-Low
Sediment Removal-Low

Life Expectancy:
Dependant upon up keep amounts

SUNTREE TECHNOLOGIES MODEL NO. NSBB-8-14

HELE CHANNEL CONCEPT DRAWING



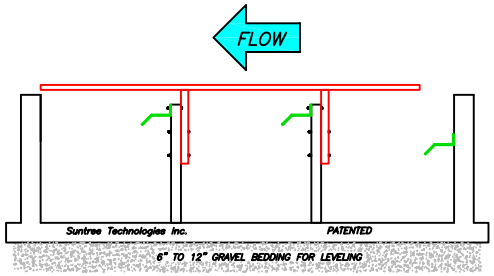
PATENTED

PRELIMINARY DRAWING

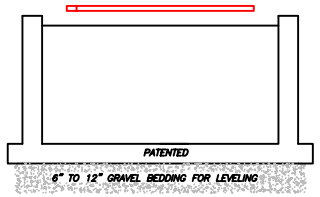
PLAN VIEW

INFLOW AND OUTFLOW PIPES ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE. (CAN NOT INTRUDE BEYOND FLUSH)

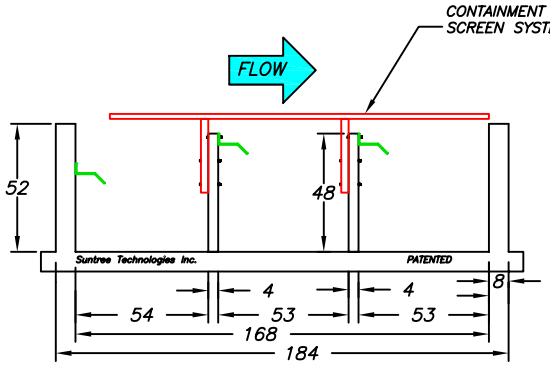
Suntree Technologies Inc.
798 Clearlake Road, Cocoa, Florida 32922
PH: 321-637-7552 Fax: 321-637-7554



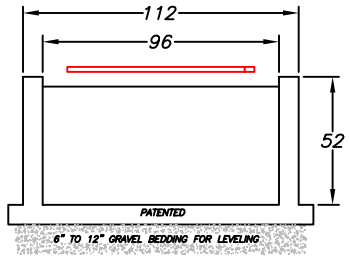
REAR VIEW



LEFT END VIEW



FRONT VIEW



RIGHT END VIEW

NOTES:

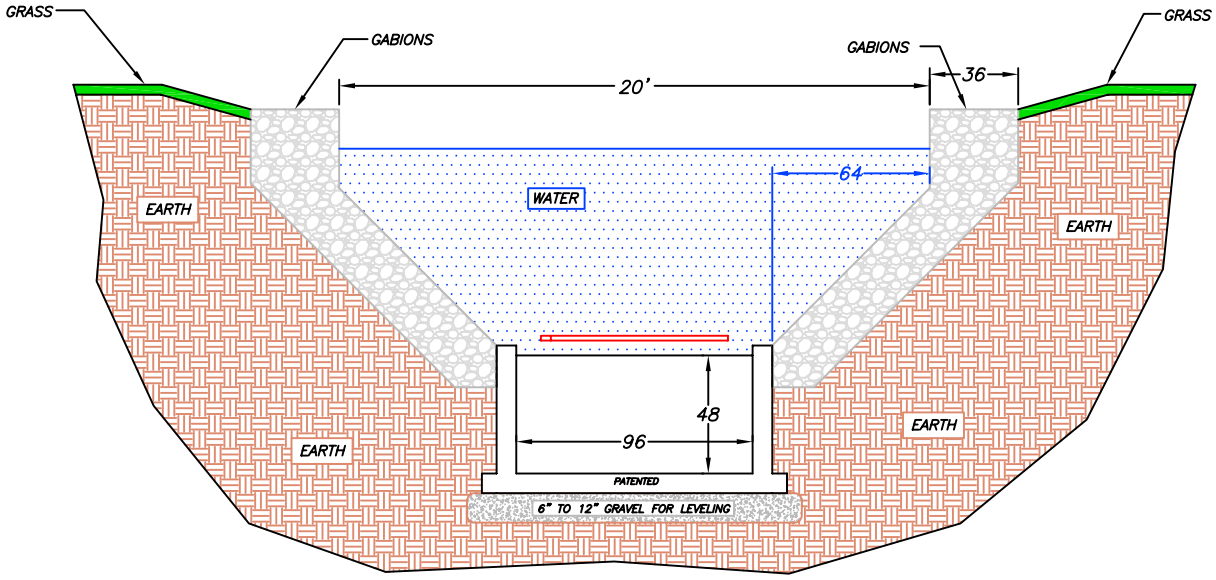
1. CONCRETE 28 DAY COMPRESSIVE STRENGTH FC=5000 PSI
2. REINFORCING: ASTM A-615 GRADE 60
3. SUPPORTS AN H20 LOADING AS INDICATED BY AASHTO.

SUNTREE TECHNOLOGIES, INC. 798 CLEARLAKE RD. SUITE #2 COCOA, FL. 32922	PROJECT: HELE CHANNEL
NUTRIENT SEPARATING BAFFLE BOX MODEL NO.NSBB-8-14	DRAWING #: 2-07-30-07-01 FILE NAME: NSBB-8-14
DATE: 07/30/07 SCALE:SF = 72	REVISIONS: DATE:
DRAFTER: T.H.H. UNITS =INCHES	REVISIONS: DATE:

SUNTREE TECHNOLOGIES MODEL NO. NSBB-8-14
END VIEW IN CHANNEL

HELE CHANNEL
CONCEPT DRAWING

Suntree Technologies Inc.
798 Clearlake Road, Cocoa, Florida 32922
PH: 321-637-7552 Fax: 321-637-7554

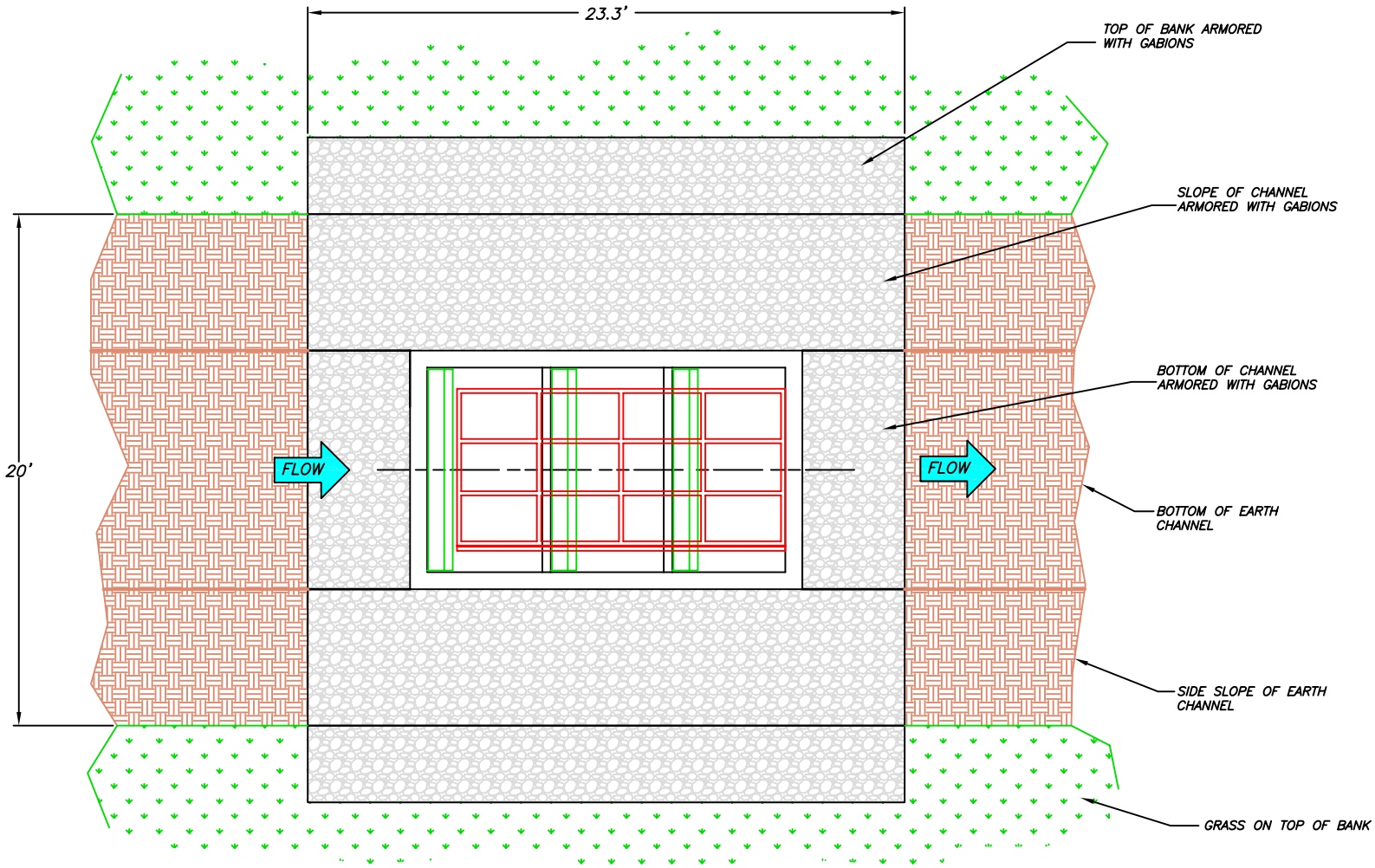


PRELIMINARY DRAWING

SUNTREE TECHNOLOGIES, INC. 798 CLEARLAKE RD. SUITE #2 COCOA, FL. 32922		PROJECT:	HELE CHANNEL
		DRAWING #:	2-07-30-07-02
NUTRIENT SEPARATING BAFFLE BOX MODEL NO.NSBB-8-14-100		FILE NAME:	NSBB-8-14
DATE: 07/30/07	SCALE:SF = 72	REVISIONS:	DATE:
DRAFTER: T.H.H.	UNITS =INCHES	REVISIONS:	DATE:

SUNTREE TECHNOLOGIES MODEL NO. NSBB-8-14
PLAN VIEW IN CHANNEL

HELE CHANNEL
CONCEPT DRAWING



Suntree Technologies Inc.
798 Clearlake Road, Cocoa, Florida 32922
PH: 321-637-7552 Fax: 321-637-7554

PRELIMINARY DRAWING

SUNTREE TECHNOLOGIES, INC. 798 CLEARLAKE RD. SUITE #2 COCOA, FL. 32922		PROJECT: HELE CHANNEL
NUTRIENT SEPARATING BAFFLE BOX MODEL NO.NSBB-8-14		DRAWING #: 2-07-30-07-03
		FILE NAME: NSBB-8-14
DATE: 07/30/07	SCALE:SF = 72	REVISIONS: / DATE:
DRAFTER: T.H.H.	UNITS =INCHES	REVISIONS: / DATE:

BIO CLEAN ENVIRONMENTAL MODEL NO. NSBB 10—14—96

RECOMMENDED PIPE SIZES:48" to 72"

FLOW, TREATMENT, & BYPASS SPECIFICATIONS FOR THE BIOMASS SEPARATING BASKET

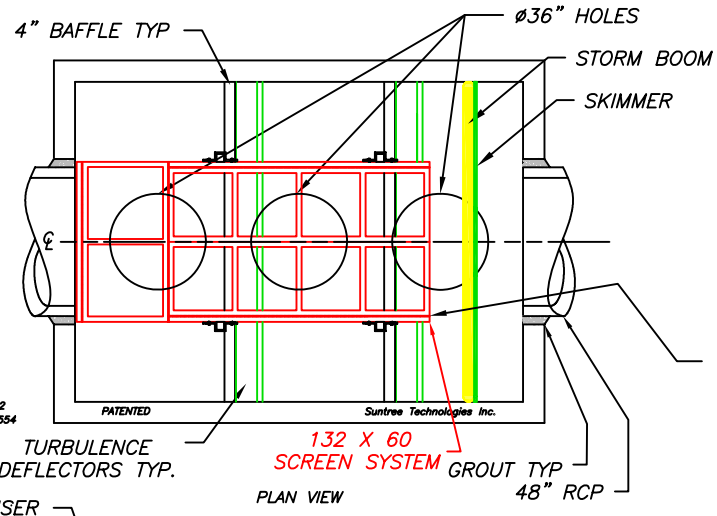
1.Inflow Pipe Area	12.5 SQ.FT.
2.Open Orifice Area in Biomass Separating Basket	57.4 SQ.FT.
3.Treatable Flow Area With No Blockage	57.4 SQ.FT.
4.Treatable Flow Area With 50% Blockage	28.7 SQ.FT.
5.Treatable Flow Area With 75% Blockage	43.0 SQ.FT.
6.Minimum Bypass Available (With Basket 100% Full)	16.2 SQ.FT.

BASKET STORAGE = 123.7 CU. FT. (4.5 CU YD.)

SEDIMENT STORAGE

Lower Front Chamber	140 CU. FT.
Lower Middle Chamber	140 CU. FT.
Lower Rear Chamber	120 CU. FT.
TOTAL	400 CU. FT. (14.8 CU YD.)

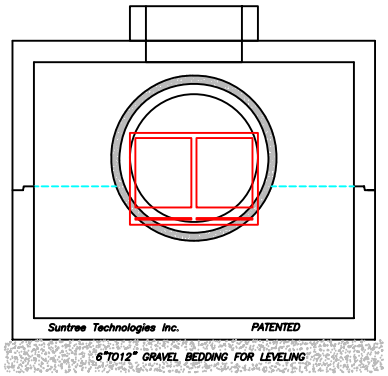
Suntree Technologies Inc.
798 Clearlake Road, Cocoa, Florida 32922
PH: 321-637-7552 Fax: 321-637-7554



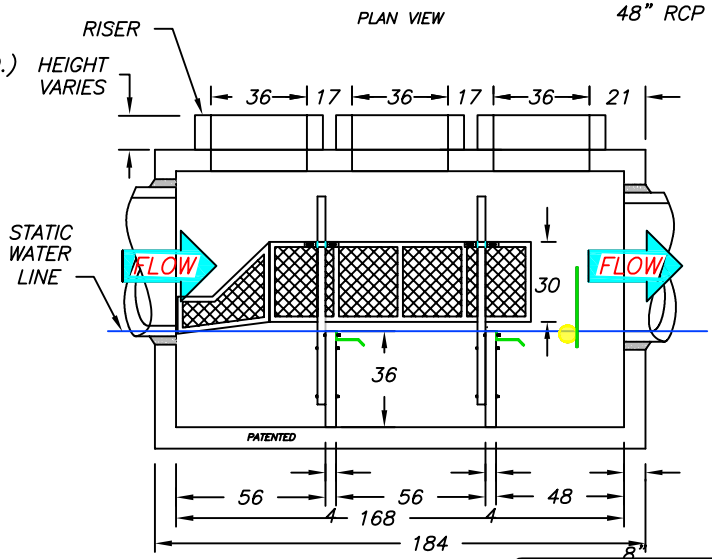
PLAN VIEW

PATENTED

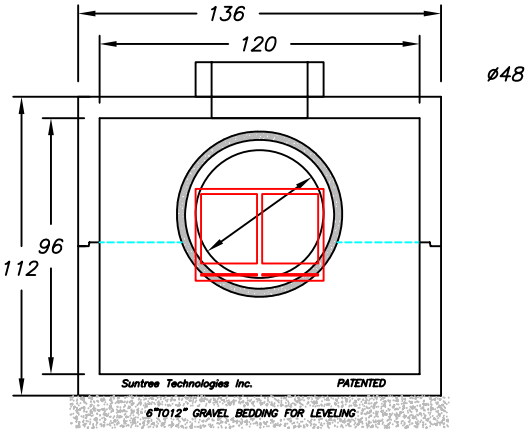
THE STRUCTURE IN THIS DRAWING IS PRIMARILY INTENDED TO BE INSTALLED IN OFF ROAD LOCATIONS WITH LESS THAN 5' OF COVER. STRUCTURES ARE READILY AVAILABLE FOR ALL OTHER CONDITIONS. CONSULT SUNTREE TECHNOLOGIES' REPRESENTATIVE FOR DETAILS.



LEFT END VIEW



FRONT VIEW



RIGHT END VIEW

PEAK DESIGN FLOW

117.8 C.F.S.

(BASED ON 6 FT. PER SEC. FLOW MULTIPLIED BY THE MIN. BYPASS AVAILABLE.)

NOTES:

1. CONCRETE 28 DAY COMPRESSIVE STRENGTH fc=5,000 PSI.
2. REINFORCING:ASTM A-615, GRADE 60.
3. SUPPORTS AN H20 LOADING AS INDICATED BY AASHTO.
4. JOINT SEALANT: BUTYL RUBBER SS-S-00210
5. ALL WALLS, TOP + BOTTOM ARE 8" THICK.

