# EXHIBIT 3

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**NEW ENGLAND - REGION I**
**5 POST OFFICE SQUARE, SUITE 100 (OEP06-4)**
**BOSTON, MASSACHUSETTS 02109-3912**

# FACT SHEET

**DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES PURSUANT TO THE CLEAN WATER ACT (CWA).**

**NPDES PERMIT NUMBER: MA0003905**

**PUBLIC NOTICE START AND END DATES:** FEB - 2 2011 — MAR - 3 2011

**NAME AND MAILING ADDRESS OF APPLICANT:**

**General Electric Company**
**1000 Western Avenue**
**Lynn, MA 01910**

**NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:**

**General Electric Aviation**
**1000 Western Avenue**
**Lynn, MA 01910**

**RECEIVING WATER(S): Saugus River**
(USGS Hydrologic Code #01070002 – North Coastal River Basin)

**RECEIVING WATER CLASSIFICATION(S): Class SB** - warm water fishery

**SIC CODES: 3724, 3566**

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## I. PROPOSED ACTION, TYPE OF FACILITY, AND DISCHARGE LOCATION

General Electric Aviation (GE Aviation), the permittee, owns and operates a facility in Lynn, Massachusetts, at which GE Aviation manufactures, tests, and assembles jet turbine engines and associated components. The facility site is comprised of approximately 223 acres and includes 45 building complexes with associated storage areas, parking areas, and traffic ways. *See* Attachment B for a site map.

In 1993, the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) last issued GE Aviation a National Pollutant Discharge Elimination System (NPDES) permit under the federal Clean Water Act (CWA) and the Massachusetts Clean Waters Act, respectively, to govern the facility's withdrawal of water *from* the Saugus River for cooling uses and its discharges of pollutants *to* the Saugus River as part of a variety of wastewater streams. These wastewater streams include non-contact cooling water (NCCW), contact cooling water, steam condensate, boiler blowdown, hydrant testing water, wash waters, stormwater, contaminated groundwater, and other miscellaneous wastewaters described herein. These wastewaters are discharged from Outfalls 001, 007, 010, 014, 018, 019, 020, 027, 028, 030, and 031. *See* Attachment A, *Outfall Flow History and Detail* (updated 1/28/09) for a listing of outfalls and flows contributing to them. *See also* Attachment C for outfall and intake locations.

The facility's current NPDES permit expired on September 29, 1998, but was administratively continued because the facility's permit renewal application was deemed timely and complete by EPA. The permittee submitted its permit renewal application on June 29, 1998, and submitted revisions to this application in May of 2000 and September of 2003. The permittee also submitted additional information on July 10, 2009, in Response to a Request for Information under Section 308(a) of the CWA.

The GE Aviation facility is a large, complex industrial site with a complicated array of wastewater discharges to the Saugus River involving numerous outfalls and a wide range of contaminants. As a result, a variety of CWA standards apply to the facility and numerous analyses have been needed to determine the appropriate permit limits.

## II. SITE HISTORY

General Electric traces its roots to Thomas Edison, who established the Edison Electric Light Company in 1878. GE Aviation was the result of the merger in 1892 of Edison's company and the Thomson-Houston Electric Company of Lynn.[1] GE Aviation began manufacturing on the site in the late 1800's. The facility started using and storing petroleum products before 1900. The No. 6 Fuel Oil and jet fuel in use today have been used at the facility since the 1940's and 1950's. The Aircraft Engines Division began operating at the current location during World War II.

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[1] MassMoments GE Jet Engine Tests in Lynn: http://www.massmoments.org/moment.cfm?mid=117

Industrial activities conducted during the early stages of the plant included the operation of an iron foundry, a steel foundry, and a machinery shop. Operations included the manufacture, assembly, and testing of electricity management and utilization components such as electric motors, switches and transformers.

Since the 1940's, the GE Aviation facility has focused on the manufacture and testing of aircraft engines, the manufacture of turbine engines, generators, gear parts, and marine propulsion units, and steam generation. Currently, the plant focuses on the manufacture and testing of small aircraft engines and engine parts, and the manufacture of ship propulsion machinery. Principal processes in aircraft engine manufacturing include machining, cleaning, fabricating, assembly, and testing. Metal machining and fabricating involves the cutting, grinding, drilling, welding, brazing, and shaping of metal fee stock into aircraft engine components. Alloys used in engine parts include titanium, aluminum, chromium, cobalt and nickel. No surface treatment, coating, or etching is done onsite.

## III. DESCRIPTION OF TREATMENT SYSTEM AND DISCHARGES

As part of its process for manufacturing jet engines and components for commercial and military applications, GE Aviation conducts machining, cleaning, descaling, coating, assembly and testing of various components at the Lynn facility. The plant runs 24 hours/day, 365 days/year. GE Aviation also operates an oil-fired steam electric power plant onsite (12 – 45 MW) for the production of steam, electricity, and compressed air. This electricity is primarily for GE Aviation's onsite needs, but at times the facility sells excess electricity to the local power grid.

Approximately 19 miles of underground drain lines ("Drainage System") collect dry weather flows (non-stormwater flows) and/or wet weather flows (stormwater runoff) throughout the site. The Drainage System accumulates, transfers, and discharges the flows to various outfalls along the Saugus River. The facility currently discharges directly to the river through 11 discharge pipes. These discharges pipes and the outfall designations are listed below:[2]

- 2 NCCW flows (over 95% river water) combined with non-stormwater flows, including infiltrated groundwater
    - Outfall 014 (test cell)
    - Outfall 018 (power plant)
- 1 river water overflow from the power plant intake and potentially infiltrated groundwater
    - Outfall 020 ( "bathtub")
- 8 stormwater flows (including infiltrated groundwater)
    - Outfall 001
    - Outfall 007
    - Outfall 010
    - Outfall 019
    - Outfall 027B
    - Outfall 028

[2] Note: Outfalls 027A and 027B are the same pipe, but discharge under different flow conditions.

  - Outfall 030
  - Outfall 031
- 1 discharge from the Consolidated Drains Treatment System (CDTS)
  - Outfall 027A

The CDTS treats dry weather flows (non-stormwater flows) collected in the Drainage System. Individual outfall vaults throughout the Drainage System collect non-stormwater flows for transfer to, and treatment by, the CDTS. Additionally, stormwater collects in the fuel farm containment area for transfer to, and treatment by, the CDTS. The flows to the CDTS are as follows:

- Flows from 6 individual outfall vaults which collect non-stormwater flows, including infiltrated groundwater
  - Outfall 007 (which collects Outfall 001 non-stormwater flows in addition to Outfall 007 non-stormwater flows)
  - Outfall 010
  - Outfall 019
  - Outfall 027B
  - Outfall 030 (which collects Outfall 028 non-stormwater flows in addition to Outfall 030 non-stormwater flows)
  - Outfall 031
- Outfall 032 (closed in early 2002) (previously discharged stormwater from fuel farm containment areas directly to the receiving water; the area is now visually inspected before the collected water is discharged to either the CDTS or trucks for disposal offsite.)

GE Aviation also previously discharged through several other outfalls currently not in use, which are listed below:

- Outfall 029 (NCCW and non-stormwater flows, including groundwater, from the gear plant; the permittee plans to demolish the gear plant, which has not been used for more than 10 years)
- Outfalls 003 and 005 (emergency discharge outfalls from test cells consisting of once-through NCCW; these outfalls have not been used for more than 10 years and are capped)

*See* Attachment C for a schematic of the outfall locations and Attachment A for a list of flows contributing to each outfall.

The draft permit regulates, among other things, the possible discharge of (a) purely non-stormwater flow, (b) purely stormwater flow, and (c) non-stormwater flow commingled with stormwater. These three possible types of discharges each raise different issues and are handled differently by the draft permit.

Both the Lynn Water and Sewer Commission (LWSC) and the Massachusetts Water Resources Authority (MWRA) provide potable water to the facility. Process wastewater is combined with sanitary waste at the facility and discharged, via three outfalls, to the

LWSC's POTW in Lynn. This discharge is regulated by an Industrial Discharge Permit issued by the LWSC.

## A. Dry Weather (Non-stormwater) Flows and the Consolidated Drains Treatment System (CDTS)

In 2000, GE Aviation initiated discharges from the CDTS, which was installed to handle groundwater seepage, in accordance with the requirements of an administrative consent order issued by MassDEP.[3] The CDTS was designed as a collection and treatment system to "substantially eliminate" the discharge of untreated non-stormwater flows from the GE Aviation facility, including groundwater infiltration, and to reduce the discharge during wet weather of untreated groundwater from the Drainage System (Outfalls 001, 007, 010, 019, 027, 028, 030 and 031). The groundwater infiltration flows to the Drainage System are generally steady, but reportedly low in volume and velocity (relative to the stormwater volumes).

### 1. Individual Outfall Vaults – Dry Weather (Non-stormwater) Flow

The eight (8) outfalls in the Drainage System have individual underground vaults which collect the non-stormwater flows from their respective parts of the Drainage System. Two of the outfalls, Outfalls 001 and 028, pump non-stormwater flows from their vaults to the vaults at Outfalls 007 and 030, respectively. This is due to the low flows associated with Outfalls 001 and 028, and the cost-effectiveness of installing a small section of piping to an adjacent outfall, rather than a larger section of piping to the CDTS. The dimensions of the outfall vaults and chambers vary based on outfall-specific characteristics such as pipe size, invert elevation, retention time, depth of baffle wall, and skimmer and pump rates.

The non-stormwater flows collect in the eight (8) individual outfall vaults, where they are trapped behind a closed discharge gate. The vaults are composed of concrete and are divided by a rigid cross-flow under-weir. This creates two chambers: the "skimming" chamber lies upstream and the "sampling" chamber lies downstream. The skimming chamber is equipped with a floating skimmer pump, which constantly skims the surface of that chamber, removing the top-most half-inch or so of the water column. Skimmed water and any light phase hydrocarbons that are present are transferred (at a maximum pump rate of about 5 gallons per minute) to a dedicated oil/water separator. The treated aqueous portion of that stream is returned to the skimming chamber.