DISTRIBUTED BY:
BIO CLEAN ENVIRONMENTAL SERVICE
P.O. BOX 869, OCEANSIDE, CA. 92049
TEL. 760-433-7640 FAX:760-433-3176
Email: info@biocleanenvironmental.net

SUNTREE TECHNOLOGIES, INC. 798 CLEARLAKE RD. SUITE #2 COCOA, FL. 32922	PROJECT: SUNTREE TECHNOLOGIES SPEC.	
NUTRIENT SEPARATING BAFFLE BOX MODEL NO.NSBB 10-14-96	REVISIONS: BASKET SYSTEM	DATE: 01/06/04
	REVISIONS:	DATE:
DATE: 01/01/04 SCALE:SF = 72	REVISIONS:	DATE:
DRAFTER: N.R.B. UNITS =INCHES	REVISIONS:	DATE:

Explanation of Sizing Recommendations and Design Parameters
– Nutrient Separating Baffle Box

Each Nutrient Separating Baffle Box is custom designed to meet the specific needs and objectives of the client, engineer, and regulatory agency. The design of the Nutrient Separating Baffle Box (NSBB) and sizing recommendations are based upon the following:

- The Nutrient Separating Baffle Box is available in 7 standard models. Within these standard models custom variations are available. Shallower profiles, deeper baffles and taller baskets are examples of variations that are always available to help meet the unique needs and requirements of each project. Larger cast in place models are available.

- The Structure of each NSBB is custom designed based upon depth of installation and loading conditions. The NSBB is structurally designed to meet potential loading conditions associated with roadways, parking lots and deep installations. These factors will affect the amount of steel used in the structure and the thickness of the concrete. Soil conditions are analyzed for potential corrosive conditions, in which case a different type of concrete will be used. The NSBB may also be coated for installations with high ground water. A detailed structural report is provided for each individual NSBB based upon individual site conditions.

- Sizing and configuration (online/offline) of the NSBB is based upon the treatment Q (the CFS that is required to be treated for pollutants) and the design Q (the CFS that the drainage system must be designed to handle; usually based upon the Q (25, 50, 100) depending on local regulations). For offline configuration the NSBB will be sized to the treatment Q and higher flows will be bypassed.

- For online configurations the NSBB will be sized to both the treatment Q and the design Q. With the online configuration sizing to the treatment Q will be determined the same as with the offline setup. The NSBB must also be sized to handle the maximum flow of the design Q. This will ensure that the NSBB will not cause flooding. It should be noted the NSBB's flow and treatment capacities have been calculated assuming that the trash basket and sediment chambers are completely full to simulate worst case scenario. Many areas the design Q is based upon the Q (100) or hundred year storm. The 100 year storm has less than a 1% chance of occurring in a given year. This standard ensures that drainage systems are designed to handle 99.9% of storm events and thus preventing the possibility of flooding. The Nutrient Separating Baffle Box is designed to this same standard for online configurations.

- Sizing is dependent upon removal efficiency requirements of the residing regulatory agency. For example, agencies in Southern California require 80% removal of TSS based upon a particle size distribution similar to that usually found in the stormwater runoff. This particle size distribution can vary between geographical areas and site conditions. The NSBB can be designed to meet the requirements of all agencies. The NSBB has been tested both in the field and laboratory since 1994. The system has been tested over a wide range of flows and velocities at different concentrations and of different particle size distributions. This combination of field and laboratory has been correlated and verified by comparing results with extensive analysis of settling and scouring velocities, Stokes Law, NSBB entrance, operating and exit velocities, Hydraulic loading rates, and data from similar and competing BMPs. This extensive testing, analysis and comparison allows the NSBB to be sized and configured to provide superior removal efficiencies over a wide range of particle sizes and flow rates.

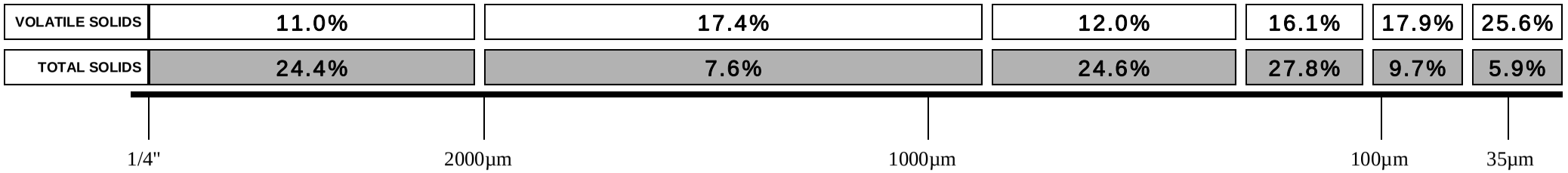
Nutrient Separating Baffle Box

Removal Efficiencies and Flow Rates

NSBB MODEL#	80% TSS Removal 1000 µm Particle Size @ Peak Treatment Flow	80% TSS Removal 250 µm Particle Size @ Peak Treatment Flow	80% TSS Removal 150 µm Particle Size @ Peak Treatment Flow	80% TSS Removal 125 µm Particle Size @ Peak Treatment Flow	80% TSS Removal 75 µm Particle Size @ Peak Treatment Flow	80% TSS Removal 50 µm Particle Size @ Peak Treatment Flow
	(Max Treatment Capacity Recommended)	Peak Treatment Flows (C.F.S)				
4-6.5-72	10.6	6.93	3.58	2.14	1.27	0.87
4-8-84	10.6	8.53	4.41	2.63	1.56	1.67
5-10-84	29.5	13.33	6.89	4.11	2.44	1.2
6-12-84	42.4	19.20	9.92	5.92	3.52	2.40
8-12-96	95.4	25.60	13.23	7.89	4.69	3.20
8-14-96	95.4	29.87	15.43	9.21	5.48	3.73
10-14-96	169.6	37.33	19.29	11.51	6.84	4.67

No Re-Suspension at These Flow Rates

Typical Particle Size Distribution (PSD) Of Stormwater Pollutants - Varies Based Upon Storm Intensity, Land Use, Impervious Coefficient, Geographical Region, Storm Drain Design



"While TSS measures the fine material suspended in the water column, it does not measure the larger bedload particles that are found in the bottom of a pipe, too heavy to become suspended except in high velocities" (ASCE Monitoring Guidelines for Measuring Stormwater Gross Solids, Stormwater Magazine, Nov/Dec 2005)".

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

P O Box 869, Oceanside, CA 92049
(760) 433-7640 • Fax (760) 433-3176
www.biocleanenvironmental.net

"The Stormwater Standard"

OPERATION & MAINTENANCE

Nutrient Separating Baffle Box

Maintenance: The Nutrient Separating Baffle Box is designed to allow for the use of vacuum removal of captured materials in the filter screens and sediment chambers, serviceable by centrifugal compressor vacuum units without causing damage to the filter or during normal cleaning and maintenance. Filters can be cleaned and vacuumed from the standard manhole access.

Maintenance Notes:

1. Bio Clean Environmental Services, Inc. recommends the Nutrient Separating Baffle Box be inspected a minimum of once every six months. The cleaning and debris removal maintenance a minimum of once year and replacement of hydrocarbon booms once a year. The procedure is easily done with the use of any standard vacuum truck.
2. Following maintenance and/or inspection, the maintenance operator shall prepare a maintenance/inspection record. The record shall include any maintenance activities performed, amount and description of debris collected, and condition of filter.
3. The owner shall retain the maintenance/inspection record for a minimum of five years from the date of maintenance. These records shall be made available to the governing municipality for inspection upon request at any time.
4. Any person performing maintenance activities must have completed a minimum of OSHA 24-hour hazardous waste worker (hazwoper) training.
5. Remove access manholes lid to gain access to filter screens and sediment chambers. Where possible the maintenance should be performed from the ground surface. Note: entry into an underground stormwater vault such as an inlet vault requires certification in confined space training.
6. Remove all trash, debris, and organics from the Nutrient Separating Screen with the vacuum hose.
7. The Nutrient Separating Screen has 3 hinged panels which will open into an upright position. This will expose the baffles. Using a vacuum hose, remove the sediment in the baffle chambers.
8. Evaluation of the hydrocarbon boom shall be performed at each cleaning. If the boom is filled with hydrocarbons and oils it should be replaced. Place new booms properly in media cage.
9. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
10. The hydrocarbon boom is classified as hazardous material and will have to be picked up and disposed of as hazardous waste. Hazardous material can only be handled by a certified hazardous waste trained person (minimum 24-hour hazwoper).

BIO CLEAN
ENVIRONMENTAL SERVICES, INC.

P O Box 869, Oceanside, CA 92049
(760 433-7640 Fax (760) 433-3176
www.biocleanenvironmental.net

Nutrient Separating Baffle Box - Removal Efficiencies

Numeric Reductions (mg/L)

	Total Suspended Solids mg/L			Total Phosphorus mg/L			Total Nitrogen mg/L		
Study	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency
Dillard & Associates - Field Test	N/A	N/A	93.3%						
Pandit - Physical Modeling	N/A	N/A	89.8%						
Sunset Park Baffle Box	81.15	26.9	66.9%	1.909	1.022	46%			
Lubnow - Harvey's Lake	918	126	86.3%	0.47	0.32	32%			
Royal - Indialantic	32.9	7.6	76.9%	1.49	0.44	70%			
Royal - Micco	16.55	8.625	47.9%	0.055	0.0425	23%			
Pastore - Pine St	110	31	71.8%	0.33	0.19	42%	3.5	1.3	63%
Pastore - 5th St	85	27	68.2%	0.31	0.21	32%	1.6	0.99	38%
Pastore - 7th St	44	27	38.6%	0.22	0.18	18%	2.3	1.3	43%

	Zinc mg/L			Lead mg/L			Copper mg/L		
Study	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency	Influent	Effluent	Removal Efficiency
Pastore - Pine St	0.072	0.044	39%	0.0085	0.0062	27%	0.012	0.0094	22%
Pastore - 5th St	0.088	0.038	57%	0.014	0.0065	54%	0.017	0.01	41%
Pastore - 7th St	0.057	0.041	28%	0.0066	0.0051	23%	0.014	0.011	21%

	BOD (mg/L)		
Study	Influent	Effluent	Removal Efficiency
Sunset Park Baffle Box	16.391	4.125	75%
Royal - Indialantic	1.88	1.4	26%
Royal - Micco	1.59	1.7	-7%

Dillard & Associates Consulting Engineers - Field Test for Suntree Nutrient Separating Baffle Box - Test Report - Feb 2005

Pandit & Gopatakrishnan - Florida Institute of Technology - Physical Modeling of a Stormwater Sediment Box - 1996 - Independent Test

Sunset Park Baffle Box - Brevard County Surface Water Improvement - St. John's River Water Management District - 1998 - Independent Test

Lubnow & Miller - Princeton Hydro - The Design, Installation, and Effectiveness of a Structural BMP for Harveys Lake - 2003 - Independent Test

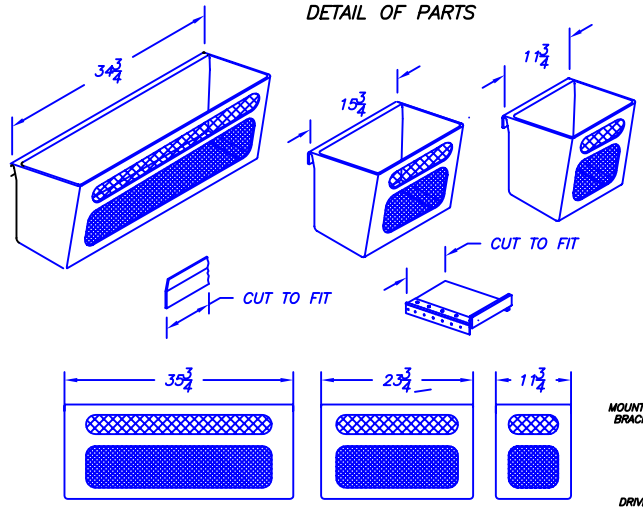
Royal & Vanderbleek - Brevard County Surface Water Improvement Div - Sediment Control Project, Indiatlantic/Micco - 1994 - Independent Test

Pastore - Blue Water Environmental - Atlantic Beach Monitoring Study: Pine St, 5th St, 7th St - 2004

Nutrient Separation Baffle Box Jobs					
Customer	**Job Name**	**# of Units**	**Model #**	**City of Install**	**Date**
City of Laguna Niguel	Laguna Niguel	1 NSBB	6-12-84	LAGUNA NIGUEL, CA	APRIL '03
Private	Grand Avenue Estate	1 NSBB	6-12-84	SAN MARCOS, CA	OCT. '03
Private	Sycamore #1	1 NSBB	6-12-84	POWAY, CA	JUNE '04
		1 NSBB	8-12-96		
Private	Sycamore #2	1 NSBB	6-12-84	POWAY, CA	MAY '04
City of Carlsbad	Cannon Road	1 NSBB	8-14-96	CARLSBAD, CA	JULY '04
Private	Farber Condos	1 NSBB	4-6-72	CARLSBAD, CA	DEC. '04
Private	Montecito	1 NSBB	6-12-84	SAN DIEGO, CA	APRIL '05
City of Chula Vista	Veterans Park	2 NSBB	4-6-72	CHULA VISTA, CA	JUNE '05
City of San Diego	Mt. Arian & Mt. Ashmun	1 NSBB	8-14-96	SAN DIEGO, CA	OCT. '05
		1 NSBB	6-12-84		
Private	Ontario Borba	1 NSBB	5-10-84	ONTARIO, CA	SEPT. "05
City of Santa Monica	Centinela Urban Runoff	1 NSBB	8-12-96	SANTA MONICA, CA	APRIL '06
Federal	Liberty Station	1 NSBB	5-10-84	POINT LOMA, CA	MAY '06
		1 NSBB	6-12-84		
Private	Mater Dei High School	2 NSBB	4-8-84	CHULA VISTA, CA	JULY '06
		2 NSBB	5-10-84		
		1 NSBB	10-12-84		
Private	Vista Village Phase 4	2 NSBB	5-10-84	VISTA, CA	JULY '06
Private	Ocean View	1 NSBB	10-14-108	OTAY MESA, CA	CURRENT
Private	Breeze Hill Promenade	1 NSBB	5-10-84	VISTA, CA	CURRENT
Bonadiman McCain, Inc.	Palo Verde	1 NSBB	11-16-114	MONTCLAIR, CA	NOV. '06
City of Simi Valley	Public Services Center	1 NSBB	4-6-60	SIMI VALLEY, CA	OCT. '06
J & S Excavating, Inc.	PD-S-961 Tract#5413	1 NSBB	5-10-84	SIMI VALLEY, CA	DEC. '06

ENVIRO–SAFE HIGH CAPACITY GRATE INLET SKIMMER
CALIFORNIA CURB SHELF BASKET WATER CLEANSING SYSTEM
SAN DIEGO REGIONAL CONTINUOUS CURB INLET

FIGURE 1
DETAIL OF PARTS



WIDTH OF INLET WILL VARY

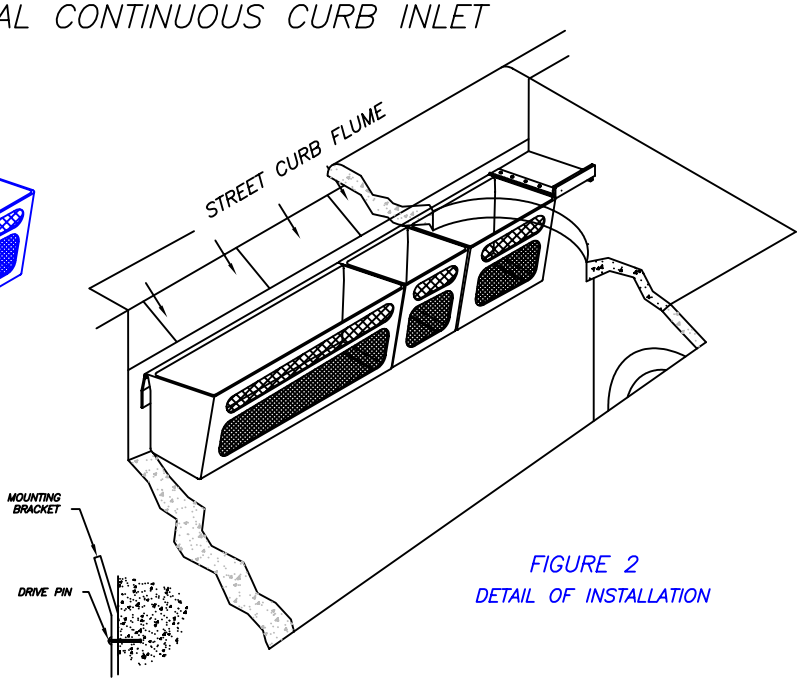


FIGURE 2
DETAIL OF INSTALLATION

FLOW RATES per 3 FT. Basket				
$Q=SO*c_d*A\sqrt{2*g*h}$ c_d = Coefficient of Discharge = .67				
	SO	$A(ft^2)$	h (ft)	Q $(\frac{ft^3}{s})$
TOP FRONT	.62	85.1	7.9	1.6
BOTTOM FRONT	.56	179.4	12.4	3.8
BOTTOM	.68	165.9	18.0	5.1
TOTAL				10.6

The above flow rates are based on unobstructed screens.