The skimming chamber is also fitted with 2 transfer pumps and a sonic sensor, which electronically determines the level of the water in the vault and responds accordingly, either turning on the transfer pump during dry weather to transfer flow to the CDTS, or during a storm event turning it off and opening the slide gate at the high-high/gate-open level. As non-stormwater flows collect in the vault, the level of water in the skimmer chamber will increase to the high level, triggering the sonic sensor to turn on the transfer

[3] MassDEP Administrative Consent Order with General Electric Company, File No. ACO-NE-99-1004, dated February 10, 1999.

pump that transfers non-stormwater flows to the CDTS for treatment. GE Aviation states that one transfer pump in each vault is designed to handle the entire non-stormwater flow in the vault, while the second pump is designed to handle flow fluctuations of up to 125 percent (particularly, the "first-flush" of wet weather flows). Design maximum pumping capacities for each vault range from 64 to 90 gallons per minute (gpm).

When the transfer process drops the elevation of the surface within the skimming chamber to the low level, the pumps shut down. Surface skimming continues while the process repeats the cycle. In this way, the system is intended to continually segregate non-stormwater flows and send them to the CDTS for treatment, except to the extent that any non-stormwater flows are discharged to the river mixed with stormwater flow. *See* Attachment D for a diagram of the outfall vaults.

The draft permit includes conditions prohibiting the discharge of non-allowable non-stormwater flows from the Drainage System vault outfalls during dry weather conditions. Any such non-allowable non-stormwater flow that is to be discharged to the Saugus River must first be treated in the CDTS prior to discharge from Outfall 027A. The draft permit also includes appropriate limits on CDTS discharges through Outfall 027A.

2. Consolidated Drains Treatment System (CDTS)

The individual outfall vaults pump the non-stormwater flows to the CDTS for treatment. The CDTS was not designed to capture, convey, or treat stormwater flows under wet weather conditions. The CDTS was constructed to minimize the risk of discharging to the river the contaminants typically associated with non-stormwater flows. Non-stormwater flows to the CDTS consist of cooling water, steam condensate, steam conduit water discharge, condensate blowdown, turbine condensate, boiler startup/soot blower drains/boiler draining for maintenance (intermittent), boiler filter backwash, ion exchange regeneration and backwash, de-aerator storage tanks (intermittent), boiler blowdown, building 64-A sump (intermittent), steam conduit water, cooling tower blowdown, stormwater collected in secondary containment dikes and truck loading areas, test cell washdown water (intermittent), condensate from air receivers, hydrant testing, sprinkler system testing water, potable water used upon NCCW system failure, groundwater infiltration, drain cleanouts, and roof mounted air conditioner wash water (no detergent).

The non-stormwater flows from the individual outfall vaults are pumped to two 450,000-gal underground equalization tanks at the CDTS. The CDTS is a batch treatment process, and the system is operated (in one of four modes) when the water in the equalization tanks reaches about 300,000 gallons. The current operating mode consists of settling in a holding tank (common to each mode) and treatment through two granulated activated carbon (GAC) units in series. Other potential operating modes include settling in the holding tank, followed by (1) treatment of dissolved air floatation (DAF) in addition to the GAC treatment, (2) treatment of DAF in place of the GAC treatment, or (3) no treatment at all. These operating modes are discussed in the consent order. Over recent years the most typical mode is the use of DAF without GAC treatment. The permittee switched from treatment with DAF, to treatment with GAC, around December of 2008.

The two GAC units in series are monitored for breakthrough. The carbon was re-loaded in December 2008. *See* Attachment E for a process flow diagram of the CDTS.

The DAF system consists of two "mixers," or tanks, in series where polyaluminum chloride and anionic emulsion polymer are added, along with air, which floats the flocculated solids to the top of the tanks for removal. The sludge from the bottom of the tank is removed and combined with the skimmed flocculated solids for offsite treatment and disposal.

The permittee has the ability to sample both before and after the DAF treatment. The treated non-stormwater flows discharge through Outfall 027A to the Saugus River.

Given that pollutant discharges would be reduced the most by operating the CDTS in the mode utilizing both DAF and GAC treatment (see above), the draft NPDES permit requires the CDTS to be operated in this manner. Specifically, the draft permit requires that the permittee properly operate and maintain all treatment systems. The draft permit also includes appropriate effluent limits for the treated discharges from Outfall 027A.

**B. Wet Weather Flows (Stormwater) and Commingled Wet and Dry Weather Flows (Stormwater and Non-Stormwater)**

1. Individual Outfall Vaults – Wet Weather Flows (Stormwater)

When a typical storm event begins, stormwater quickly accumulates in the Drainage System and is channeled in the same network of outfalls (001, 007, 010, 019, 027, 028, 030 and 031) but at a much higher volume and velocity than non-stormwater flows during dry weather conditions. Since the gates of the individual outfall vaults are closed at the start of the storm, both the skimming and the sampling chambers of the vaults fill very rapidly, and within a few minutes the level of the surface in the chambers will have moved well beyond the high level to the high-high level, which trips the outfall gates to open. When the water reaches the high-high level, the sonic sensor shuts down all pumps to both the oil/water separator and the CDTS, and the stormwater (likely commingled with non-stormwater flow) is discharged to the river.

When the level of water in both chambers returns to the low level, the outfall gate closes and non-stormwater flows again begin to accumulate in the vaults. The sonic sensor is set to operate the pumps normally so that the water level in the skimming chamber is never lower than the baffle. This is designed to retain floating material for skimming.

As currently operated, a storm event of about 0.1 inches in magnitude triggers the gates of the individual outfall vaults to open by being raised, causing the discharge of any wastewater that is present (namely, stormwater commingled with any non-stormwater flow present in Drainage System) directly to the Saugus River, without treatment in the CDTS. The operation of each gate can be controlled electronically at a single location. The electronic system records the operations over the last 24 hours. The gates are set to open a few inches at a time, to attempt to reduce the velocity of the stormwater discharging from the vaults.

The draft permit contains conditions which require development and implementation of BMPs designed to minimize the presence of pollutants in stormwater flows. In addition, the draft permit has conditions that require BMPs to maximize the extent to which at least the first flush of stormwater (commingled with non-stormwater flows) will be transferred to the CDTS for treatment prior to discharge.

2. Individual Outfall Vaults and Outfalls – Commingled Wet and Dry Weather Flows (Stormwater and Non-Stormwater)

GE Aviation has identified four possible ways in which non-stormwater flows could be commingled and discharged with wet weather flows. First, it is conceivable that a small volume of non-stormwater could be present in the outfall vault at the point when a storm surge trips the gate to discharge to the river. In this case, a small volume of skimmed non-stormwater flow combined with a significant volume of stormwater may be discharged to the river. Second, groundwater could infiltrate into the Drainage System (as described below) at times when an outfall gate is open, resulting in a combined discharge of stormwater and non-stormwater flow (i.e., the infiltrated groundwater).

GE Aviation indicated in the *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, dated July 10, 2009, that the standard operating protocol calls for the CDTS operator to manually run the transfer pumps in all eight vaults during the days leading up to a significant storm event, to attempt to reduce the non-stormwater flows in the vaults to the low level. In addition, the presence of non-stormwater flows in the Drainage System during wet weather could be further reduced by avoiding activities that generate non-stormwater flows to the extent possible during wet weather conditions. For example, to the extent that equipment washing or maintenance generates non-stormwater flow, then these activities should be avoided to the extent possible during wet weather. The draft permit includes provisions requiring both the operating protocols described above as BMPs to minimize the discharge from the Drainage System outfalls of non-stormwater flow commingled with stormwater.

Third, GE indicates that there could be occasional and minor leakage around the gates at individual outfalls, due to the variance in static pressure associated with accumulated water held up behind the gate and the tidal pressure on the outside of the gate. Fourth, outfall gates could mistakenly be left open after periods of wet weather, allowing the discharge of non-stormwater flow during dry weather. The draft permit's conditions prohibit, during both wet and dry weather, the discharge to the river of non-stormwater flow from the Drainage System outfalls as a result of "leakage" or other equipment malfunction (e.g., pump or power failure, gate malfunctions). Any such discharges will be unlawful unless they comply with the "bypass" or "upset" conditions set forth in Parts II.B.4 and II.B.5 of the permit, Standard Conditions.

For most of the Drainage System outfalls, the 1993 permit established dry weather and wet weather monitoring requirements. The dry weather flows are now primarily supposed to be routed to the CDTS, but some dry weather flow could potentially be discharged out of individual outfalls in combination with stormwater, as described above.

To the extent that GE Aviation would discharge non-stormwater flows commingled with its stormwater, and these non-stormwater flows are not of a type typically authorized under the MSGP, the draft permit includes effluent discharge limits applicable to these non-allowable non-stormwater flows. The derivation of these effluent limits is explained farther below.

**C. Groundwater**

Remediation of contaminated groundwater is an ongoing effort throughout the site. Three pump-and-treat systems located onsite discharge treated groundwater to the Lynn POTW. GE Aviation states in the *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, dated July 10, 2009, that the drainage system could pass through light non-aqueous phase liquids (LNAPL) remediation sites at the facility.