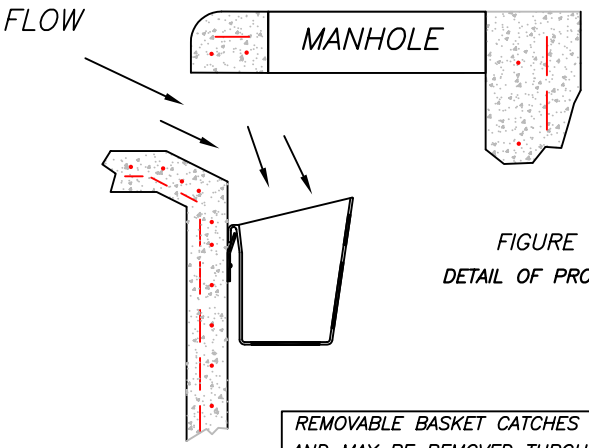


FIGURE 3
DETAIL OF PROCESS

REMOVABLE BASKET CATCHES EVERYTHING AND MAY BE REMOVED THROUGH MANHOLE WITHOUT ENTRY.

NOTES:

1. SHELF SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO BASKET.
2. SHELF SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS,GEL COATED FOR UV PROTECTION.
3. SHELF SYSTEM ATTACHED TO THE CATCH BASIN WITH NON–CORROSIVE HARDWARE.
4. FILTRATION BASKET STRUCTURE MANUFACTURED OF MARINE GRADE FIBERGLASS,GEL COATED FOR UV PROTECTION.
5. FILTRATION BASKET FINE SCREEN AND COARSE CONTAINMENT SCREEN MANUFACTURED FROM STAINLESS STEEL.
6. FILTRATION BASKET HOLDS BOOM OF ABSORBENT MEDIA TO CAPTURE HYDROCARBONS. BOOM IS EASILY REPLACED WITHOUT REMOVING MOUNTING HARDWARE.
7. FILTRATION BASKET LOCATION IS DIRECTLY UNDER MANHOLE FOR EASY MAINTENANCE.

BOX MANUFACTURED FROM MARINE GRADE FIBERGLASS & GEL COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

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COCOA FL. 32922
TEL. 321–637–7552 FAX 321–637–7554

CURB INLET BASKET SYSTEM

DATE: 04/12/04	SCALE:SF = 15
DRAFTER: N.R.B.	UNITS =INCHES

PROJECT:	
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

CALIFORNIA CURB SHELF BASKET WATER CLEANSING SYSTEM
SAN DIEGO REGIONAL STANDARD CURB INLET

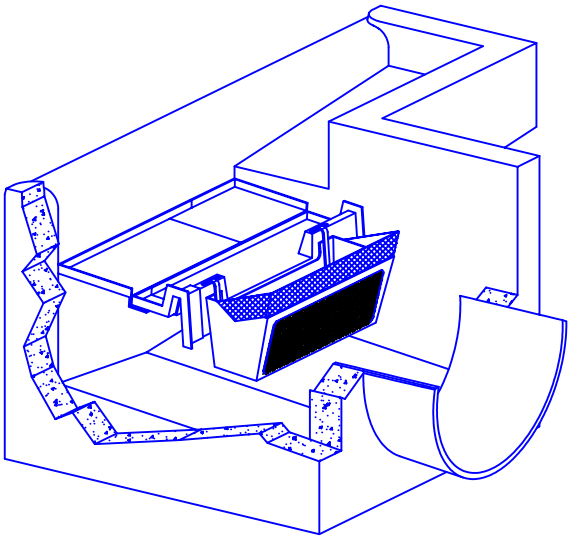

FIGURE 1
DETAIL OF PARTS

WIDTH OF INLET WILL VARY

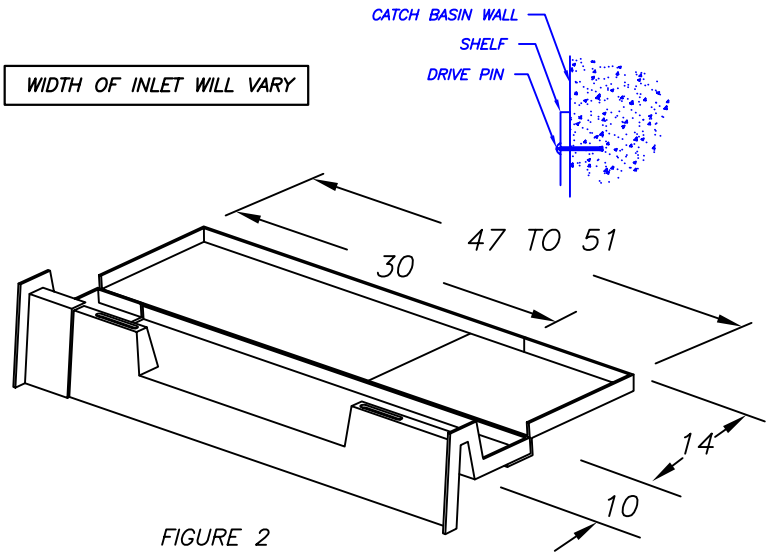

FIGURE 2
DETAIL OF INSTALLATION

REMOVABLE BASKET CATCHES EVERYTHING AND MAY BE REMOVED THROUGH MANHOLE WITHOUT ENTRY.

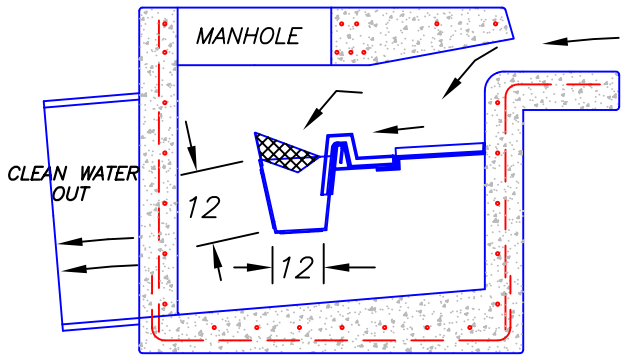

FIGURE 3
DETAIL OF PROCESS

FLOW RATES per 3 FT. Basket				
$Q=SO*c_d*A\sqrt{2*g*h}$ c_d = Coefficient of Discharge = .67				
	SO	$A(ft^2)$	h (ft)	Q $(\frac{h^3}{s})$
Coarse Screen	.62	.84	0.146	1.06
Med Screen	.56	1.36	0.75	3.53
Fine Screen	.68	1.02	1.167	4.01
TOTAL				8.6

The above flow rates are based on unobstructed screens.

NOTES:

1. SHELF SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO BASKET.
2. SHELF SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS,GEL COATED FOR UV PROTECTION.
3. SHELF SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTRATION BASKET STRUCTURE MANUFACTURED OF MARINE GRADE FIBERGLASS,GEL COATED FOR UV PROTECTION.
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6. FILTRATION BASKET HOLDS BOOM OF ABSORBENT MEDIA TO CAPTURE HYDROCARBONS. BOOM IS EASILY REPLACED WITHOUT REMOVING MOUNTING HARDWARE.
7. FILTRATION BASKET LOCATION IS DIRECTLY UNDER MANHOLE FOR EASY MAINTENANCE.

BOX MANUFACTURED FROM MARINE GRADE FIBERGLASS & GEL COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

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CURB INLET BASKET SYSTEM

DATE: 04/12/04 | SCALE:SF = 15

DRAFTER: N.R.B. | UNITS =INCHES

PROJECT:	
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

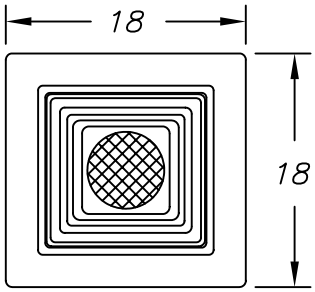
Curb Inlet Basket - Removal Efficiencies

Removal Efficiencies (mg/L)

	Turbidity (NTU)			Total Nitrates mg/L			Total Iron mg/L			Zinc mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
University of Southern California			84%			85%	24.3	10.4	64%	24.3	10.4	79%

University of Southern California - Civil and Environmental Engineering. HYDRAULIC PERFORMANCE, POLLUTANT REMOVAL EFFICIENCIES, AND ECONOMIC EVALUATION OF CATCH BASIN INSERT DEVICES 2005 - Independent Test

Part # GISB-18-18-12

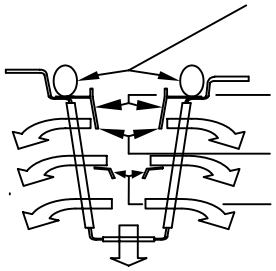


TOP VIEW

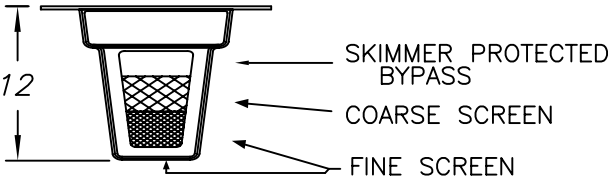
Flow Specifications

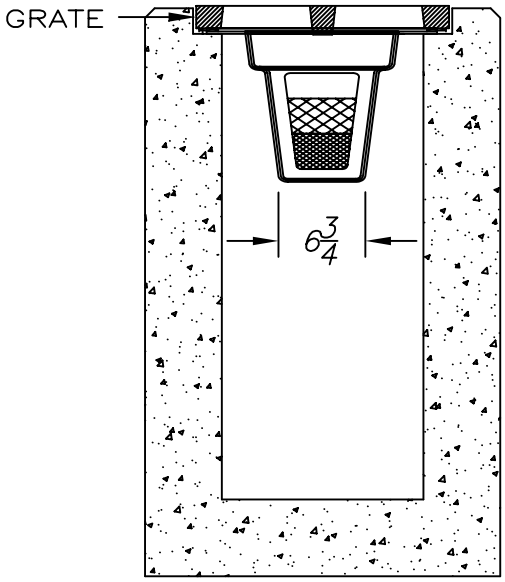
Description of filter opening	Percent Open (Based on Screen Dimensions)	Total Square Inches per Unit	Square Inches of Total Unobstructed Openings	Flow Rate (Cubic Feet per Second)
Skimmer protected By-Pass	100%	48.0	48.0	1.7 cfs
Coarse Screen 3/4" x 1-3/4" stainless steel flattened expanded	62%	48.0	29.7	1.3 cfs
Medium Screen 10x10 mesh stainless steel	56%	48.0	26.8	1.3 cfs
Fine screen 14 x 18 mesh stainless steel	68%	49.0	49.0	1.8 cfs
THROAT FLOW RATE Total:.8cfs			TREATED FLOW RATE Total: 4.4cfs	
FLOW RATES BASED ON UNOBSTRUCTED OPENINGS				

FLOW SCHEMATIC



SIDE VIEW





CONCRETE STRUCTURE

BOX MANUFACTURED FROM MARINE GRADE FIBERGLASS & GEL COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

REMOVE GRATE
INSERT GISB
REINSTALL GRATE

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TEL. 321-637-7552 FAX 321-637-7554

GRATE INLET SKIMMER BOX
GISB-18-18-12

DATE: 04/12/04 | SCALE:SF = 15

DRAFTER: N.R.B. | UNITS =INCHES

PROJECT:	
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

Grate Inlet Skimmer Box - Removal Efficiencies

Numeric Reductions (mg/L)

	Total Suspended Solids mg/L			Total Phosphorus mg/L			Total Nitrogen mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek			74%			57%	24.3	10.4	57%
Creech Engineering Report			73%			79%			79%
Witman's Pond	978	329	66%	18.6	0.452	98%	48.08	9.86	79%
UC Irvine			53%						

	Zinc mg/L			Lead mg/L			Copper mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
UC Irvine			11%			99%			
Longo Toyota	13.7	0.73	95%	1.5	0.2	87%	1.9	0.1	95%

	Ammonia, Salicylate mg/L			Fecal Coliform CFU/100 mL			Cadmium		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek	0.38	0.23	39%						
UC Irvine						33%			94%

	Hydrocarbons mg/L			COD (mg/L)		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek			54%	2670	1490	44%
Witman's Pond	110	50	55%			
UC Irvine			90%			
Longo Toyota	199	10.43	95%			

Reedy Creek - Site Evaluation of a Grate Inlet Skimmer Box for Debris, Sediment, and Oil & Grease Removal - 1999 - Independent Test

Creech Engineering Report - Pollutant Removal Testing for a Grate Inlet Skimmer Box - 2001

Witman's Pond - Restoration Project - Massachusetts Dept of Environmental Management - 1998 - Independent Test

UC Irvine - Optimization of Stormwater Filtration at the Urban/Watershed Interface - Dept of Environmental Health - 2005 - Independent Test

Longo Toyota - Field Test - City of El Monte - 2002 - Independent Test

HAWAII REPORT: The Efficiency of Storm Drain Filters in Removing Pollutants from Urban Road Runoff

Performance matrix for field tested DII systems				
Parameter	**AbTech**	**Hydrocompliance**	**KriStar**	**Bioclean**
Initial device cost (10 ft drain inlet)	10	5	15	20
Initial installation requirements	10	2.5	7.5	5
Flow capacity	5	10	2.5	7.5
Turbidity during short term test	5	10	7.5	2.5
Short term RDS retention	10	5	7.5	2.5
Short term organics retention	10	2.5	7.5	5
Long term RDS retention	2.5	10	7.5	5
Long term PAH retention (mg)	5	10	7.5	5
Long term O/G retained (mg)	10	5	2.5	7.5
Long term overall rubbish retention	5	5	10	10
Suitability for Vector Control	5	2.5	7.5	10
Unit durability	7.5	2.5	7.5	10
Media replacement Costs	5	10	15	20
Suitability for Type B basin	2.5	2.5	7.5	10
Servicing Requirements	18	9	15	22
TOTAL SCORE	**110.5**	**91.5**	**127.5**	**142**
Performance of DII is ranked from one to four, with increasing scores assigned to increasing performance of the device. Ranks for each category are scaled to 10 except initial costs and media replacement costs which are scaled to 20. Servicing requirements are based on a score of 25 as determined in Appendix A. Maximum total possible score is 185.				

The Complete Report can be Viewed at: http://www.biocleanenvironmental.net/reports/reports.htm

Table 17: DII Servicing Time Table

Site	DII System	Required Servicing Time (hours)
15	Hydrocompliance	1.75
17	KriStar	1.0
18	AbTech	0.5
19	Bioclean	0.25

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"The Stormwater Standard"
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Table 19: Total Servicing Box-Score Summary

Site	DII System	Total Scores
15	Hydrocompliance	9
17	KriStar	15
18	AbTech	18
19	Bioclean	22

Bio Clean

Cost: $120 per foot, $1,200 total for a typical Type A catch basin.

Maintenance Time: 15 minutes

At a cost of $1,200 per unit, it would cost $2.52 million to install 2,100 BioClean systems. This is less than but comparable to the KriStar system. Assuming that a work crew could service 42 units a day, it would take about two and one-third months to service all locations. This system is the simplest to service and access. The hardy construction of the system is a definite advantage and it is anticipated that replacement of the BioClean system and/or its parts would be very infrequent.

Recommendation: Potentially feasible system for large scale BMP implementation.

Hydrocompliance Hydrokleen

Cost: $3,900 per initial catch basin (assuming six subunits in a standard Type A catch basin). Replacement cost of pillows: $150 (x amount of units in catch basin)

Maintenance Time: 105 minutes per catch basin

Assuming a median of $3,900 per catch basin, it would cost $8.19 million to install the Hydrocompliance system in 2,100 catch basin. This figure does not include the replacement cost of pillows. It would take a crew 26 months to service each location.

Recommendation: This system is not recommended for large scale BMP implementation.

The Complete Report can be Viewed at: http://www.biocleanenvironmental.net/reports/reports.htm

AbTech Ultra-Urban

Cost: $250 per 13 inches, $2,250 total for a typical Type A catch basin.

Maintenance Time: 30 minutes

At a cost of $2,250 per catch basin, it would cost $4.2 million to install 2,100 AbTech systems. Assuming that a work crew could service 21 catch basins each day after initial installation, it would take a crew less than five months to service each location. This system, however, is the most effective for capturing oil and grease. It performs relatively poorly for PAH capture, and is the worst performer for sediment.

Recommendation: This system is not recommended for large scale BMP implementation.

KriStar Flogard+ Plus

Cost: $165 per linear foot, or $1,650 per catch basin. Replacement costs: polymer liners $60-100 and pillows $50-90 (prices for both are size dependent) (x amount of units in catch basin)

Maintenance Time: 60 minutes per catch basin

At a cost of $1,650 per catch basin, it would cost $3.65 million to install 2,100 KriStar systems. Once installed, assuming that a work crew could service 14 catch basins a day, it would take a work crew just over seven months to service all locations. Regular replacement of pillows represents the major cost expedenture beyond installation.