Given the age of the Drainage System (dating back to the early 1900's), the seamed concrete/clay tile construction methods of the underground drainage pipes, the porous nature of the fill closest to the river, and the high relative elevation and tidal influence of the water table, it is expected that a significant (though indeterminate) component of wet weather discharges from the Drainage System outfalls consists of infiltrated groundwater commingled with stormwater. GE Aviation states that as the water table rises during wet weather or high tides, the static pressure of the groundwater surrounding partially filled drain pipes forces groundwater through seams and cracks into the pipes. Ultimately, such infiltrated groundwater may be discharged out the Drainage System outfalls commingled with stormwater. In addition, in its most recent Permit Renewal Application Amendment, GE Aviation states that although the facility has implemented an extensive drain relining effort to minimize or eliminate the potential for groundwater infiltration to the Drainage System, groundwater seepage may still account for some of the discharges from any of the Drainage System outfalls during wet weather.[4] At the same time, however, GE Aviation also stated in correspondence dated March 25, 2009, that <u>all</u> dry weather flows are transferred to the CDTS.[5] (In the Administrative Consent Order entered between MassDEP and GE in 1999, cited above, it was stated that pipe lining efforts would "substantially eliminate the discharge of untreated dry weather flow, including infiltration ...." 1999 MassDEP ACO ¶ 7.)

In further discussion with GE Aviation, the permittee stated that the Drainage System Outfalls (001, 007, 010, 019, 027, 028, 030, and 031) have essentially all their groundwater treated at the CDTS prior to discharge.[6] At the same time, GE Aviation also

[4] NPDES Permit Renewal Application Amendment, September 2003.
[5] Email correspondence from Steven Lewis (GE Aviation) to Nicole Kowalski (EPA) dated March 25, 2009.
[6] Email correspondence from Steven Lewis (GE Aviation) to Nicole Kowalski (EPA) dated April 3, 2009.

has indicated that there is a potential for groundwater infiltration to commingle with discharges through Outfalls 014, 018, and 020.

GE Aviation elaborated in its *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, dated July 10, 2009, that when stormwater lines and manhole inverts have elevations below the (tidally-influence) groundwater elevation, that portion of the storm system is effectively submerged in groundwater and therefore has the potential of being infiltrated by groundwater. Static pressures could force seepage through cracks, joints, and along annular spaces behind separated pipe lining.

Based on all of the information provided by GE Aviation, specifically the most recent, *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, dated July 10, 2009, EPA believes that the potential for contaminated groundwater infiltration to all outfalls exists. GE Aviation acknowledges that prior groundwater investigations conducted in connection with site investigations under the Massachusetts Contingency Plan have detected the presence of the following constituents in the site groundwater:

PCBs (Aroclor 1242, Aroclor 1248, Aroclor 1260),
oil and grease (O&G),
metals (antimony, arsenic, beryllium, cadmium, calcium, chromium, copper, iron, ferrous iron, lead, magnesium, manganese, mercury, nickel, selenium, silver, sodium, thallium, zinc),
Volatile Petroleum Hydrocarbons (VPHs),
Extractable Petroleum Hydrocarbons (EPH),
Semi-Volatile Organic Compounds (SVOCs) (Acenaphthene, acenaphthylene, anthracene, benzo(a)pyrene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)pthalate, carbazole, chrysene, dibenzo(a,h)anthracene, dibenzofuran, di-n-octylphthalate, diethylphthalate, p-dichlorobenzene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, 4-methylphenol, 2,4-dimethylphenol, m-dichlorobenzene, o-dichlorobenzene, o-cresol, p-chloro-m-cresol, N-Nitroso-diphenylamine, naphthalene, phenanthrene, phenol, pyrene, total polyaromatic hydrocarbons (PAHs)),
Volatile Organic Compounds (VOCs) (acetone, benzene, bromodichloromethane, bromoform, bromomethane, 2-butanone, carbon disulfide, carbon tetrachloride (tetrachloromethane), chlorobenzene, chloroethane, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethane, 1,2-dichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,4-dioxane, dichlorodifluoromethane, ethylbenzene, ethylether, 2-hexanone, isopropylbenzene, 4-methyl-2-pentanone, methylene chloride, methyltertbutylether naphthalene, n-butylbenzene, n-propylbenzene, p-cymene, sec-butyl benzene, tert-butyl benzene, tert-amyl methyl ether, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trimethylbenzene, 1,2,4-trichlorobenzene, 1,3,5-trimethylbenzene,

> tetrachloroethene, toluene, trichloroethene, trichlorofluoromethane, vinyl chloride, m-xylene, m/p-xylene, o-xylene, total xylenes).[7,8]

As a result, it is reasonably possible that one or more of these contaminants could be present in any discharges of untreated infiltrated groundwater.

Furthermore, monitoring of non-stormwater flows in the outfall vaults indicates levels of copper, zinc, PCBs, and residual chlorine which exceed State water quality standards. Monitoring of non-stormwater flows in the outfall vaults also indicates elevated levels of Total Suspended Solids (TSS), antimony, iron, lead, nickel, vinyl chloride, and PAHs.[9]

The draft permit contains conditions that prohibit the discharge during dry weather of untreated contaminated groundwater, either alone or in combination with any other discharge, directly to the receiving water. Any dry weather discharges of contaminated groundwater must first receive treatment in the CDTS and be discharged from Outfall 027A. (As discussed farther below, the draft permit includes conditions imposing effluent limits and monitoring requirements for the CDTS discharges through Outfall 027A based on technology standards and water quality standards.) Any dry weather discharge of contaminated groundwater that has not first been treated in the CDTS will be unlawful unless it is an authorized "bypass" or "upset" discharge under the conditions of Parts II.B.4 and II.B.5 of the Standard Conditions of the permit.

Additionally, the draft permit requires development and implementation of site-specific BMPs to minimize the infiltration of contaminated groundwater into the drainage system. The BMPs require, at a minimum, that the Drainage System outfalls open only during wet weather (after the first flush of stormwater is transferred to the CDTS for treatment) and remain closed during all periods of dry weather. Additionally, the BMPs include inspection of the outfall pipelines which discharge directly to the receiving water (including, at a minimum, Outfalls 014, 018, and 020), and require upgrading the pipe lining integrity of outfalls expected to discharge contaminated groundwater directly to the receiving water. These measures will minimize both the commingling of groundwater contaminants with stormwater discharges from the Drainage System outfalls and the pollutant load within any non-stormwater discharges from the Drainage System outfalls.

The above-described prohibitions, BMPs and effluent limits are derived from the technology-based and water quality-based requirements of the CWA, as set forth farther below.

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[7] NPDES Permit Renewal Application Revision, May 2000.

[8] E-mail correspondence from Steven Lewis (GE Aviation) to Nicole Kowalski (EPA), March 25, 2009, Attachment: Complete list of constituents that have been detected in the groundwater at the site.

[9] Response to Request for Information, Section 308(a) of the Clean Water Act (CWA), July 10, 2009.

**D. Excavation Dewatering**

Occasionally, GE Aviation dewaters a remediation, construction or pipe repair-related excavation on site. Dewatering events typically involve removal of groundwater and/or "potable" water from shallow excavations below the water table on the site. Since groundwater is listed as contributing to non-stormwater flows and the CDTS is specifically designed to treat potential contaminants from groundwater infiltration, treatment at the CDTS is required prior to discharge of excavation dewatering under the existing State Administrative Consent Order (ACO).

When groundwater collects in an excavation area, the permittee is required to sample such water for total petroleum hydrocarbons (TPH). TPH measures the total concentration of all petroleum-related hydrocarbon compounds within a specified carbon range.[10] The petroleum-related compounds included within this analysis range from compounds with 6 carbon ($C_6$) atoms to compounds with 25 carbon atoms ($C_{25}$). TPH concentrations are commonly used by regulatory agencies in the United States to establish target cleanup levels for soil or water.[10] Site remediation projects conducted under State law in MA and NH have consistently imposed a maximum effluent limitation for TPH of 5.0 parts per million (ppm) or milligrams per liter (mg/l) and this limit is readily attainable with standard treatment technology.[11]

If TPH is measured at less than 5.0 mg/l, the excavation water may be pumped directly or indirectly to the CDTS underground storage tanks for eventual treatment in the CDTS. The permittee shall ensure that the excavation water is pumped to the CDTS and not commingled with stormwater for direct discharge to the receiving water. If TPH is measured at 5.0 mg/l or more, the permittee is required to containerize this excavation water and either (a) pump it to the Lynn POTW for treatment if it has specific approval to do so from the POTW, or (b) dispose of this water appropriately off-site.

**E. Drainage System Cleaning**

Periodically, GE Aviation performs routine cleaning of its drainage system, which includes vaults, catch basins, lines, manholes and lift stations, by pressure washing with potable water and using a vacuum or dredge to remove accumulated sediment. These solids are removed and disposed of as solid waste off-site. In the past, GE Aviation collected the water that drained from the solids for discharge to the POTW following analytical testing and approval from Lynn Water and Sewer Commission. In a letter to EPA dated October 9, 2001, GE Aviation sought approval to allow storm and wash water to remain in the drain system and be discharged through the related outfall to the Saugus River.

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[10] Weisman, Wade. 1998. *Analysis of Petroleum Hydrocarbons in Environmental Media, Volume 1.* Total Petroleum Hydrocarbon Criteria Working Group Series, March 1998.

[11] USEPA, Remediation & Miscellaneous Contaminated Sites General Permit (RGP), NPDES Permit No. MAG910000 & NHG910000.

GE Aviation stated in a letter dated May 19, 2009, that the cleaning process involves the use of a vactor truck, which uses city water (no detergent or solvents of any kind) to suspend and fluidize mainly sand and soil sediment within the catch basin. Once sediment is suspended in the water column, the slurry is vacuumed from the catch basin. Occasionally, the water is decanted from the slurry and discharged back into the catch basin while retaining the solids in the vactor truck. The water is then discharged into the Drainage System to the same catch basin from which it was removed.

The draft permit prohibits the discharge of drainage system cleaning water directly to the receiving water. All drainage system cleaning water shall be either disposed of offsite or transferred directly to the CDTS for treatment. The draft permit also requires proper off-site disposal of the solid waste and minimization of the amount of solids that are left behind in the drain lines. The use of detergents and/or solvents in Drainage System Cleaning is prohibited.