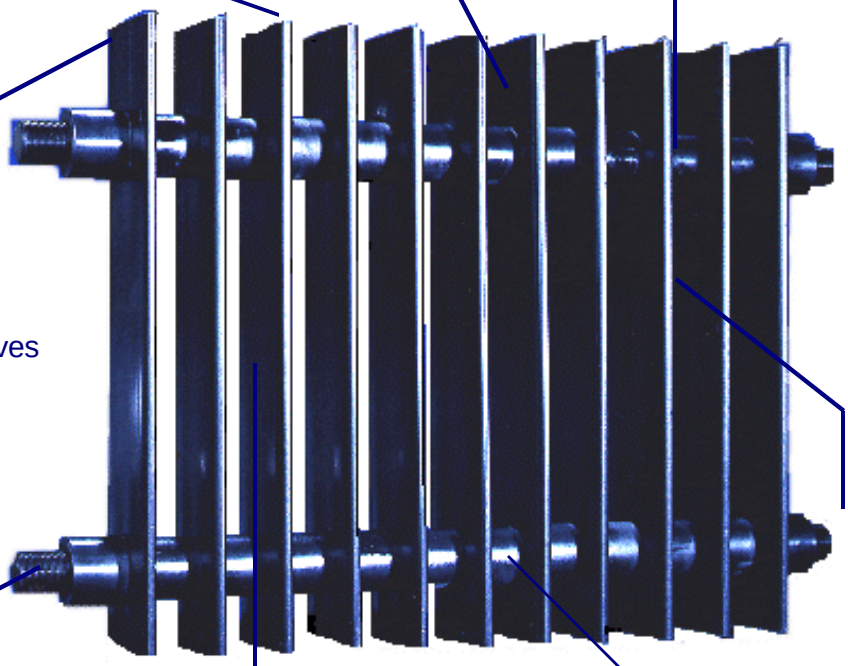
Recommendation: Potentially feasible system for large scale BMP implementation.

HYDROTHANE SYSTEMS

Non-corrosive
Racks never rust or corrode.
Ideal for salt water uses.

Polyethylene Bars
Higher abrasion resistance
than even steel!

Eliminates frazil ice
Frazil and anchor ice do not
attach to rack surfaces, reduces
headloss, improves flow



Rounded Bars
Reduces headloss, improves
flow

Lightweight
75% lighter than steel

Fiberglass Tie Rods
High strength protruded 1.25” dia
fiberglass tie rods provide strength
and flexibility.

Flexible spacing
Bar spacing up to 8” or angled up to
40 degrees for fish diversion screens

Smooth Hard Surfaces
Resists all marine growth including
zebra mussels and barnacles

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TRASH RACKS
non-metallic

APPENDIX E

EXCERPTS from CITY NPDES PERMIT and WKIP STORM WATER OUTFALL DATA

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF
HONOLULU, HAWAII

PART 2

APPLICATION FOR NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR

STORMWATER DISCHARGES INTO WATERS OF THE UNITED STATES FROM MUNICIPAL SEPARATE STORM SEWER SYSTEMS

November 16, 1992

NOTES AND ABBREVIATION USED IN PERMIT APPLICATION

ABBREVIATION AND NOTES

ID Number	Receiving Water Identification Number and Stations
CT	Census Tract Number
TMK	Tax Map Key
Area	Area of Drainage Basin in acres
GLU/Area	General Land Use Area
CPOP/FPOP	Current Resident Population/Future Resident Population
STR	Stream
Cond	Conduit (Pipe Diameter) size in inches or feet
mj	Major outfall as defined in 40 CFR Part 123 Subpart B
mn	Not a major outfall (minor) as defined
Flow	Design Flow Rate in cubic feet per second (CFS)
Recvwater	Receiving Waters of the United States except when discharge is to gulch
SIC	Standard Industrial Classification Code
FSP	Field Screening Points
WQMN	Water Quality Monitoring Network
WQMS	Water Quality Monitoring Station
NPDES	National Pollutant Discharge Elimination System
ASS	Automobile Service Station
CNL	Could not locate
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act of 1986

GENERAL LAND USE DESIGNATION

A	Agriculture
CM	Commercial/Resort/Military Base
ID	Industrial
R	Residential
PF	Public Facility
U	Undeveloped/Open Space

SPECIFIC LAND USE

BWS	Board of Water Supply
CC	Community Center
Ch	Church
Cem	Cemetery
Ci	City Installation
Pk	Park
St	State Installation
Sch	School
HECO	Hawaiian Electric Co.
Hosp	Hospital
Fy	Freeway/Roadway
FS	Fire Station
Inst	Institution

GC	Golf Course
Fe	Federal Installation
PO	Post Office
WWTP	Wastewater Treatment Plant
WWPS	Wastewater Pumping Station
MLF	Municipal Land Fill
MIn	Municipal Incinerator
HT	Hawaiian Telephone

INFLO TYPE

ACW	Non-contact Cooling Water [Air Conditioning (HVAC), once through Condenser Water]
ACWW	Uncontaminated Air Conditioning Cooling Tower Water
CB	Catch Basin Inlet
DI	Drainage Inlet
FPD	Fish Pond Drain, Indoor
LIW	Landscape Irrigation Water
RD	Roof Drain
SDGW	Sump Drain for Ground Water Seepage
SPW	Swimming Pool Water, Direct Connection
SWD	Storm Water Drain, Direct Connection
SWOF	Storm Water Outfall
SWR	Storm Water Runoff, Sheet Flow
TEFF	Treated Process Effluent, Direct Connection
UEFF	Untreated/Nontreated/Uncontaminated Process Effluent, Direct Connection

ID NUMBER SYMBOLS

C	Central Oahu Prefix
H	Honolulu District Prefix
L	Leeward District Prefix
N	North Shore District Prefix
W	Windward District Prefix
WC	Waianae District Prefix
M	Military Drain
P	Private Drain
S	Hawaii State Drain

HAZARDOUS WASTES UNDER RCRA

LQG	Large Quantity Generator
SQG	Small Quantity Generator
PG	Provisional Generator
NR	Non-Regulated Generator
Trans	Transporter
TSDF	Treatment, Storage, and Disposal Facility

OTHER MISCELLANEOUS ABBREVIATIONS

ab	above
ac	across
Av	Avenue
be	below
bt	between
Bl	Boulevard
Chl	Channel
cor	corner
de	deadend
ES	East Side
ES	Elementary School
Dr	Drive
Fy	Freeway
HS	High School
Hy	Highway
IS	Intermediate School
in	intersection
jt	junction
NS	North Side
NB	North Branch
NF	North Fork
nr	near
Pl	Place
Rd	Road
Str	Stream
SS	South Side
SB	South Branch
SF	South Fork
Wy	Way
Wk	Walk
WS	West Side

TABLE 2(ii)-3

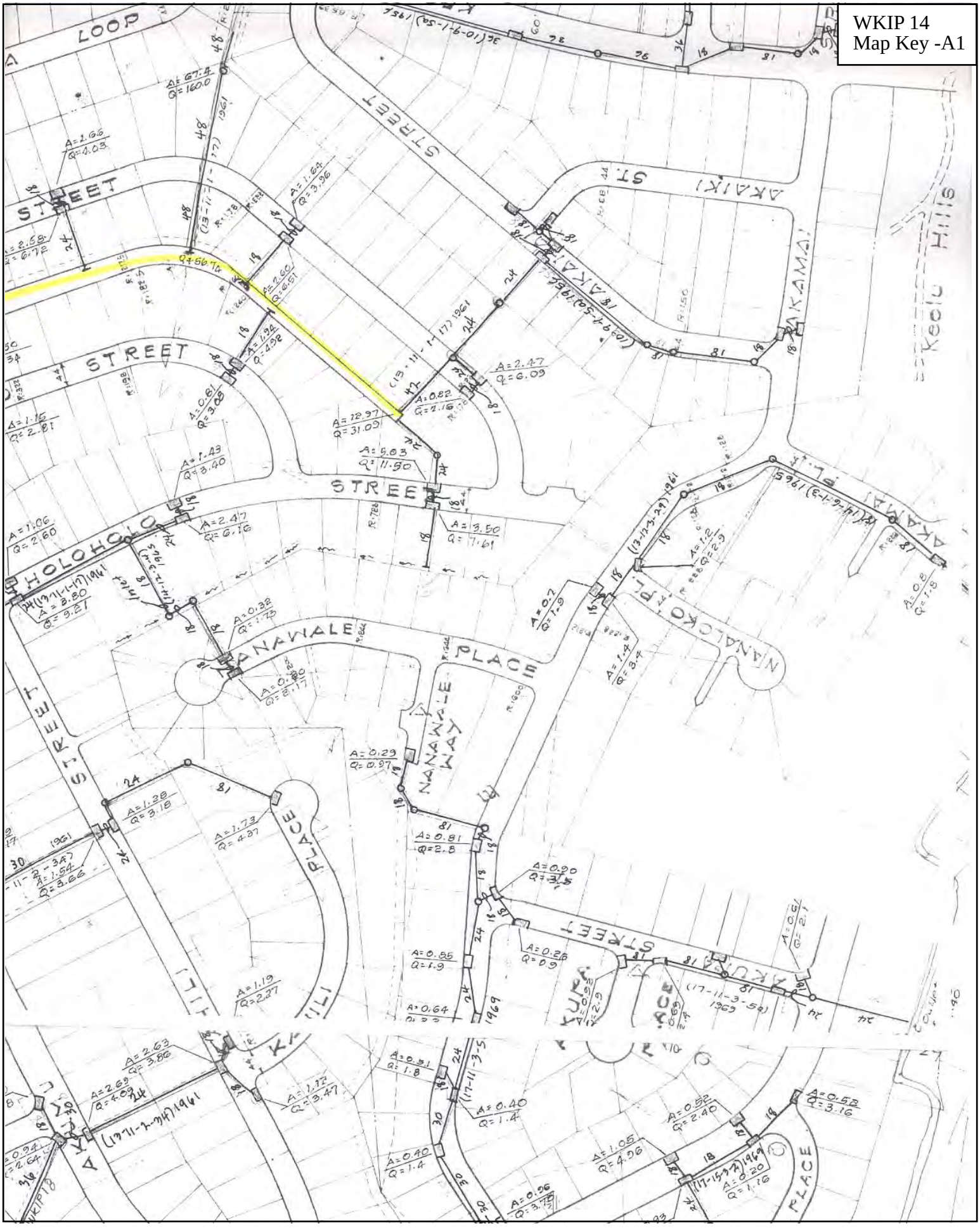
RECEIVING WATERS	ID #
Windward District	
Ahuimanu (Kahaluu) Stream	WAUS
Ahuimanu Stream South Branch	WASB
Haiamoa Stream	WHIS
Heeia Stream	WHAS
Iolekaa (Heeia) Stream	WIAS
Kaalaea Stream	WKAA
Kaelepulu Stream	WKIP
Kahaluu Stream	WKUS
Kahaluu Stream Segment	WKSS
Kahanaiki (Maunawili) Stream	WKKI
Kahawai (Waimanalo) Stream	WWKB
Kailua Bay	WKAB
Kaipapau Stream	WKAU
Kamooalii (Kaneohe) Stream	WKEK
Kaneohe Bay	WKEB
Kaneohe Stream	WKES
Kawa Stream	WKAS
Kawa Stream, East Branch	WKSE
Kawainui (Kaelepulu) Stream	WKWS
Keaahala Stream	WKHS
Keaahala Stream, North Branch	WKNB
Kii Marsh	WKII
Maakua	WMLU
Makaua Stream	WMAA
Maunawili Stream	WMIS
Muliwaiolena Stream	WMAS
Nuupia Pond	WNAP
Omao (Maunawili) Stream	WMIO
Oneawa Channel	WOAC
Pacific Ocean at Hauula	WPOH
Pacific Ocean at Kaaawa	WPOK
Pacific Ocean at Kahuku	WPKP
Pacific Ocean at Laie	WPOL
Puha Stream (Inoaole)	WPAS
Waihee (Kahaluu) Stream	WWES
Waikane Stream	WWAS
Waimanalo Bay	WWOB
Waimanalo Stream	WWAI

LIST OF ALL STORM WATER OUTFALL DATA

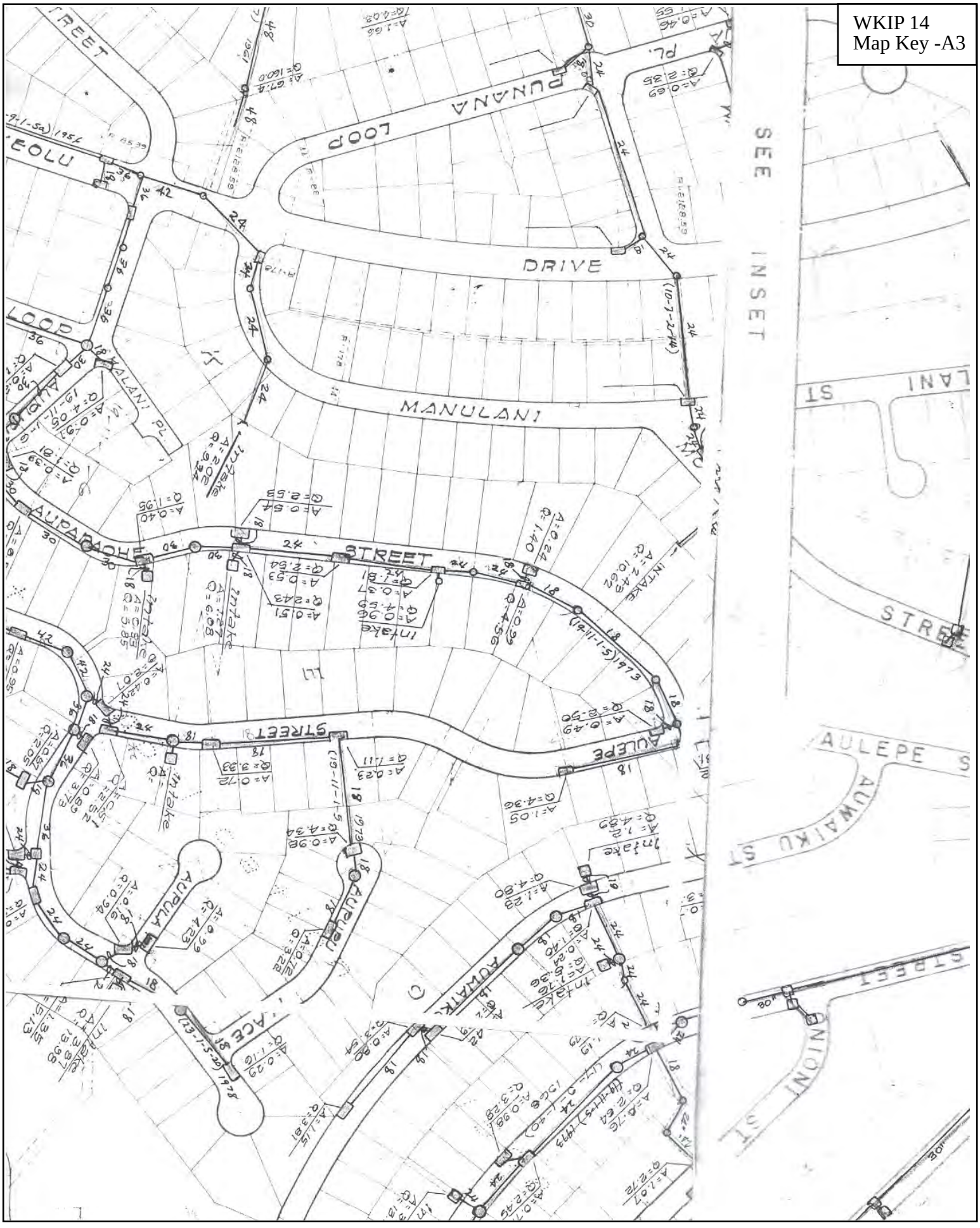
IDNUMBER	Area	Flow	Type	Cond	Cellnumber	Street/Location	Recvwater
WKIP02	44.2	130.1	mj	36,24	3-K-6	Iana nr Iana Pl	Kaelepulu Canal
WKIP03			mn	18	3-L-5	Iana nr Paokano Pl	Kaelepulu Canal
WKIP04			mn	30	3-L-5	bt Paokano Pl & Lp	Kaelepulu Canal
WKIP05	124.1	850.0	mj	3-48	3-L-5	bt Paokano Pl & Lp	Kaelepulu Canal
WKIP06			mn	30	3-L-5	Iana nr Ikemaka Pl	Kaelepulu Canal
WKIP07	18.2	53.6	mj	2-36	3-K-4	Iana be Ikemaka Pl	Kaelepulu Canal
WKIP08	4.5	13.2	mj	36	3-K-4	Iana nr Keolu Dr	Kaelepulu Canal
WKIP09	4.5	14.2	mn	30	3-K-3	bt Akumu & Akiu Pl	Kaelepulu Pond
WKIP10	323.0	846.0	mj	35X	3-K-3	bt Akiu & Akalei Pl	Kaelepulu Pond
WKIP10FSPA					3-L-3	nr 1029 Liku	Kaelepulu Pond
WKIP10FSPB					3-L-2	nr 1062 Kina	Kaelepulu Pond
WKIP10FSPC					3-M-1	nr 1305 Hele	Kaelepulu Pond
WKIP11			mn	18	3-K-3	Akalei Pl (end)	Kaelepulu Pond
WKIP12	2.1	5.6	mn	18	3-K-3	Halula Pl (end)	Kaelepulu Pond
WKIP13	5.5	14.4	mn	30	3-K-3	Akumu & Halula	Kaelepulu Pond
WKIP14	87.4	381.3	mj	19X	3-J-3	bt Halula & Iopono Lp	Kaelepulu Pond
WKIP15	11.4	28.7	mj	42	3-J-3	Akumu nr Holoholo	Kaelepulu Pond
WKIP16	11.7	29.4	mj	42	3-J-3	Iopono Lp nr Hoolea Pl	Kaelepulu Pond
WKIP17	1.8	4.8	mn	18	3-J-3	Iopono Lp	Kaelepulu Pond
WKIP18	7.3	18.3	mj	36	3-J-3	Akumu nr Iopono Lp	Kaelepulu Pond
WKIP19	2.0	5.0	mn	18	3-J-3	Kahili nr Akumu	Kaelepulu Pond
WKIP20	2.1	5.3	mn	18	3-J-3	bt Lauloa & Akumu	Kaelepulu Pond
WKIP21	3.4	8.6	mn	24	3-J-3	Kahili & Lauloa	Kaelepulu Pond
WKIP22	2.0	5.1	mn	18	3-I-4	Kahili acr Hamakua	Kaelepulu Pond
WKIP23	4.4	11.2	mn	24	3-I-3	Kahili acr Akiohala	Kaelepulu Pond
WKIP24	6.1	15.4	mn	30	3-I-3	Kahili nr Lauloa	Kaelepulu Pond
WKIP25	4.1	10.8	mn	30	3-I-3	Akumu & Kahili	Kaelepulu Pond
WKIP26	8.3	29.5	mj	36	3-I-2	Akumu & Akamai	Kaelepulu Marsh
WKIP27	1.1	5.0	mn	18	3-I-2	Akuila Pl (end)	Kaelepulu Marsh
WKIP28	3.2	15.8	mn	30	3-I-2	Akuila Pl	Kaelepulu Marsh
WKIP29	3.1	13.1	mn	24	3-I-2	Akupa (end)	Kaelepulu Marsh
WKIP30	28.6	85.2	mj	36,18	2-J-33	Kahako & Kanapuu	Kaelepulu Str (D)
WKIP31	36.3	189.2	mj	54	2-J-33	Kanapuu nr Kahako	Kaelepulu Str (D)
WKIP32	76.7	373.7	mj	84	2-I-33	Kahako nr Kaanua	Kaelepulu Str (D)
WKIP33	11.2	60.0	mj	42	2-I-33	Kahako nr Akaakoa	Kaelepulu Str (D)
WKIP34	167.4	1830.0	mj	14X	2-I-33	Akaakoa nr end	Kaelepulu Str (D)
WKIP35	26.9	113.0	mn	24	2-J-34	Paukiki & Pinana cor	Kaelepulu Str (D)
WKIP36	8.2	28.7	mn	24	2-I-34	Akaakaawa & Akaakoa	Kaelepulu Str (D)
WKIP37	21.6	95.0	mj	48	2-I-34	Keolu Bridge fr Kanapuu	Kaelepulu Str (D)
WKIP38	33.6	193.2	mj	54	2-I-34	Keolu Dr & bridge	Kaelepulu Str (D)
WKIP39	21.7	89.2	mj	42	2-I-34	Keolu Dr nr Akuleana	Kaelepulu Str (D)
WKIP40	4.4	20.6	mj	42	2-I-34	Keolu Dr fr school	Kaelepulu Str (D)
WKIP41	2.4	10.0	mn	18	2-I-35	Akuleana Pl	Kaelepulu Str (D)
WKIP42	9.8	57.2	mj	36	3-I-1	Akuleana nr Akumu	Kaelepulu Str (D)
WKIP43	58.2	359.6	mj	60	3-I-1	Akumu nr Akuleana	Kaelepulu Str (D)
WKIP44	4.7	9.9	mn	18	3-I-1	Akamai Pl (end)	Kaelepulu Str (D)
WKIP45	10.3	36.7	mn	30	3-I-2	Kiukee Pl	Kaelepulu Marsh
WKIP46	1.5	6.3	mn	18	3-I-2	Keolu nr Akiahala Pl	Kaelepulu Marsh
WKIP47	73.5	388.8	mj	10X	3-H-2	Keolu nr Akiahala Pl	Kaelepulu Marsh
WKIP48	53.8	306.6	mj	8x	3-H-3	Keolu nr Akipohe	Kaelepulu Marsh
WKIP49	16.6	115.4	mj	48	3-H-3	bt Akea Pl & Akipohe	Kaelepulu Marsh
WKIP50	8.2	42.1	mj	36	3-H-3	Keolu & Akea Pl	Kaelepulu Marsh
WKIP51P	7.4	22.6	mn	30	3-I-3	Kukilakila P2 TMK4-2-94:43	Kaelepulu Marsh

LIST OF ALL STORM WATER OUTFALL DATA

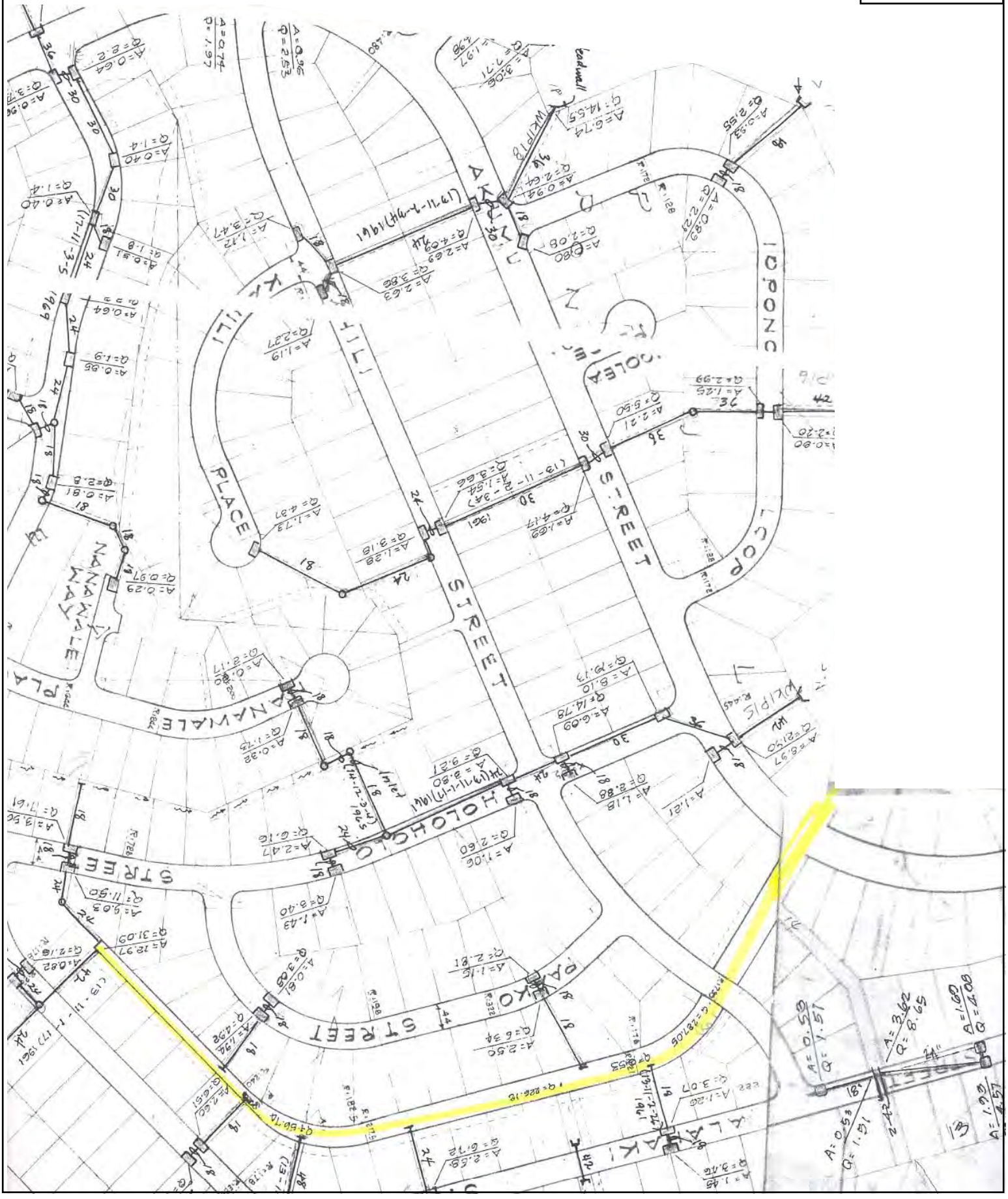
IDNUMBER	Area	Flow	Type	Cond	Cellnumber	Street/Location	Recvwater
WKIP52	138.0	1350.0	mj	20x7	3-I-4	bt Akiohala & ES	Kaelepulu Marsh
WKIP53P	0.8	7.3	mn	18	3-I-4	Kukilakila P1 TMK4-2-93:71	Kaelepulu Marsh
WKIP54P	3.0	28.1	mn	30	3-I-4	Kukilakila P1 TMK4-2-93:71	Kaelepulu Marsh
WKIP55	3.3	21.3	mn	30	3-I-4	Hamakua Dr (end)	Kaelepulu Pond
WKIP56	16.6	39.4	mj	42	3-I-4	Ohiki Pl	Kaelepulu Pond
WKIP57	6.0	16.4	mj	36	3-I-4	bt Hamakua & Papalani	Kaelepulu Pond
WKIP58	7.6	21.7	mj	36	3-J-4	Keolu & Papalani	Kaelepulu Pond
WKIP59	10.7	28.3	mj	42	3-J-4	Pahumele Wy	Kaelepulu Pond
WKIP60	8.3	24.1	mn	30	3-J-4	Pahumele	Kaelepulu Pond
WKIP61	6.3	15.9	mj	36	3-J-4	Wanăao nr Pomahina	Kaelepulu Pond
WKIP62	1.8	4.6	mn	18	3-J-3	Wanaao acr Halula Pl	Kaelepulu Pond
WKIP63	2.4	6.1	mn	18	3-K-3	Wanaao acr Akalei Pl	Kaelepulu Pond
WKIP64	8.5	26.6	mj	42	3-K-4	nr Wanaao Pl	Kaelepulu Pond
WKIP65	16.2	50.6	mj	42	3-K-4	Paopua Lp fr Wanaao	Kaelepulu Canal
WKIP66	11.2	35.0	mj	36	3-L-5	Paopua Lp fr Wanaao	Kaelepulu Canal
WKIP67	11.8	36.9	mj	36	3-K-5	Paopua Lp nr Pl	Kaelepulu Canal
WKIP68	9.5	14.3	mn	18	3-K-6	Wanaao & Auwinala	Kaelepulu Canal
WKIP69	2.9	6.6	mn	24	3-K-6	Kakahiaka nr Wanaao	Kaelepulu Canal
WKIP70	3.2	7.3	mn	24	3-K-7	Kakahiaka nr Wanaao	Kaelepulu Str
WKIP71	2.9	6.7	mn	18	3-K-7	Kakahiaka	Kaelepulu Str
WKIP72	3.2	7.3	mn	18	3-K-7	Kakahiaka nr Cul-de-sac	Kaelepulu Str
WKIP73	5.3	12.3	mn	24	3-K-7	Mahealani Pl (end)	Kaelepulu Str
WKIP74	5.3	12.1	mn	24	3-L-6	Paumakua & Wy	Kaelepulu Str
WKIP75	16.2	37.2	mn	30	3-L-7	Alala (end)	Kaelepulu Str
WKIP76	1.5	5.7	mn	18	2-J-34	Kanapuu (end)	Kaelepulu Str (D)
WKIP77	1.0	3.6	mn	18	2-J-32	Kanapuu Pl (end)	Kaelepulu Str (D)
WKKI01	3.4	7.7	mn	18	2-A-34	Lunaai & Lunaapono Pl	Kahanaiki Str
WKKI02	2.8	6.4	mn	18	2-A-34	Lunaai nr Lunahelu	Kahanaiki Str
WKKI03	2.3	5.3	mn	18	2-A-34	Lunahelu (end)	Kahanaiki Str
WKKI04	4.8	10.3	mn	18	2-A-35	Lunaai nr Lunaanela	Kahanaiki Str
WKKI05	5.4	12.0	mn	18	3-A-1	Lunaai nr Pl	Kahanaiki Str
WKKI06	3.3	7.6	mn	18	3-A-1	Auloa Rd nr Lunaai	Kahanaiki Str
WKKI07	6.0	12.5	mn	24	2-A-34	Lunahelu & Lunahelu	Kahanaiki Marsh
WKKI08	22.6	48.6	mj	36	2-A-34	Lunaanela nr Lunahelu	Kahanaiki Marsh
WKKI09	2.3	4.9	mn	18	2-B-34	Lunahooia Pl	Kahanaiki Marsh
WKKI10	3.5	7.9	mn	18	2-A-34	Lunaanela nr Pl	Kahanaiki Marsh
WKKI11	4.8	10.2	mn	18	2-B-34	Lunahooia/Maunawili	Kahanaiki Marsh
WKKI12	3.0	6.2	mn	18	2-B-34	Maunawili/Lunahooia	Kahanaiki Marsh
WKKI13	0.9	2.1	mn	18	2-A-34	Lunaanela/Lunaai	Kahanaiki Marsh
WKKI14	3.8	7.0	mn	18	2-B-35	Maunawili Rd	Kahanaiki Marsh
WKKI15	3.7	7.7	mn	18	2-B-35	Maunawili Rd	Kahanaiki Marsh
WKKI16	1.6	3.6	mn	18	2-B-35	Lunaai Pl nr Lunaai	Kahanaiki Marsh
WKKI17	3.0	6.8	mn	18	3-B-1	Lunaai Pl	Kahanaiki Marsh
WKKI18	2.6	5.9	mn	18	3-B-1	Lunahooko Pl (end)	Kahanaiki Marsh
WKKI19	2.7	6.4	mn	18	3-B-1	Lunaai Pl (end)	Kahanaiki Marsh
WKKI20S	27.1	66.7	mj	36	3-A-2	Kalan Hy	Kahanaiki Marsh
WKKI21S	5.0		mn	24	3-B-2	Kalan/Kapaa	Kahanaiki Str
WKKI22P	12.1	34.5	mj	36	3-B-3	Kapaa fr DIT TMK4-2-14:4	Kahanaiki Str
WKKI23P	0.0	0.0	mj	48	3-B-3	Kapaa fr DIT TMK4-2-14:4	Kahanaiki Str
WKKI24P	4.9	14.9	mn	18	3-B-3	Kapaa fr DIT TMK4-2-14:4	Kahanaiki Str
WKNB01	109.2	494.1	mj	2-60	4-V-13	Heeia ES	Keaahala NB
WKNB01FSPA					4-V-13	Emepela Pl	Keaahala NB
WKNB01FSPB					4-T-12	Haiku & Kahuhipa	Keaahala NB