The draft permit also includes a BMP requirement that prohibits drainage system cleaning during wet weather conditions, and prior to periods of forecasted wet weather conditions. This will help to prevent, to the maximum extent practicable, the commingling of drainage system cleaning water with stormwater.

**F. Chemical Additives**

Numerous chemical additives are used at the facility during normal operations to minimize the corrosion of equipment parts, extend the life of rinse and cooling water, limit bio-growth in recirculated water, balance pH, prevent scaling, scavenge for oxygen, reduce foaming or remove dissolved/ionized solids. A list of *Water Treatment Chemicals Potentially Discharged to the Storm Drain* [Drainage System] is included in Attachment F.[12] Use of any unlisted additives must be approved by EPA prior to use onsite. Additionally, as described in detail in Part III.I of this fact sheet, below, the use of Foamtrol AF2290 is prohibited in the draft permit.

The draft permit prohibits the discharge of water containing additives (except cooling water authorized for discharge through Outfall 018 or 014) directly to the receiving water. The draft permit requires that any discharge of water containing additives (except cooling water authorized for discharge through Outfall 018 or 014) be transferred to the CDTS for treatment.

**G. Stormwater Dye Tracing**

GE Aviation performs routine stormwater dye tracing studies using a specially formulated version of Xanthene dye of a non-toxic nature.[13] Nearly all dye tracing studies take place during dry weather, therefore if a quantity of dye in visible concentration should reach the outfall, it would be trapped by a closed gate and be

[12] NPDES Permit Renewal Application Amendment, September 2003, Exhibit 2-2.
[13] NPDES Permit Renewal Application Amendment, September 2003, p. 2-11.

pumped to the CDTS, where it would be combined with additional non-stormwater flows prior to treatment.

The Massachusetts Water Quality Standards (314 CMR 4.05(4)(b)(6)) states that Class SB waters "shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class." Therefore, the permit requires, as a site-specific BMP, that no discharge shall contain dye in visible concentrations. Additionally, the draft permit prohibits performance of dye tracing studies during wet weather conditions, prior to periods of forecasted wet weather conditions, and whenever any outfall gate is open. The permittee shall visually inspect the outfalls for discharges of dye during the dye testing studies. Any discharge of visible dye shall be considered a violation of the permit. Part I.A.18 of the draft permit states that the discharge shall not cause objectionable discoloration of the receiving waters.

**H. Oil Sheens**

A general condition of the 1993 permit requires "no discharge of oil sheen in other than trace amounts." However, the Massachusetts Water Quality Standards (314 CMR 4.05(4)(b)(7)) state that Class SB waters "shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life." Therefore, the draft permit replaces the current condition with a narrative condition tracking the language of the State water quality standards. In addition, given that a concentration of oil and grease of 15 mg/L is recognized as the level at which many oils produce a visible sheen, the draft permit also imposes an oil and grease limit of 15 mg/L for outfalls with discharges that are expected to be contaminated with oil and grease, as described below in Part V.C, Proposed Permit Effluent Limitations and Conditions.

**I. Foam Control Plan**

The current permit includes the following language which applies to all outfalls, "There shall be no discharge of floating solids, oil sheen, or visible foam in other than trace amounts."

Due to the natural characteristics of the Saugus River, turbulence at the discharge points on the riverbank can generate foam. Investigations conducted by ENSR for GE Aviation in October 1994 and September 1996 found that foam in the receiving water at Outfalls 014 and 018 was not the result of the addition of floating, suspended or settleable solids, or other pollutants, but rather occurred naturally due to turbulence and the natural salinity of the Saugus River. The study also stated that the foam was generated during mid-to-low tide due to non-laminar flow and the entrainment of air at the discharge point.

The Massachusetts Water Quality Standards (314 CMR 4.05(4)(b)(5)) state that Class SB waters "shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom." Additionally, EPA's "Gold Book"[14] states that all waters shall be free from substances attributable to wastewater or other discharges that: settle to form objectionable deposits; float as debris, scum, oil, or other matter to form nuisances; and produce objectionable color, odor, taste, or turbidity.

To be consistent with these standards, the draft permit replaces the current permit requirement with a condition stating that "The effluent shall not contain a visible oil sheen, foam, or floating solids at any time." The permittee states that it plans to reduce the amount of foam generating during mid-to-low tide by injecting anti-foam chemicals into the discharges through Outfalls 014 and 018. EPA has approved the use of a water-based anti-foam agent in other individual NPDES permits. Injection of an oil-based formulation would be cause for concern, however, since this water is discharged directly to the receiving water. Therefore, the draft permit allows the use of Foamtrol AF3551, the water-based anti-foam agent currently in use at the site, but prohibits the use of Foamtrol AF2290, the oil-based anti-foam agent. Specifically, use of oil-based anti-foam agents, such as Foamtrol AF2290, is prohibited in the draft permit.

### J. Cooling Water Intake Structures

The GE Aviation facility includes three cooling water intake structures (CWISs): the Power Plant CWIS, the Test Cell CWIS, and the Gear Plant CWIS. The Power Plant CWIS consists of three seawater pumps (total design capacity 172.8 MGD) and six condenser cooling pumps (total design capacity 58.3 MGD) that supply non-contact cooling water to the Power Plant. The Test Cell CWIS, located at the end of an intake canal perpendicular to the flow of the river, is equipped with two seawater pumps (total design capacity 78.5 MGD) that supply cooling water for aircraft engine testing. The Gear Plant CWIS is currently inactive and scheduled for demolition beginning October 2010. See the evaluation and determination of the BTA in Attachment J for a more detailed description of each CWIS.

## IV. SUMMARY OF MONITORING DATA

The effluent limitations and all other requirements described herein may be found in the draft permit. The effluent data submitted by the permittee in discharge monitoring reports (DMRs) is summarized in Attachment G.

## V. PERMIT BASIS AND EXPLANATION OF EFFLUENT/INTAKE LIMITS

### A. Receiving Water Description

The Saugus River is located in the North Coastal River basin and is a tributary to Lynn Harbor. At the point of GE Aviation's discharge, the Saugus River is classified under the Massachusetts Department of Environmental Protection's (MassDEP) Surface Water

[14] EPA 440/5-86-001, Quality Criteria for Water 1986.

Quality Standards (SWQS), *see* 314 CMR 4.06(1)(d)(1) and Table 23, as a Class SB water and an Outstanding Resource Water (ORW).

ORWs are afforded higher protection to maintain their existing uses and water quality. Class SB waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. In approved areas, SB waters shall also be suitable for shellfish harvesting with depuration (Restricted Shellfish Areas). In addition, these waters are to have consistently good aesthetic value. This segment of the Saugus River, #MA93-44, is on the MassDEP's 2008 303(d) list of impaired waters (for fecal coliform, oil & grease, temperature, and flow alterations).

The segment of the Saugus River receiving GE Aviation's wastewater discharges, and providing the facility's water for cooling, lies within the Rumney Marsh Area of Critical Environmental Concern (ACEC). An ACEC receives special recognition by the State because of the quality, uniqueness, and significance of its natural and cultural resources. ACEC designation creates a framework for enhanced local, regional, and State stewardship of these critical resources. The purpose of the ACEC Program is to preserve, restore, and enhance critical environmental resources and resource areas of the Commonwealth of Massachusetts. The goals of the program are to identify and designate these ecological areas, to increase the level of protection for ACECs, and to facilitate and support the stewardship of ACECs.

Rumney Marsh is a biologically significant salt marsh adjacent to the Saugus River which provides habitat for a wide range of aquatic species and native and migratory birds. Due to the historical alteration of this wetland, there are ongoing efforts to restore portions of this salt marsh and the related intertidal areas. The majority of land surrounding the GE Aviation facility, including its CWISs, is located within this ACEC-designated area.

**B. General Basis of Permit Requirements**

The Clean Water Act (CWA), 33 U.S.C. §§ 1251 *et seq.*, prohibits the discharge of pollutants to waters of the United States without authorization from a National Pollutant Discharge Elimination System (NPDES) permit, unless the discharge is otherwise authorized by the statute. *See* 33 U.S.C. §§ 1311(a) and 1342(a). The CWA also prohibits a discharger from withdrawing water from a water body through a cooling water intake structure (CWIS) for its cooling needs unless authorized by an NPDES permit.

The NPDES permit is the mechanism used to implement the CWA's technology-based and water quality-based requirements on a facility-specific basis. As such, NPDES permits impose pollutant discharge limits, cooling water intake restrictions, and other requirements, such as requirements for best management practices, maintenance, monitoring and reporting.

The draft NPDES permit for GE Aviation was developed in accordance with statutory and regulatory requirements under the CWA and applicable Federal and State regulations. The regulations governing the EPA NPDES permit program are generally found at 40 CFR Parts 122, 124, 125, and 136.

When developing permit limits, EPA applies technology-based and water quality-based requirements. Where both types of requirements apply to a particular pollutant discharge or cooling water withdrawal, the more stringent requirement is included in the permit so that both types of requirements will be satisfied. EPA also considers any variances that may be requested, and considers the limits and conditions in any existing permit in the context of "anti-backsliding" requirements. *See* 33 U.S.C. § 1342(o).

1. Technology-Based Requirements

The CWA imposes a number of technology standards requiring the use of particular levels of pollution control technology. Federal technology-based treatment requirements represent the minimum level of control that must be imposed under Sections 301(b) and 402 of the CWA (*see* 40 CFR §125 Subpart A). Technology-based discharge standards include: (a) the best practicable control technology currently available (BPT) standard for a limited number of "conventional pollutants" and metals, (b) the best conventional control technology (BCT) standard for other conventional pollutants; and the best available technology economically achievable (BAT) standard for toxic and non-conventional pollutants.[15] *See* 33 U.S.C. §§ 1311(b)(1)(A), 1311(b)(2)(A), and 1311(b)(2)(E). In addition, CWA § 316(b) requires that the design, location, construction and capacity of a discharger's cooling water intake structure(s) (CWISs) reflect the best technology available for minimizing adverse environmental impacts (BTA). 33 U.S.C. § 1326(b). Which of the CWA's technology standards apply to a given facility is determined by a variety of factors, such as the type of pollutant at issue, the type of facility in question, and whether or not the facility has a CWIS.