WKIP 14
Map Key -A1
STREET
AKAIKI ST
AKAMAI
Keolu Hills
HOLOHOLO
NANALOKO PL
NANAILE PLACE
NANAWALE
PLACE

WKIP 14
Map Key -A2


WKIP 14
Map Key -A3
PUNANA LOOP
DRIVE
MANULANI
STREET
AULEPE
SEE INSET

WKIP 14
Map Key -A4



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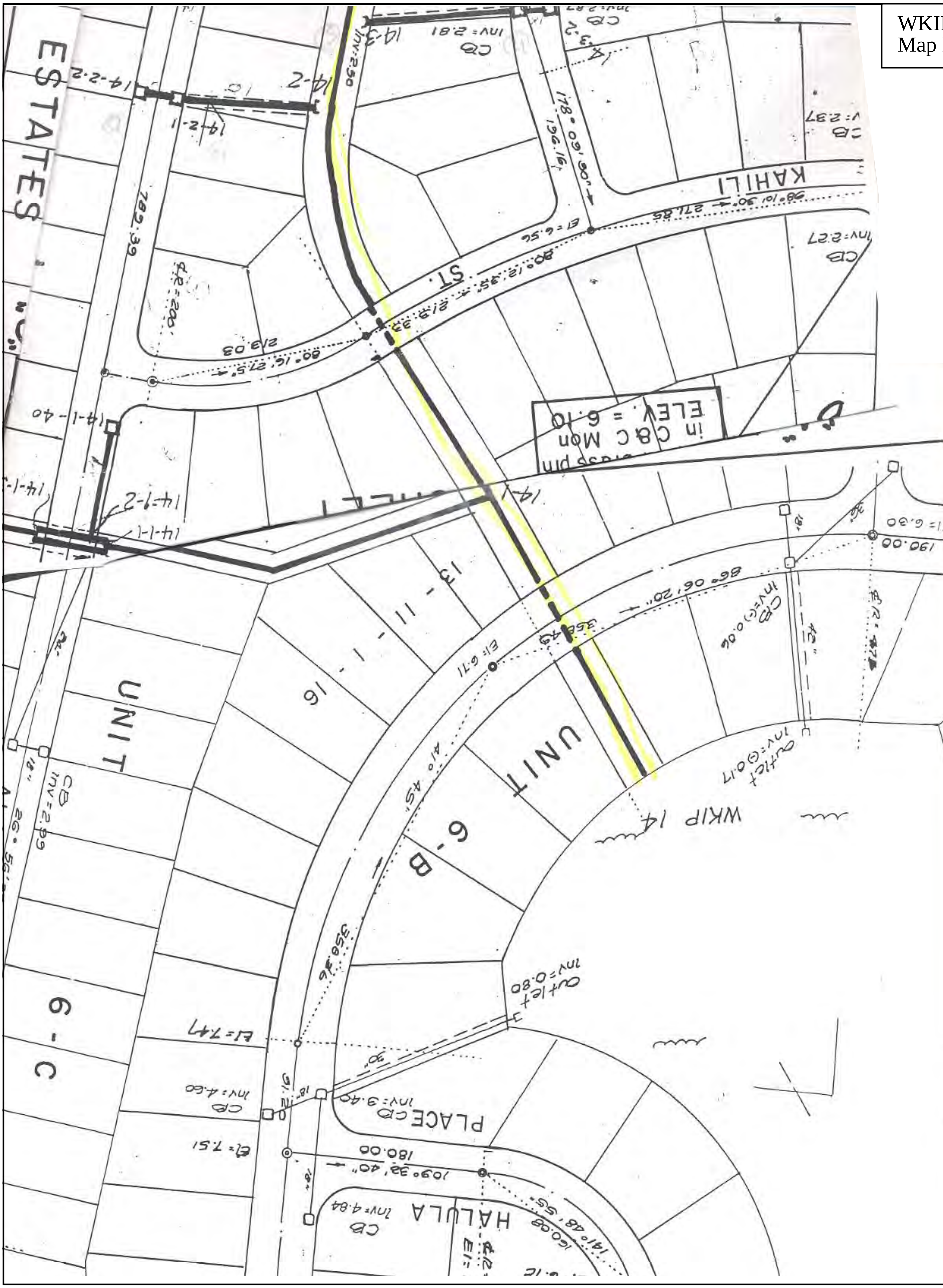
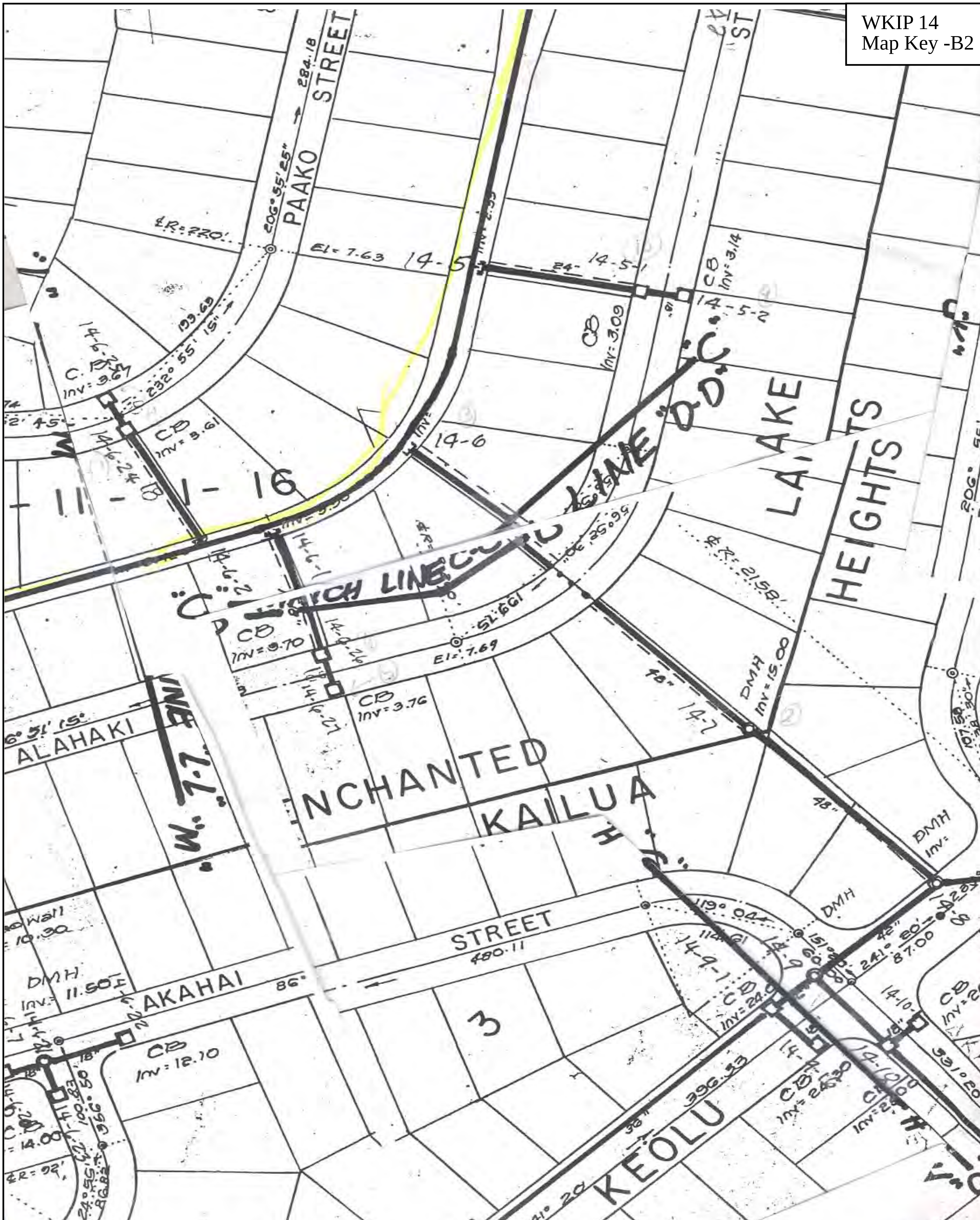
Map Key -B1



WKIP 14
Map Key -B2



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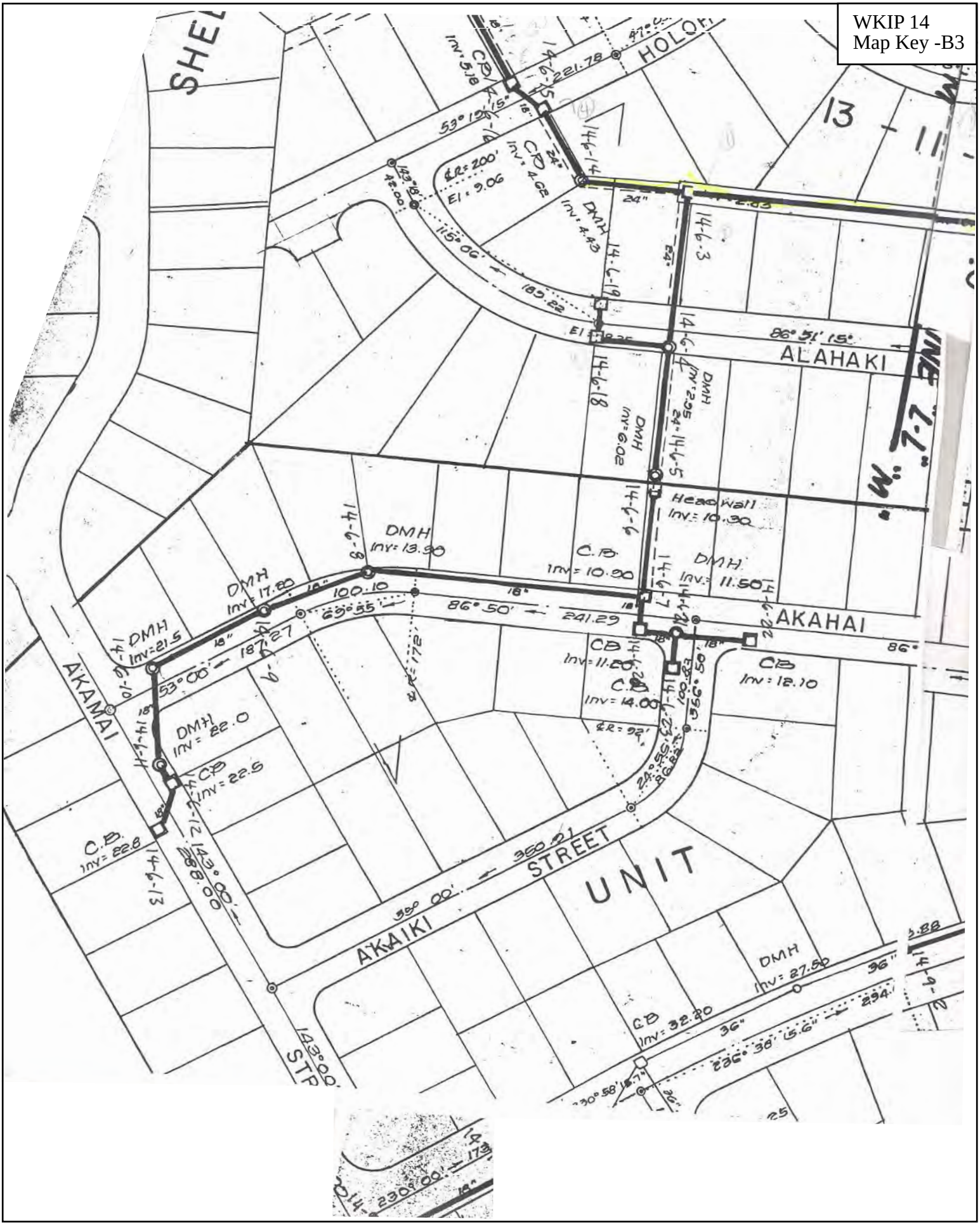
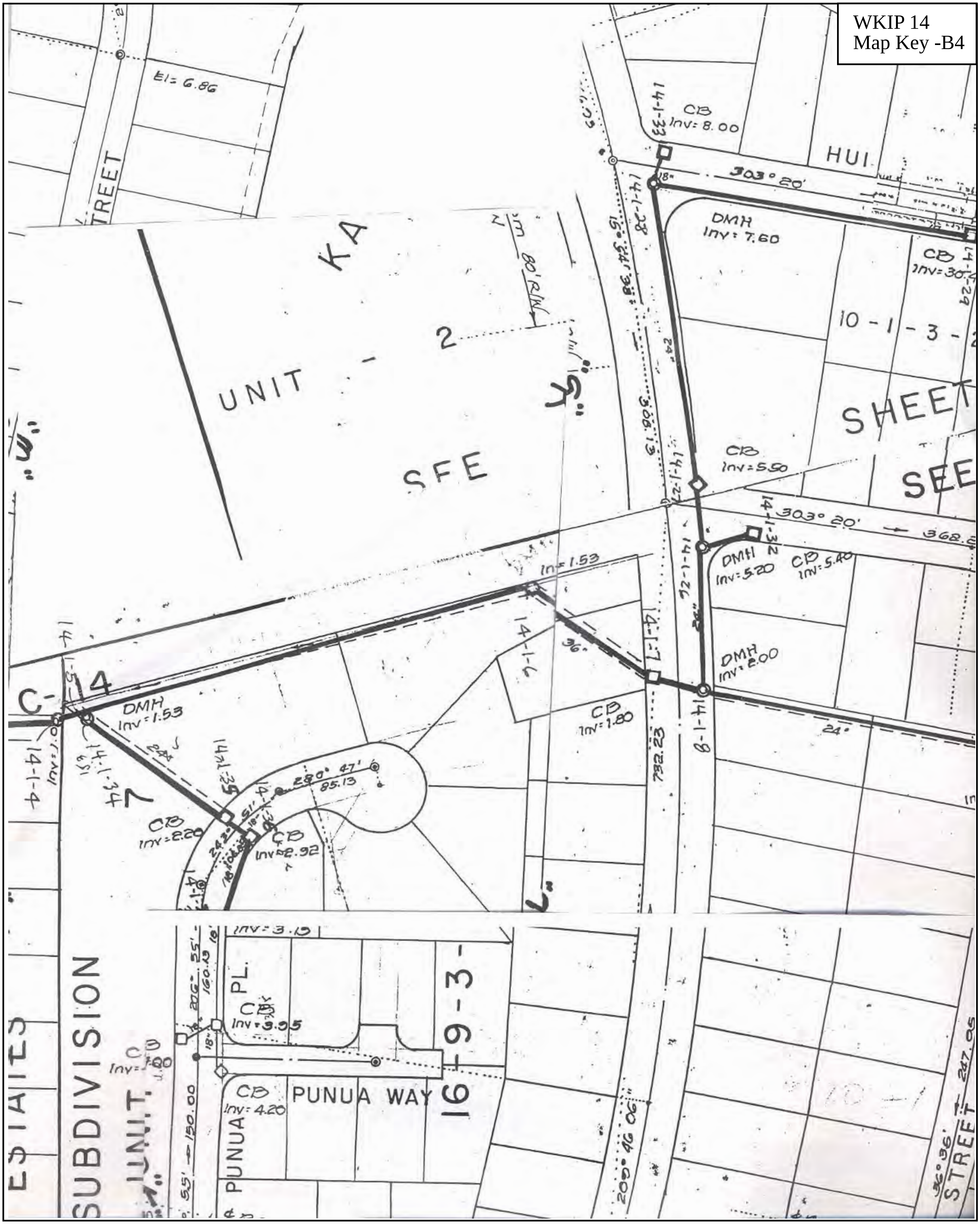
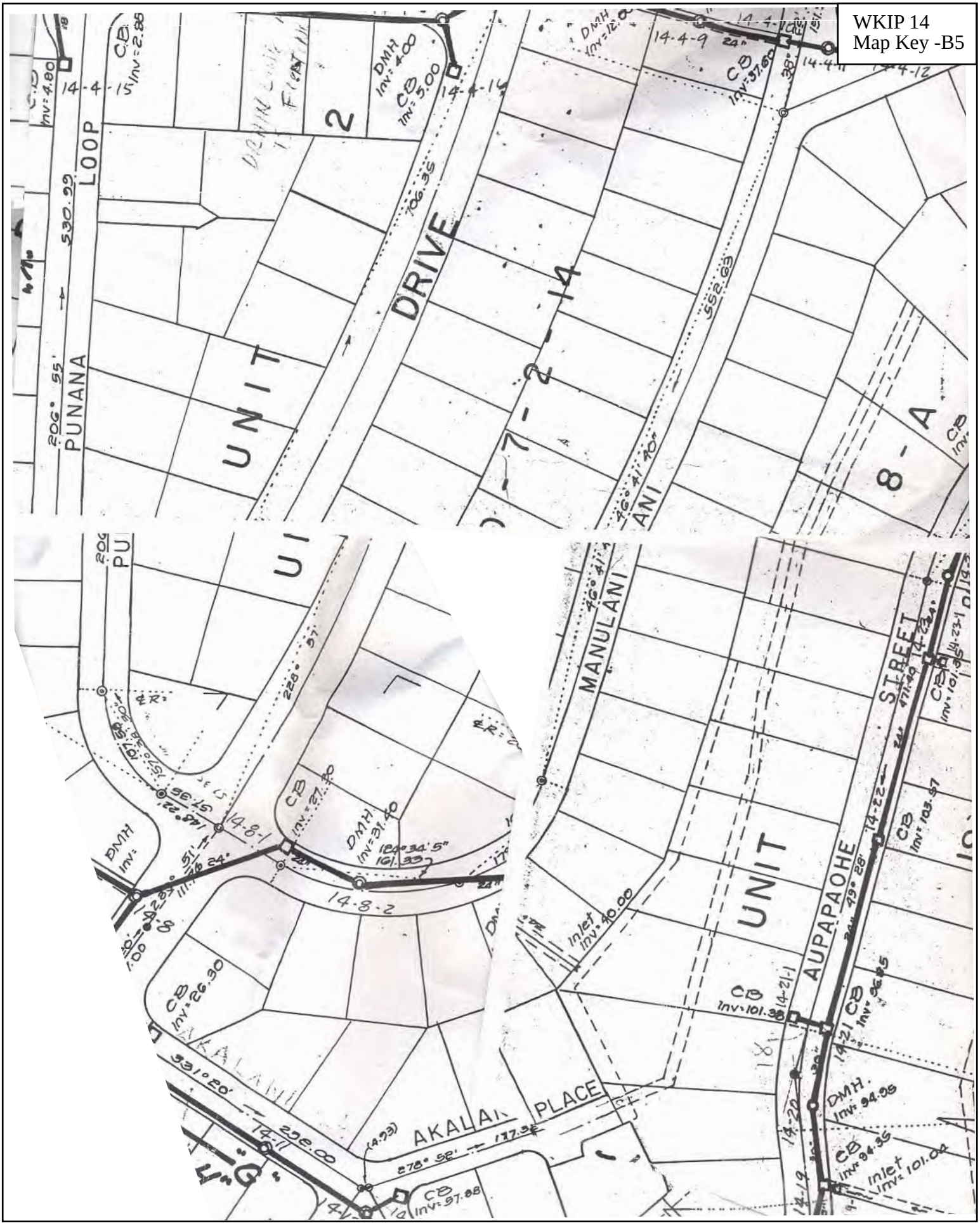
Map Key -B3



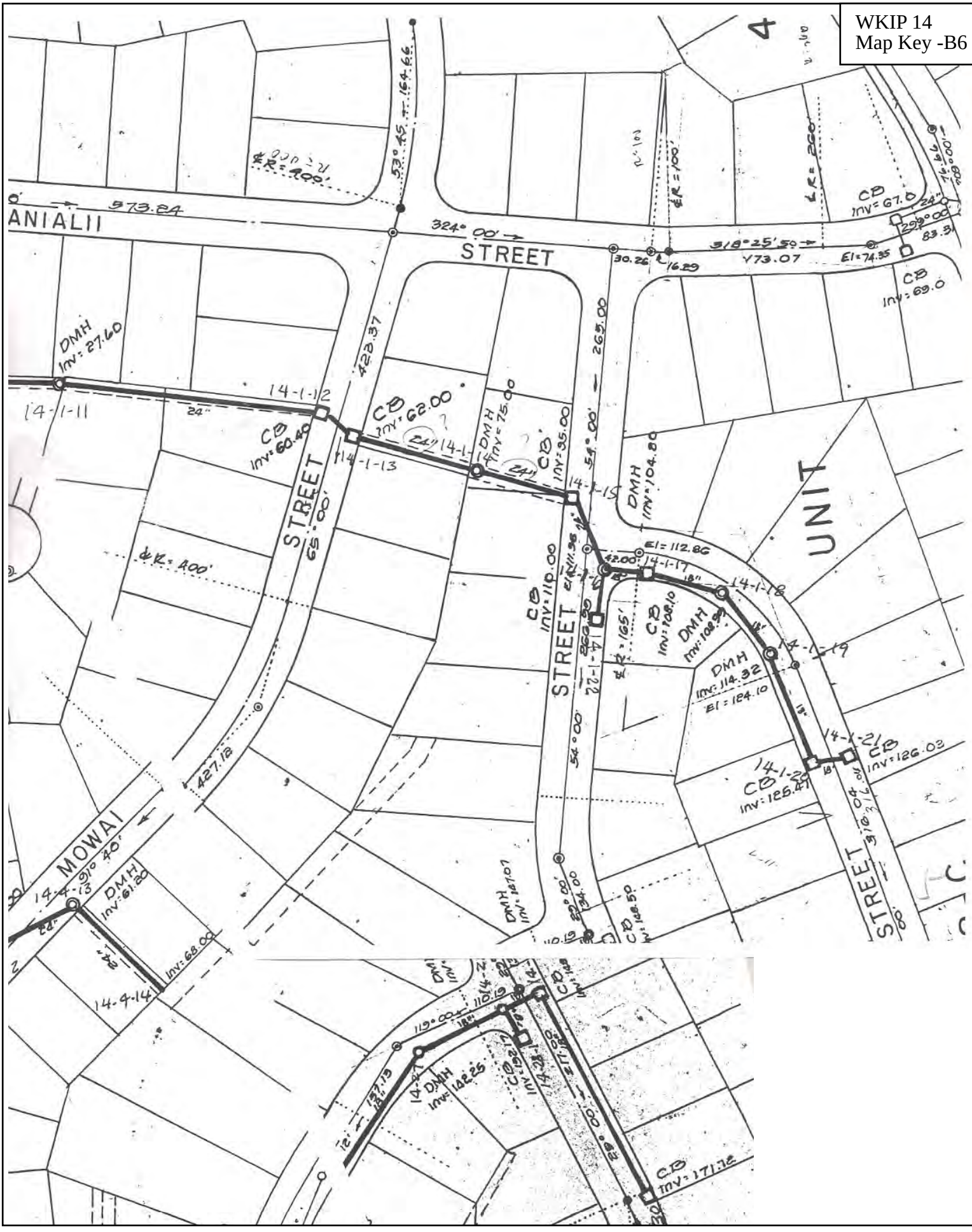
WKIP 14
Map Key -B4



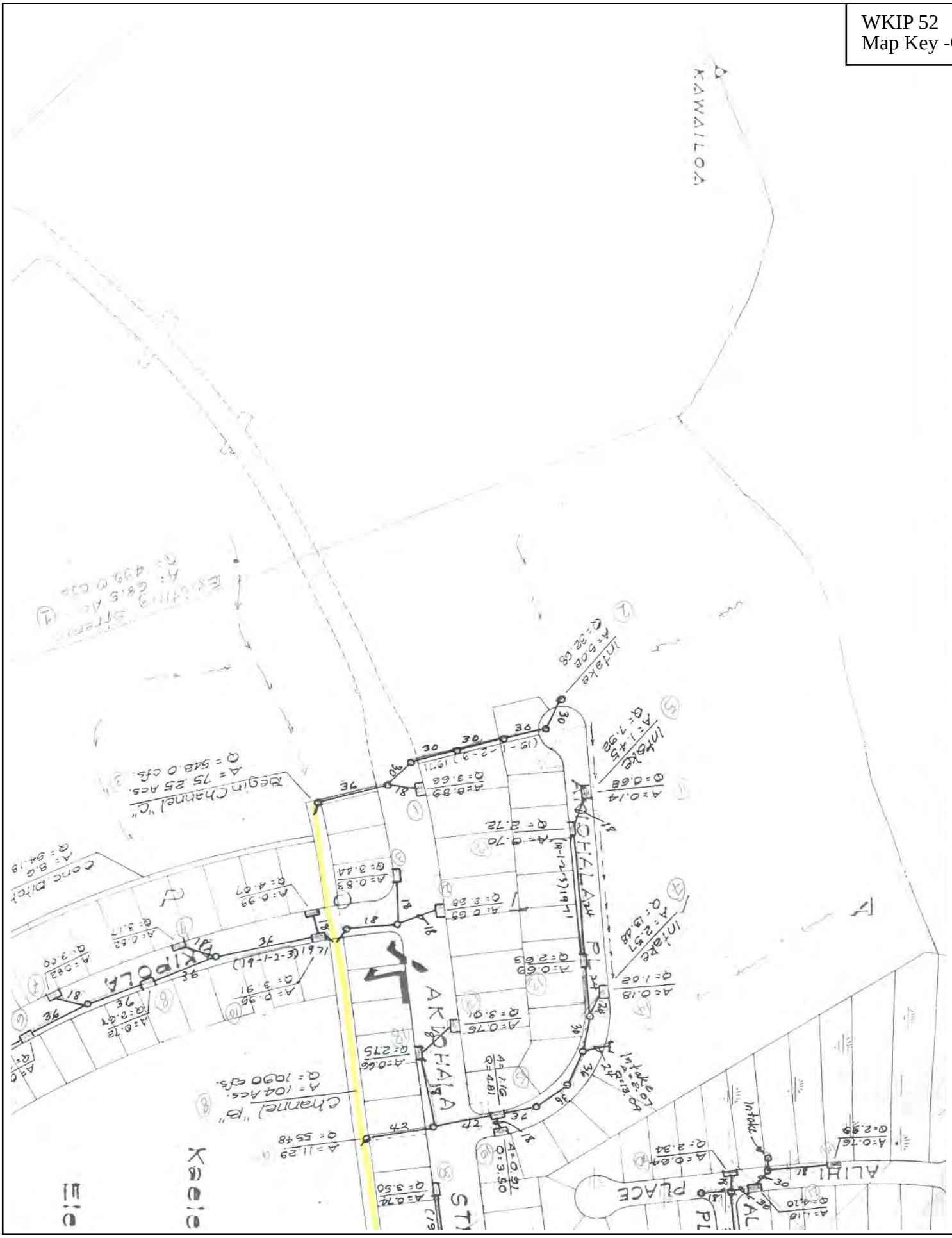
WKIP 14
Map Key -B5

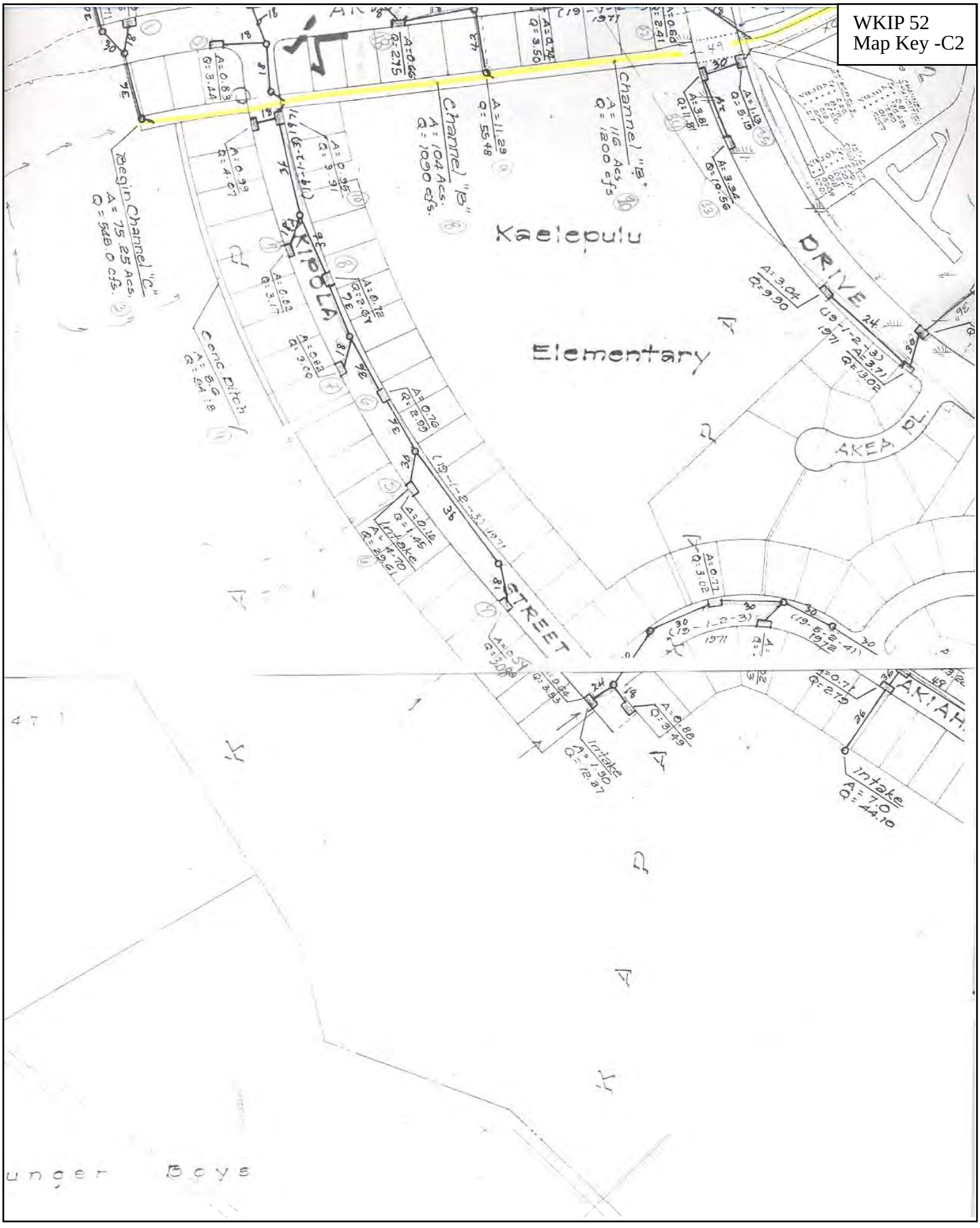


WKIP 14
Map Key -B6

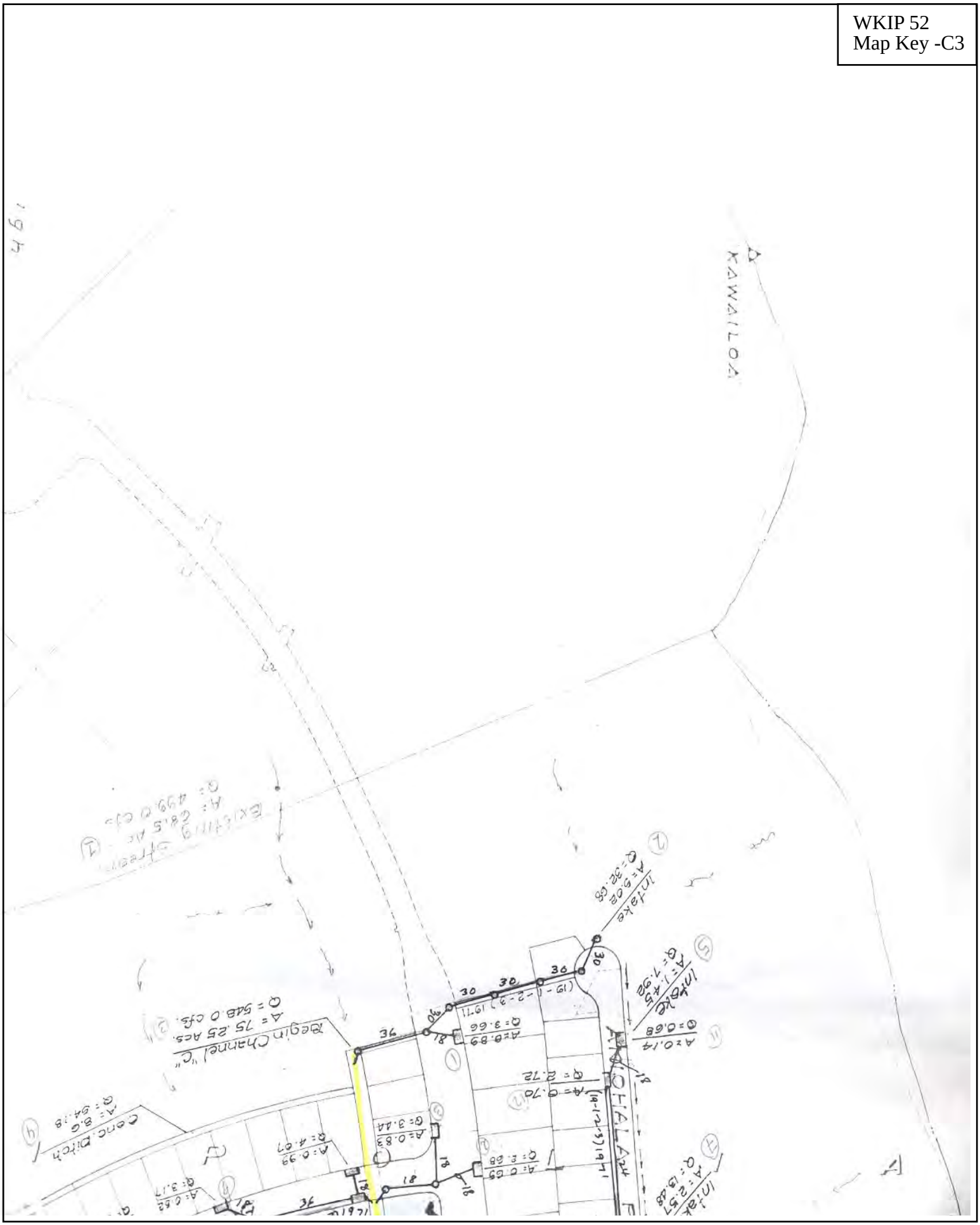


WKIP 52
Map Key -C1




WKIP 52
Map Key -C2
Kaelepulu
Elementary
KIPOLA
STREET
DRIVE
AKEA PL.
AKIAH
Begin Channel "C"
A = 75.25 Acs.
Q = 548.0 cfs.
Conc. Ditch
A = 8.6
Q = 54.16
Channel "B"
A = 104 Acs.
Q = 1090 cfs.
Channel "B"
A = 116 Acs
Q = 1200 cfs
Intake
A = 1.46
Q = 4.70
A = 29.61
Intake
A = 1.90
Q = 12.87
Intake
A = 7.10
Q = 44.10