Existing point sources discharging pollutants to receiving waters were initially subject to effluent limitations based on the BPT standard, which were to have been satisfied by July 1, 1977. *See* 33 U.S.C. §§ 1311(b)(1)(A), 1314(b)(1)(B). The BPT standard required compliance with effluent limitations based on the "best practicable control technology currently available." *Id.* The CWA sets forth a number of factors that EPA is to consider in determining the BPT. These factors are as follows:

(i) The age of equipment and facilities involved;
(ii) The process employed;
(iii) The engineering aspects of the application of various control techniques;
(iv) Process changes;
(v) Non-water quality environmental impacts (including energy requirements);

[15] The CWA also imposes "new source" standards under Section 306, 33 U.S.C. § 1316, for facilities considered to be "new sources" under the statute. The GE Aviation facility in Lynn is not, however, a "new source" under the CWA.

(vi) The total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application; and

(vii) Such other factors as the Administrator deems appropriate.

33 U.S.C. § 1314(b)(1)(A). See also 40 C.F.R. § 125.3(d)(1).

Existing point sources discharging conventional pollutants are subject to effluent limitations based on the BCT standard, which were to have been satisfied by March 31, 1989. *See* 33 U.S.C. §§ 1311(b)(2)(E), 1314(b)(4)(A); *see also* 40 C.F.R. § 401.16 (conventional pollutants include biochemical oxygen demand (BOD), total suspended solids (TSS) (nonfilterable), pH, fecal coliform, oil and grease). The BCT standard requires compliance with limitations based on the "best conventional pollutant control technology." The CWA sets forth a number of factors that EPA must consider in determining the BCT. These factors are the same as those specified above with regard to the BPT standard, with two additions. First, a factor regarding comparative costs and benefits is specified that reads as follows: "the reasonableness of the relationship between the cost of attaining a reduction in effluent and the effluent reduction benefits derived." 33 U.S.C. § 1314(b)4)(B); 40 C.F.R. § 125.3(d)(2)(i). Second, the following additional relative cost factor also should be considered: "the comparison of the cost and level of reduction of such pollutants from the discharge from publicly owned treatment works to the cost and level of reduction of such pollutants from a class or category of industrial sources." Effluent limitations for conventional pollutants based on BCT may not be less stringent than those based on BPT, as BCT is a more advanced (i.e., stringent) standard than BPT.

Discharges of toxics and "nonconventional" pollutants (*i.e.*, pollutants that are neither "toxic" nor "conventional," such as heat) from existing point sources were required to comply by March 31, 1989, with effluent limitations based on the BAT standard. *See* 33 U.S.C. § 1311(b)(2)(A) and (F); *see also* 40 C.F.R. § 401.15 (list of toxic pollutants). The BAT standard requires compliance with:

> effluent limitations . . . which . . . shall require application of the best available technology economically achievable . . ., which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants, as determined in accordance with regulations issued by the [EPA] Administrator pursuant to section 1314(b)(2) of this title, which such effluent limitations shall require the elimination of discharges of all pollutants if the Administrator finds, on the basis of information available to him ... that such elimination is technologically and economically achievable . . . as determined in accordance with regulations issued by the [EPA] Administrator pursuant to section 1314(b)(2) of this title . . ..

33 U.S.C. § 1311(b)(2)(A). That is, EPA must require the most stringent possible limits that could be met by use of the most effective pollution control technologies that are

technologically and economically achievable, and that will result in reasonable progress toward eliminating the discharge of the pollutant(s) in question. The CWA specifies the following factors for EPA to consider in determining the BAT:

(i) The age of equipment and facilities involved;
(ii) The process employed;
(iii) The engineering aspects of the application of various control techniques;
(iv) Process changes;
(v) Non-water quality environmental impacts (including energy requirements);
(vi) The cost of achieving such effluent reduction; and
(vii) Such other factors as the Administrator deems appropriate.

33 U.S.C. § 1314(b)(2)(A); 40 C.F.R. § 125.3(d)(3). Notably, these BAT factors do not include a comparison of the costs and benefits of the pollutant discharge reductions. *See EPA v. Nat'l Crushed Stone Ass'n*, 449 U.S. 64, 74 (1980) ("[s]imilar directions are given the Administrator for determining effluent reductions attainable from the BAT [as are given for the BPT standard,] except that in assessing BAT total cost is no longer to be considered in comparison to effluent reduction benefits").

BAT is the CWA's most stringent standard for existing dischargers. "Congress intended these limitations to be based on the performance of the single best-performing plant in an industrial field." Chem. Mfrs. Ass'n v. EPA, 870 F.2d 177, 226 (5th Cir.1989). See also Kennecott v. EPA, 780 F.2d 445, 448 (4th Cir. 1985) ("In setting BAT, EPA uses not the average plant, but the optimally operating plant, the pilot plant which acts as a beacon to show what is possible."). EPA has not defined "economically achievable" but pollution control technology is considered to be economically achievable if the cost of using it will not cause a plant to shut down.

CWA § 316(b) specifies the technology standard applicable to cooling water intake structures (CWISs). It requires that the location, construction, design and capacity of CWISs must reflect the best technology available for minimizing adverse environmental impacts (BTA). 33 U.S.C. § 1326(b). Thus, Section 316(b) dictates the aspects of CWISs that must be considered in determining the BTA: namely, their location, construction, design and capacity. The statute further dictates that the BTA must be an "available" techology – which EPA interprets to mean technologically and economically achievable – and the "best" technology for "minimizing" adverse environmental impacts. As a result, EPA interprets the statute to call for the cost of technological alternatives to be considered insofar as it might affect a technology's availability. Similarly, EPA considers technology issues, such as engineering considerations, insofar as they may affect an option's "technological availability" and its cost. In addition, EPA must consider the extent to which the options are able to reduce the adverse environmental impacts of CWIS operation to help determine which options "minimize" such adverse impacts.

The statute does not mandate additional specific factors to be considered in determining the BTA in the same way that CWA § 304(b) does so for the technology standards applicable to pollutant discharges. *See Entergy Corp. v. Riverkeeper, Inc.*, ___ U.S. ___, 129 S.Ct. 1498, 1507 (2009). As a result, EPA has discretion to reasonably consider other factors that it deems relevant. *See id.* at 1507 – 1509. In setting BTA standards in the past, EPA has used its discretion in appropriate cases to consider factors such as the ones specified for effluent discharge standards in CWA § 304(b) (e.g., non-water environmental effects and energy requirements). EPA has also exercised its discretion to consider a comparison of the costs and benefits of a given technology option. The Supreme Court recently confirmed that EPA has the discretion, but is not required, to consider such a comparison of costs and benefits. *See id.* at 1508.

EPA has two alternative methods for giving effect to the CWA's technology standards. First, EPA can approach the matter on an industrial category-wide basis (e.g., for steam-electric power plants or paper mills). Industrial categories may, in turn, be broken down into sub-categories based on factors such as the type of processes used or the location of the facilities (e.g., effluent limitations may be tailored for different types of paper mills). EPA then determines the pollution reduction method(s) that satisfies the applicable technology standard for that industrial category (e.g., BAT or BCT), and sets the effluent limitations for particular pollutants based on the use of that method. These industrial category-wide (or sub-category-wide) effluent limitations are referred to as National Effluent Limitation Guidelines (NELGs). Once a pertinent NELG has been developed, it is used to determine the limits to be included in individual facility permits. *See* 40 C.F.R. § 125.3(c)(1).

Second, when EPA has not developed an NELG (or a CWIS standard) for a particular industry, or for a particular pollutant discharged by an industry for which NELGs have otherwise been promulgated, the Agency uses its Best Professional Judgment (BPJ) to develop permit limits based on a case-by-case, site-specific application of the relevant technology standard. *See* 33 U.S.C. § 1342(a)(1)(B); 40 C.F.R. § 125.3(c)(2). *See also* 40 C.F.R. § 125.90(b) (BPJ-based requirements for CWISs under CWA § 316(b)). As one court has explained, "BPJ limits constitute case-specific determinations of the appropriate technology-based limitations for a particular point source." *NRDC v. EPA*, 859 F.2d 156, 199 (D.C. Cir. 1988). This court further explained that:

> [i]n what EPA characterizes as a 'mini-guideline' process, the permit writer, after full consideration of the factors set forth in section 304(b), 33 U.S.C. § 1314(b), (which are the same factors used in establishing effluent guidelines), establishes the permit conditions 'necessary to carry out the provisions of [the CWA].' § 1342(a)(1). These conditions include the appropriate ... BAT effluent limitations for the particular point source. ... [T]he resultant BPJ limitations are as correct and as statutorily supported as permit limits based upon an effluent limitations guideline.

*Id. See also Texas Oil & Gas Ass'n v. EPA*, 161 F.3d 923, 929 (5th Cir. 1998) ("Individual judgments thus take the place of uniform national guidelines, but the technology-based standard remains the same.") Consistent with this understanding, EPA's regulations state that when developing an effluent limitation on a BPJ-basis, the permit writer considers the relevant factors specified in CWA § 304(b), *see* 40 C.F.R. § 125.3(d), "the appropriate technology for the category or class of point sources of which applicant is a member, based upon all available information," and "any unique factors relating to the applicant." *Id.* at § 125.3(c)(2)(i)-(ii).