WKIP 52
Map Key -C3



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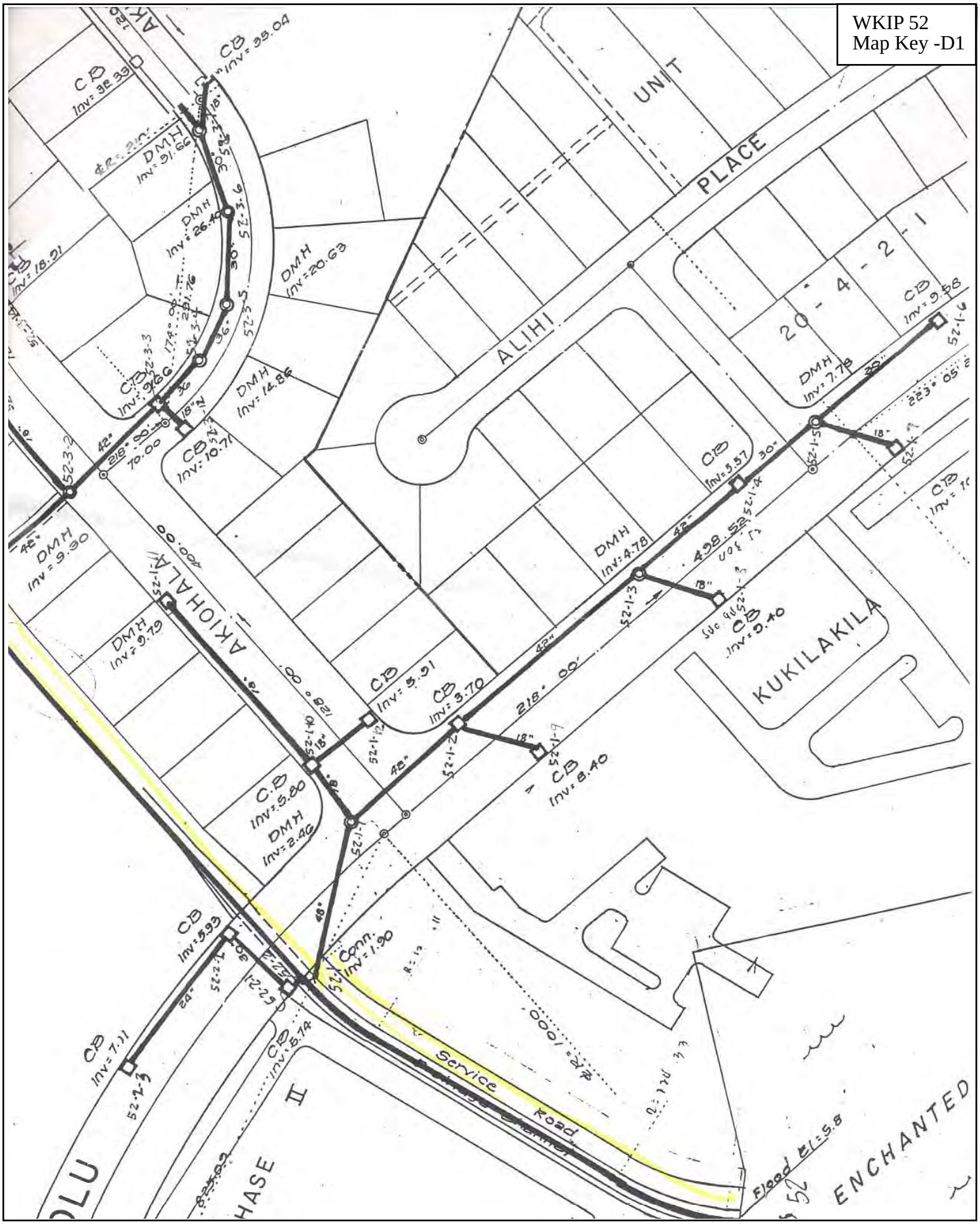
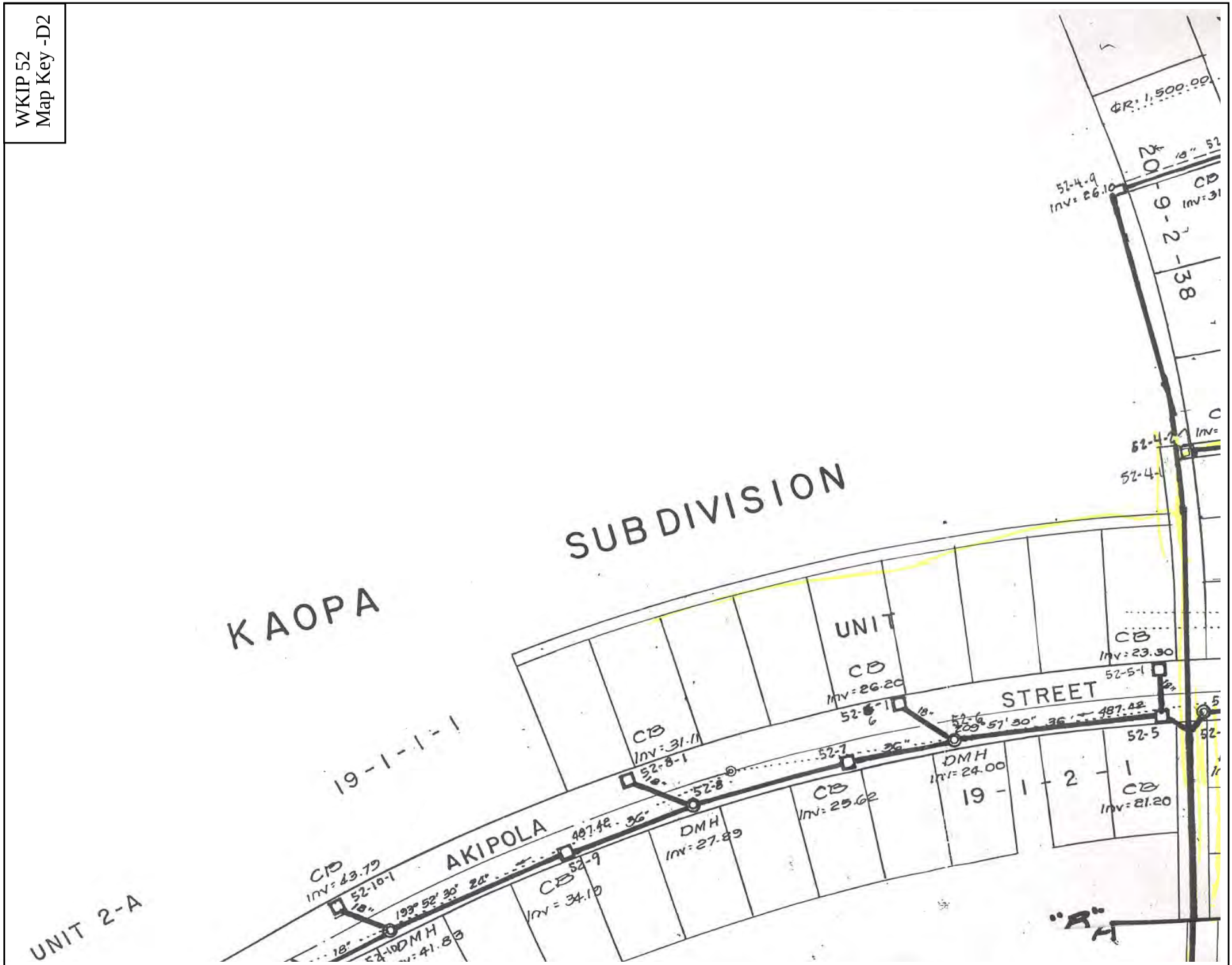
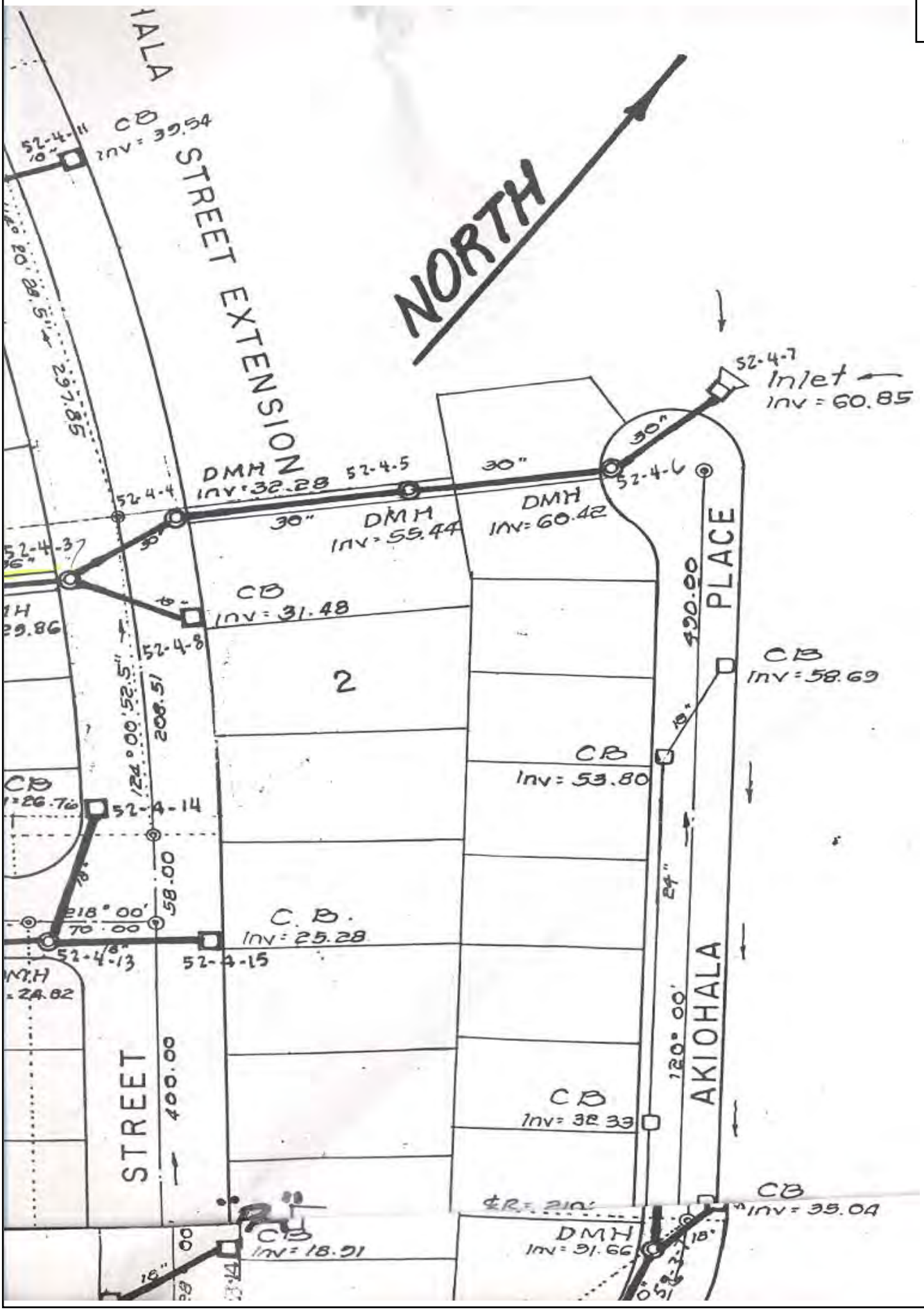
Map Key -C4


WKIP 52
Map Key -D1
ALIHI PLACE
UNIT
20 - 4 - 2 - 1
KUKILAKILA
AKIOHALA
Service Road
ENCHANTED
Flood El=5.8
DMH Inv=20.63
DMH Inv=14.86
DMH Inv=9.30
DMH Inv=9.79
DMH Inv=4.78
DMH Inv=7.78
DMH Inv=2.46
CB Inv=10.71
CB Inv=5.91
CB Inv=3.70
CB Inv=8.40
CB Inv=5.80
CB Inv=5.93
CB Inv=7.31
CB Inv=5.74
Conn. Inv=1.90
CB Inv=3.57
CB Inv=9.58
CB Inv=9.40
438.52
218.00
70.00

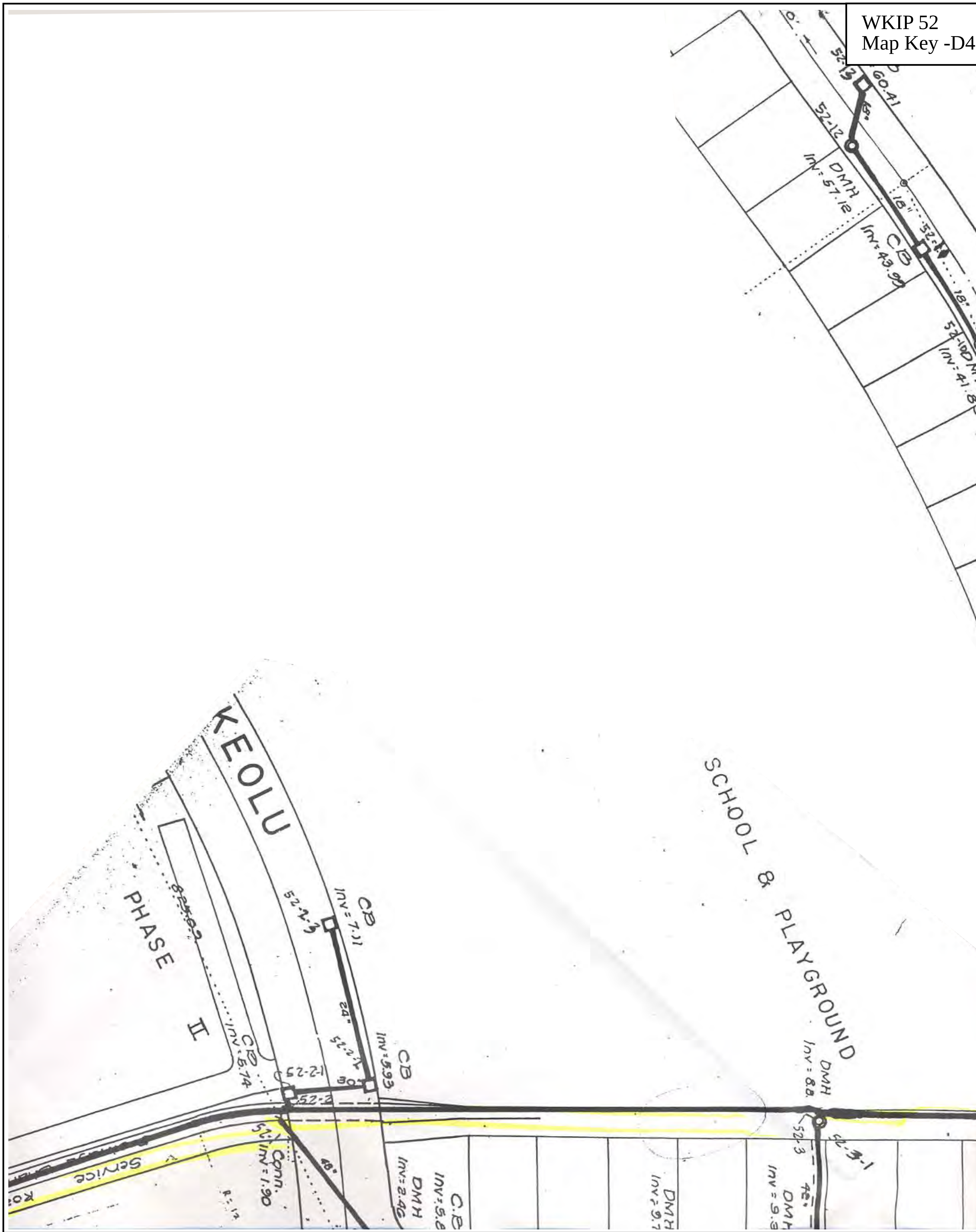
WKIP 52
Map Key -D2



WKIP 52
Map Key -D3



WKIP 52
Map Key -D4



APPENDIX F
COST ESTIMATING WORKSHEET

Appendix F - Cost Estimating Worksheet

Drainage Outfall	Burdoned Rate	Structural BMP/ Materials	Quantity	Dimensions #	BMP Cost	Installation man-hours	total cost materials, installation incl equipment rental			Equipment Rental/days	Equipment Rental/cost/ day	Total Costs
WKIP 14	$300	Bio Clean CIB	10	sized to fit	$3,000	3	$41,500			5	$500	$2,500
	$300	[1] Hydrothane Trashrack	2	24	$35	6	$5,530	**$47,030**		0.5	$500	$250
WKIP 52	$300	Bio Clean CIB	8	sized to fit	$3,000	3	$32,700			3	$500	$1,500
	$300	Hydrothane Trashrack	1	140	$35	12	$9,500	**$42,200**		1	$1,000	$1,000
WKIP 10	$300	NSBB	1	sized to fit	$35,000	96	$75,800			6	$2,000	$12,000
	$300	Bio Clean CIB	4	sized to fit	$3,000	3	$16,600			2	$500	$1,000
	$300	Bio Clean GISB	2	sized to fit	$1,250	2	$3,950			0.5	$500	$250
	$300	Hydrothane Trashrack	1	24	$35	4	$2,290			0.5	$500	$250
[A] Option 1	$300	Hele Channel Bank Stabilization (concrete)	1	74	$350	180	$89,900	**$202,279**	**Option 1**	5	$2,000	$10,000
[A] Option 2	$300	Hele Channel Bank Stabilization (veg/mechanical riprap)	1	667	$93	300	$162,031	**$274,410**	**Option 2**	5	$2,000	$10,000
	$300	Kamahele Ditch Bank Stabilization (veg/mechanical riprap)	1	23	$93	32	$13,739			1	$2,000	$2,000
WKIP 44	$300	Bio Clean CIB	15	sized to fit	$3,000	3	$62,000			7	$500	$3,500
	$300	Hydrothane Trashrack	1	108	$35	12	$7,880	**$69,880**		1	$500	$500
						Total BMPs	$523,420					
Enchanted Lake Area		Street Sweeper	1		185000		$185,000					
		Vacuume Truck	1		250000		$250,000					
		* Trash Pump	1		3000		$3,000					
						Grand Total	**$961,420**					

Note:

[1] Hydrothane blade = 1/2 wide - 4-inch spacing

[#] Dimensions in SF except bank stabilization which is in SY and CY (for concrete)

[A] Option 1 and 2 assume mainly hand labor no access for vehicles.

* Tsurumi Pumps Model EPT3-100HA (11 HP/4-in discharge), incl. intake/discharge hoses and shipping