Additional guidance about developing technology-based requirements on a BPJ basis is provided by the EPA's manual for permit writers. *See* Office of Wastewater Management, U.S. Environmental Protection Agency, "NPDES Permit Writers' Manual" (Permit Writers' Manual) (September 2010). The Permit Writer's Manual identifies a wide array of materials that can be used to inform BPJ permitting decisions, including EPA technical guidance documents pertaining to the development of technology and water-quality-based limits and permit compliance data. Notably, the list of BPJ permitting tools also specifically references other NPDES permits, including those from other media (i.e., RCRA and SPCC). Thus, the Permit Writers' Manual instructs that permit writers may derive BPJ limits by, among other things, (1) transferring numerical limitations from appropriate existing sources (*e.g.*, a similar NPDES permit or an existing ELG for an analogous industrial category), or (2) developing new numeric limitations.

With regard to the GE Aviation facility, there are no directly applicable NELGs. Therefore, EPA has determined technology-based requirements for this NPDES permit on a case-by-case, BPJ basis. This has involved consideration of the relative performance of alternative pollution reduction methods, including methods in use at other facilities, as well as the pertinent factors specified in Section 304(b) of the CWA, 33 U.S.C. § 1314(b), and 40 C.F.R. § 125.3(d).

EPA has also considered various NELGs which, although not strictly applicable to GE Aviation, provide relevant information because they were developed for industrial categories similar or analogous to the GE Aviation facility in important ways. In other words, these NELGs are not strictly determinative of the technology-based limits to be applied to the GE Aviation facility, but they provide useful information to inform EPA's BPJ.

The draft permit's effluent monitoring requirements have been established under the authority of Sections 308(a) and 1342(a)(2) of the Clean Water Act, 33 U.S.C. §§ 1318(a) and 1342(a)(2), and in accordance with EPA regulations set forth at 40 CFR § 122.41(j), 122.44(i) and 122.48. The monitoring program in the permit specifies routine sampling and analysis which will provide information on the facility's pollutant discharges and the reliability and effectiveness of the installed pollution abatement equipment. Approved analytical procedures are to be found in 40 CFR Part 136 unless other procedures are specified in the permit.

The CWA requires compliance with BPT, BCT and BAT effluent limits no later than March 31, 1989. *See* 33 U.S.C. § 1311(b)(1)(A) and (2); 40 C.F.R. § 125.3(a)(2). Thus, the statutory deadline for achieving compliance with effluent limits based on these standards has already passed and compliance is required immediately. NPDES permits may not include compliance schedules and deadlines that would purport to extend these statutory compliance deadlines. *See* 40 C.F.R. § 122.47(a)(1).

2. Water Quality-Based Requirements

Water quality-based limitations are required in NPDES permits when effluent limits and other requirements and standards more stringent than technology-based requirements are necessary to maintain or achieve compliance with State or Federal water quality requirements. *See* 33 U.S.C. § 1311(b)(1)(C); 40 C.F.R. § 122.44(d)(1). State water quality standards (WQS) have three components: (a) beneficial designated uses for water bodies or segments of water bodies; (b) instream numeric and/or narrative water quality criteria intended to protect the assigned designated uses; and (c) antidegradation requirements intended to ensure that once a particular level of water quality is attained it will not be degraded, except under very limited circumstances, and to protect especially high quality or important water bodies. *See* 40 C.F.R. § 131.12; 310 CMR 4.04(3). The Massachusetts Surface Water Quality Standards, found at 314 CMR 4.00, include each of these three elements.

The State assigns each of the water bodies under its jurisdiction, and in some cases specific segments of these water bodies, to a particular water quality classification (e.g., Class A, Class B or Class C). Each water quality classification is assigned a particular set of designated uses and accompanying water quality criteria. Massachusetts also has a number of water quality criteria that apply to all its waters, including narrative water quality criteria requiring restrictions on the discharge of toxic constituents and mandating the use of EPA criteria established pursuant to Section 304(a) of the CWA unless the WQS specify a different criterion for the specific pollutant or the State establishes site-specific criteria.

When using chemical-specific numeric criteria to develop permit limits, both the acute and chronic aquatic-life criteria, expressed in terms of maximum allowable in-stream pollutant concentration, are used. Acute aquatic-life criteria are considered applicable to daily time periods (i.e., maximum daily limits), while chronic aquatic-life criteria are considered applicable to monthly time periods (i.e., average monthly limits). Chemical-specific limits are allowed under 40 CFR § 122.44(d)(1) and are implemented under 40 C.F.R. § 122.45(d). Pursuant to 40 C.F.R. § 122.45(d)(2), the Region has established maximum daily limits and average monthly discharge limits for specific chemical pollutants for this permit.

A facility's design flow is used when deriving constituent limits for daily and monthly time periods, as well as for weekly periods where appropriate. The dilution provided by the receiving water is also factored into this process where appropriate. Narrative criteria from the State's water quality standards provide a basis for limiting toxicity in discharges where (a) a specific pollutant can be identified as causing or contributing to the toxicity but the State has no numeric standard; or (b) toxicity cannot be traced to a specific pollutant.

NPDES permits must address any pollutant or pollutant parameter (conventional, non-conventional, toxic and whole effluent toxicity) that is or may be discharged at a level that causes, contributes, or has a "reasonable potential" to cause or contribute to an excursion above any water quality standard. *See* 40 C.F.R. § 122.44(d)(1). An excursion occurs if the projected or actual in-stream concentration of a pollutant discharge exceeds the applicable criterion or interferes with maintenance of applicable designated uses. In determining whether there is a reasonable potential for an excursion, EPA considers (a) existing controls on point and non-point sources of pollution; (b) pollutant concentrations and variability in the effluent and receiving water; (c) the sensitivity of the test species used in toxicity testing; (d) known water quality impacts of processes on wastewater; and, (e) where appropriate, dilution of the effluent in the receiving water. *See id.* In the case of this receiving water, EPA has conservatively assumed no dilution in evaluating the water quality-based criteria for toxic and non-conventional pollutants, given the tidal nature of the receiving water and the dearth of flow available at low tide, the value of the resource, and the assumption that non-allowable non-stormwater discharges receive internal dilution via commingling with stormwater in the Drainage System.

Federal regulations found at 40 CFR Section 131.12 require states to develop and adopt a statewide antidegradation policy, as part of their water quality standards, to ensure the maintenance and protection of existing instream water uses and the level of water quality necessary to protect the existing uses. Antidegradation policies are also supposed to maintain the quality of waters which exceed levels necessary to support propagation of fish, shellfish, and wildlife and to support recreation in and on the water, subject to limited exceptions. The Massachusetts Antidegradation Policy is found at Title 314 CMR 4.04.

The antidegradation requirements of the Massachusetts WQS provide heightened protection for Outstanding Resource Waters (ORWs). As previously mentioned, the GE Aviation facility discharges wastewater to, and withdraws water for cooling from, a segment of the Saugus River that is classified as an ORW under the Massachusetts WQS. *See* 310 CMR 4.06(1)(d)(2), 4.06(5) and 4.06 (Tables and Figures: Table 23 (Saugus River: Boston Street Bridge to the mouth -- Qualifiers ("Outstanding Resource Waters"). This segment of the river is also part of the State-designated Rumney Marshes Area of Critical Environmental Concern (ACEC), which is an extensive and biologically significant salt marsh system to the north of Greater Boston area.

The State's antidegradation requirements restrict both new (or increased) and existing discharges of pollutants to ORWs. While GE Aviation is not proposing new or increased pollutant discharges, its existing discharges still must satisfy the antidegradation requirements. Specifically, the State regulations provide that:

> [a]ny person having an existing discharge to these waters shall cease said discharge and connect to a Publicly Owned Treatment Works (POTW) unless it is shown by said person that such a connection is not reasonably available or feasible. Existing discharges not connected to a POTW shall be provided with the highest and best practical method of waste treatment

> determined by the Department as necessary to protect and maintain the outstanding resource water.

314 CMR 4.04(3)(a). Therefore, GE Aviation's existing discharges of pollutants to ORW portions of the Saugus River must cease and be redirected to a POTW (in this case, the Lynn Water & Sewer Commission POTW), unless such redirection is "not reasonably available or feasible," in which case such pollutant discharges must receive the "highest and best practical method of waste treatment" that MassDEP determines is needed to protect and maintain the ORW. In MassDEP's antidegradation policy document, entitled, "Implementation Procedures for the Antidegradation Provisions of the Massachusetts Surface Water Quality Standards, 314 CMR 4.00" (10/21/09) (MassDEP Antidegradation Implementation Procedures), the State explains that "[t]he purpose of this requirement is to minimize any degradation and to ensure that water quality remains as close to natural background conditions as feasible." *Id.* at 6.[16]

Under the State's WQS, the MassDEP implements an "authorization process" in connection with the application of its antidegradation requirements. *See* 314 CMR 4.04(5). In 314 CMR 4.05(5)(b), the WQS provide that, "[a]n authorization to discharge to the narrow extent [that discharges to ORWs are] allowed in 314 CMR 4.04(3) … may be granted by the Department where the applicant demonstrates compliance with 314 CMR 4.04(5)(a)2. through 314 CMR 4.04(5)(a)4." These provisions, in turn, specify as follows:

> (a) An authorization to discharge to waters designated for protection under 314 CMR 4.04(2) may be issued by the Department where the applicant demonstrates that:
>
> 2. No less environmentally damaging alternative site for the activity, receptor for the disposal, or method of elimination of the discharge is reasonably available or feasible;

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[16] MassDEP's 2009 Antidegradation Implementation Procedures supercedes its 1992 document entitled, "Antidegradation Review Procedure For Discharge Requiring A Permit Under 314 CMR 3.03." Nevertheless, the 1992 document is of interest in that its discussion of the antidegradation protections for ORWs is consistent with the 2009 document, but adds some additional detail regarding the "highest and best practical method of waste treatment" requirement. Specifically, the 1992 document states (at p. 7) that 314 CMR 4.05(3)'s restrictions on existing discharges to ORWs mean:

> … that existing discharges will be connected to POTW's where possible. Where it is not possible, treatment levels higher than those required by the technology-based review may be imposed. The purpose of this higher treatment is to provide the highest water quality possible so that the ORW is at minimal risk of degradation and to insure that water quality remains as close as natural background conditions as possible.

3. To the maximum extent feasible, the discharge and activity are designed and conducted to minimize adverse impacts on water quality, including implementation of source reduction practices; and
4. The discharge will not impair existing water uses and will not result in a level of water quality less than that specified for the Class.

314 CMR 4.04(5)(a)2 – 4.04(5)(a)4. The MassDEP Antidegradation Implementation Procedures, at 6, further state that:

> [i]n connection with an application for permit renewal, at its discretion, the Department may require an existing discharge to an ORW to undergo the authorization process in 314 CMR 4.04. This could be appropriate, for example, where new methods of reuse and conservation of wastewater, alternative methods of production or operation, improved process controls, or improved wastewater treatment facility operation may be available.

Thus, permit requirements for GE Aviation's existing discharges to ORW portions of the Saugus River must comply with the Massachusetts WQS's antidegradation requirements and may require a specific antidegradation authorization from the State.

3. Section 316(a) of the Clean Water Act

Heat is defined as a pollutant under Section 502(6) of the CWA. 33 U.S.C. § 1362(6). As with other pollutants, discharges of heat (or "thermal discharges") generally must satisfy both technology-based standards (specifically, the BAT standard) and any more stringent water quality-based requirements that may apply. State WQS may include numeric temperature criteria, as well as narrative criteria and designated uses, that apply to particular water body classifications and may necessitate restrictions on thermal discharges.

Section 316(a) of the CWA, 33 U.S.C. § 1326(a), provides, however, that thermal discharge limits less stringent than technology-based and/or water quality-based requirements may be authorized if the biological criteria of Section 316(a) are satisfied. The approval of less stringent thermal discharge limits under CWA § 316(a) is referred to as a "Section 316(a) variance." In addition, the Massachusetts SWQS provide that "any determinations concerning thermal discharge limitations in accordance with 33 U.S.C. 1251 § 316(a) will be considered site-specific limitations in compliance with 314 CMR 4.00." *See* 314 CMR 4.05(4)(a)(2)(c) and 4.05(4)(b)(2)(c) (for Class SA and SB waters, respectively).

Thermal discharge variances, and the demonstration that an applicant must make to obtain one, are addressed in CWA § 316(a) and EPA regulations, including those promulgated at 40 CFR §125, Subpart H. In essence, the applicant must demonstrate that the alternative, less stringent effluent limitations it desires, considering the cumulative impact of its thermal discharge together with all other significant impacts on the species affected, will assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the water body receiving the thermal discharge (BIP). *See* 33 U.S.C. § 1326(a); 40 C.F.R. § 125.73(a) and (c)(1)(i). An existing thermal discharger can perform either a predictive or a retrospective analysis in an effort to demonstrate that the protection and propagation of the BIP will be assured despite its proposed thermal discharge variance. If the applicant makes this demonstration to the satisfaction of EPA (or, if appropriate, the State), then the permitting authority may issue the permit with the requested alternative, variance-based thermal discharge limits. Conversely, if the demonstration does not adequately support the requested variance-based thermal discharge limits, then the permitting authority shall deny the requested variance. In that case, the permitting authority shall either impose limits based on the otherwise applicable technology-based and water quality-based requirements or, at its discretion, impose alternative variance-based limits that the permit record demonstrates *will* assure the protection and propagation of the BIP. *See also* Part V.C.8, below, for further discussion of this matter.

4. Requirements for Cooling Water Intake Structures under CWA § 316(b)

As indicated above, technology-based NPDES permit requirements for cooling water intake structures (CWISs) are based on CWA § 316(b), 33 U.S.C. § 1326(b), which requires "that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impact." As with effluent discharge limits, CWIS requirements must also comply with any more stringent conditions that might be necessary to achieve compliance with any applicable State water quality standards. *See* 40 C.F.R. § 125.84(e). The operation of CWISs can cause or contribute to a variety of adverse environmental effects, such (a) as killing or injuring tiny aquatic organisms, including but not limited to fish larvae and eggs, by entraining them in the water withdrawn from a water body and sent through the facility's cooling system (entrainment), and (b) killing or injuring larger organisms, including but not limited to juvenile and adult fish, by impinging them against the intake structure's screens, racks, or other structures (impingement). Section 316(b) applies if the applicant for a discharge permit seeks to withdraw cooling water from a water of the United States.

Therefore, CWA § 316(b) applies to this permit due to the operation of CWISs at the GE Aviation facility. At this time, there are no national categorical standards that are in effect that apply § 316(b) to the CWISs at the GE Aviation facility. As a result, EPA has developed technology-based requirements for the facility's CWISs by applying CWA § 316(b) on a BPJ, site-specific basis. *See* 40 C.F.R. § 125.90(b). EPA's evaluation and determination of the BTA for the Test Cell and Power Plant CWISs are set forth in Attachment J to this fact sheet.

5. Antibacksliding

A permit may not be renewed, reissued or modified with less stringent limitations or conditions than those contained in the previous permit unless in compliance with the anti-backsliding requirements of the CWA [see Sections 402(o) and 303(d)(4) of the CWA and 40 CFR §122.44(l)(1 and 2)]. EPA's antibacksliding provisions prohibit the relaxation of permit limits, standards, and conditions except under certain circumstances. Effluent limits based on BPJ, water quality, and State certification requirements must also meet the antibacksliding provisions found at Section 402(o) and 303(d)(4) of the CWA.

**C. Proposed Permit Effluent Limitations and Conditions**

In the text above, EPA explained in general terms the technology-based and water quality-based requirements of the CWA. In the text below, EPA explains how it has applied these requirements in developing a draft NPDES permit for GE Aviation. As a whole, the draft permit's conditions are based on a combination of technology-based and water quality-based requirements, as well as a CWA § 316(a) variance for thermal discharges.

The discussion below, and the draft permit itself, address dry weather and wet weather pollutant discharges separately, and cover GE Aviation's many discharge outfalls as well as its many different types of pollutant discharges and its withdrawals of river water for cooling uses. Monitoring requirements are also addressed.

1. Drainage System Outfalls (Outfalls 001, 007, 010, 019, 027B, 028, 030, and 031)

a. Requirements during dry weather

The draft permit includes conditions prohibiting dry weather discharges of non-stormwater flows, including contaminated groundwater infiltration, from Drainage System outfalls 001, 007, 010, 019, 027B, 028, 030, and 031. This prohibition is based on both a BPJ application of pertinent technology standards and Massachusetts water quality standards.

Dry weather discharges of non-stormwater flows from the facility through the Drainage System outfalls potentially include process wastewaters and contaminated groundwater infiltration. As detailed above, these non-stormwater flows could include a range of toxic, nonconventional and conventional pollutants. As a result, any such discharges would need to satisfy effluent limitations based on BAT and BCT requirements.

The BAT standard calls for the "best available technology economically achievable … which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants …." 33 U.S.C. § 1311(b)(2)(A). The BCT standard calls for the "best conventional pollutant control technology." *Eliminating* dry weather discharges from these outfalls would clearly satisfy these standards.

Under its Administrative Consent Order (ACO) with MassDEP, GE Aviation designed its Drainage System to "substantially eliminate" dry weather discharges from the above-listed outfalls. To meet this standard, GE Aviation installed equipment enabling it to close these outfalls during dry weather and convey non-stormwater from the Drainage System vaults to the CDTS for treatment prior to discharge through Outfall 027A. GE

Aviation has also lined some Drainage System pipes to minimize the presence of infiltrated contaminated groundwater in the water in the Drainage System pipes and vaults.

In addition, other facilities dealing with the problem of contaminated groundwater infiltration have also eliminated dry weather discharges of untreated wastewater (including contaminated groundwater) by taking steps to prevent or minimize groundwater infiltration, and by installing systems to collect and treat such wastewater prior to discharge. For example, the ConocoPhillips bulk petroleum storage facility in East Boston, MA (NPDES Permit MA0004006), and the Exxon Mobil facility in Boston, MA (NPDES Permit MA0000833), both have installed, or are installing, systems to collect and treat contaminated groundwater and preclude discharges of untreated groundwater during dry weather.

In light of the above, eliminating untreated dry weather pollutant discharges from the listed Drainage System outfalls appears technologically and economically achievable for GE Aviation and would reduce pollutant discharges equivalent to that achieved by the best performing facilities.

EPA has also considered the various BAT and BCT factors specified above and can see no reason that a prohibition on dry weather discharges would not satisfy the BAT and BCT standards. The BAT factors, as discussed above, are as follows:

(i) The age of equipment and facilities involved;
(ii) The process employed;
(iii) The engineering aspects of the application of various control techniques;
(iv) Process changes;
(v) Non-water quality environmental impacts (including energy requirements);
(vi) The cost of achieving such effluent reduction; and
(vii) Such other factors as the Administrator deems appropriate.

The BCT factors, also discussed above, include the first five items listed above, along with the following two factors: (i) "the reasonableness of the relationship between the cost of attaining a reduction in effluent and the effluent reduction benefits derived;" and "the comparison of the cost and level of reduction of such pollutants from the discharge from publicly owned treatment works to the cost and level of reduction of such pollutants from a class or category of industrial sources." 33 U.S.C. § 1314(b)(4)(B); 40 C.F.R. § 125.3(d)(2)(i). Nothing about any of these factors would preclude a prohibition on dry weather discharges from constituting effluent limitations that satisfy the BAT and BCT standards, and GE Aviation should be able to meet such a prohibition with its existing Drainage System (perhaps with certain modifications).

EPA also considered the Massachusetts WQS and concludes that a prohibition on dry weather discharges would satisfy the State's antidegradation requirements, as detailed above.

b. Requirements during wet weather

During wet weather, the Drainage System collects stormwater which is commingled with various types of non-stormwater flows (including contaminated groundwater infiltration). As the water table rises during wet weather, the static pressure of the groundwater surrounding partially filled drain pipes forces groundwater through seams and cracks into the pipes. Therefore, it is expected that a significant (though indeterminate) percentage of discharges from the Drainage System outfalls during wet weather will include infiltrated groundwater (mixed with stormwater and certain other non-stormwater flows). This presents a particular threat of pollution to the Saugus River due to the historical groundwater contamination on site and the lack of treatment at the Drainage System outfalls.

Based on present information, EPA concludes that completely eliminating discharges from the Drainage System outfalls during wet weather does not appear to be technologically achievable at the present time. The overall volume of wastewater in the Drainage System, including stormwater, infiltrated groundwater and various non-stormwater flows, is neither fully quantified nor predictable, and it exceeds the capacity of the pipes and pumps to collect all of it and transfer it to the CDTS for storage and treatment.

Different issues are presented by (a) the stormwater (and *non-stormwater* (*i.e.*, "dry weather") flows typically authorized under the MSGP for discharge along with stormwater), and (b) the remaining non-stormwater flows that may be commingled with the stormwater but are not typically authorized under the MSGP for discharge together with the stormwater. Therefore, these two types of wastewater will be addressed separately below, beginning with the former.

i. Stormwater Discharges (including non-stormwater flows typically authorized under the MSGP for discharge with stormwater)

EPA reviewed the 2008 Multi-Sector General Permit for stormwater discharges from industrial sources (MSGP) for assistance in determining on a BPJ basis technology-based limits for GE Aviation's discharges of stormwater. The MSGP also authorizes the discharge of certain non-stormwater flows together with stormwater that is being discharged in compliance with relevant provisions of the MSGP. The non-stormwater flows are referred to in the MSGP as "allowable non-stormwater discharges," *see* MSGP § 1.1.3, and that phrase will be used here. Allowable non-stormwater flows include the following discharges:

- Discharges from fire-fighting activities;
- Fire hydrant flushings;
- Potable water, including water line flushings;
- Uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gases or liquids;
- Irrigation drainage;

- Landscape watering provided all pesticides, herbicides, and fertilizer have been applied in accordance with the approved labeling;
- Pavement wash waters where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed);
- Routine external building washdown that does not use detergents;
- Uncontaminated ground water or spring water;
- Foundation or footing drains where flows are not contaminated with process materials; and
- Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions of your facility, but not intentional discharges from the cooling tower (e.g., "piped" cooling tower blowdown or drains).

Sector AB of the MSGP (Transportation equipment, industrial or commercial machinery) specifies Stormwater Pollution Prevention Plan (SWPPP) components to regulate the discharge of stormwater, and Sector O of the MSGP (Steam Electric Generating Facilities) also contains SWPPP components, along with a benchmark monitoring concentration of 1.0 mg/L total iron. Since parts of the GE Aviation facility are engaged in the activities covered by these sectors, EPA has included technology-based permit limits for stormwater discharges (and allowable non-stormwater discharges) from these MSGP provisions in the SWPPP requirements of the draft permit. Monitoring for total iron is addressed under Section C.1.b.ii.j. (Metals) of this fact sheet.

ii. Non-Allowable Non-Stormwater Flows commingled with stormwater

As stated above, during wet weather GE Aviation's Drainage System collects and discharges stormwater commingled not only with allowable non-stormwater discharges, but also with other contaminated non-stormwater flows (such as contaminated groundwater infiltration). The draft NPDES permit for the facility sets limits on these "non-allowable non-stormwater flows[17]" that satisfy technology-based and water quality-based requirements.

As stated above, EPA does not currently deem it feasible for GE Aviation to eliminate the discharge of stormwater commingled with both allowable non-stormwater discharges and non-allowable non-stormwater discharges. Moreover, EPA does not currently deem it feasible for GE Aviation to completely eliminate the commingling of the non-allowable non-stormwater discharges with the stormwater. GE Aviation does not currently appear to be able to identify all of the pipes that are connected to and contribute wastewater to the Drainage System vaults. This is the result of the size of the GE Aviation site, the long

[17] Non-allowable non-stormwater flows discharged from this facility consist of contaminated groundwater, cooling water, condensate blowdown, steam conduit blowdown, boiler startup/soot blower drains/boiler draining for maintenance (intermittent), boiler filter backwash, ion exchange regeneration and backwash, de-aerator storage tanks (intermittent), boiler blowdown, building 64-A sump (intermittent), steam conduit water, cooling tower blowdown, stormwater collected in secondary containment dikes and truck loading areas, test cell washdown water (intermittent), hydrant testing, sprinkler system testing water, potable water used upon NCCW system failure, drain cleanouts (including drainage system cleaning), roof mounted air conditioner wash water (no detergent), excavation dewatering, and stormwater dye tracing.

history of industrial activity at the site, the failure to document the location of all the pipes that have been placed on the site, and the subterranean location of the piping. Furthermore, GE Aviation currently appears to be unable to fully eliminate the infiltration of groundwater into Drainage System pipes because (a) all pipes may not have been located, and (b) some may be submerged in the water table under certain conditions, such as when the water table rises due to the effects of stormwater infiltration or high tides. Thus, it may not be possible to undertake pipe lining projects across the entire site to prevent all groundwater infiltration.

While it may not be possible to completely eliminate the wet weather discharge of contaminated non-stormwater discharges commingled with stormwater, EPA concludes that additional steps can and should be taken to further reduce the amount of non-allowable non-stormwater flows discharged in this manner. GE Aviation should be able to further reduce these discharges through some combination of the following available measures (some of which are already used at the facility to some extent):

- isolate contaminated groundwater through storm drain inspection and repair;
- collect and treat contaminated groundwater separately through an alternative groundwater extraction system (such as wells or trenches) and provide treatment prior to discharge to either the Drainage System outfall vaults or the Saugus River;
- treat commingled contaminated groundwater, stormwater, and other wastewater flows prior to their discharge to the receiving water; and/or
- isolate non-allowable non-stormwater discharges through re-piping directly to the CDTS.

EPA is presently unable to determine all the specific steps that should be taken to reduce the non-allowable non-stormwater flows of concern commingled with stormwater. Therefore, EPA has included a narrative condition in the draft permit that calls for GE Aviation to eliminate to the maximum extent practicable the discharge of untreated non-allowable non-stormwater flows (other than allowable non-stormwater discharges) commingled with stormwater.

The draft permit requires implementation of certain Best Management Practices (BMPs) to help achieve the goal specified in the narrative condition. For example, the draft permit has conditions requiring BMPs to maximize the extent to which at least the first flush of stormwater will be transferred to the CDTS for treatment prior to discharge. The first flush of stormwater will mix with non-stormwater flow already accumulated in the Drainage System. As a result, the first flush of wet weather flow is likely to include a relatively substantial proportion of non-stormwater flow and capturing and treating it will help to minimize the discharge of untreated non-stormwater discharges commingled with stormwater. Thus, the draft permit requires that the Drainage System outfall gates open only during wet weather, after the first flush of pollutants has been transferred to the CDTS for treatment. In order to capture a sample representative of the commingled discharge, samples shall be taken during the first 30 minutes of stormwater discharge through the outfall (after the first-flush of stormwater flow is sent to the CDTS).

Additionally, the draft permit requires GE Aviation to develop a Stormwater Pollution Prevention Plan (SWPPP) with site specific BMPs, as required under 40 CFR § 122.44(k)(4), to eliminate, to the maximum extent possible, the discharge of non-allowable non-stormwater flows.

In addition, to the extent that the non-allowable non-stormwater discharges cannot be fully eliminated, the draft permit includes numeric effluent limits and monitoring requirements to address these discharges. These effluent limits and monitoring requirements pertain to the wide range of pollutants that may be present in non-allowable non-stormwater discharges from the Drainage System.

EPA has determined on a BPJ basis that the above combination of permit conditions will satisfy the BAT and BCT technology standards that apply for the control toxic, nonconventional and conventional pollutant discharges. These permit conditions should also satisfy Massachusetts WQS, including various specific numeric criteria (e.g., criteria for oil & grease) and the antidegradation provisions discussed above. In reaching this determination, EPA considered the BAT factors, detailed above, for the toxic and nonconventional pollutants, and the BCT factors, also detailed above, for the conventional pollutants. EPA also considered pollution control measures that have been taken at other facilities dealing with the problem of commingled stormwater and non-stormwater flows (including contaminated groundwater infiltration), as discussed above.

Finally, EPA has also considered the conditions in certain existing NELGs and NPDES permits for similar or analogous facilities or industries that could reasonably inform the development of permit conditions for GE Aviation. For example, EPA has promulgated NELGs for certain pollutants commonly discharged by the Steam Electric Power Generating Point Source Category (Steam Electric NELGs), *see* 40 CFR Part 423, but these NELGs do not strictly apply to the GE Aviation facility.[18] The Steam Electric NELGs are "applicable to discharges resulting from the operation of a generating unit by an establishment *primarily engaged in the generation of electricity* for distribution and sale which results primarily from a process utilizing fossil-type fuel … in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium," 40 C.F.R. § 423.10 (emphasis added). GE Aviation's facility is *not* primarily engaged in the generation of electricity for distribution and sale.

While the Steam Electric NELGs do not directly apply to the GE Aviation facility, EPA has decided on a case-by-case, BPJ basis that it is reasonable to rely in part on the Steam Electric NELGs in developing certain technology-based limits for the GE Aviation facility. This makes sense because the Steam Electric NELGs do not apply to the facility only because it is not "primarily engaged in the generation of electricity for distribution and sale." GE Aviation does, however, operate a steam-electric power plant fired by oil for the production of steam and electricity on this site. In other words, the facility has pollutant "discharges resulting from the operation of a generating unit . . . engaged in the

[18] EPA has not promulgated NELGs for manufacturers of Aircraft Engine and Engine Parts (SIC 3724) and Speed Changers, or of Industrial High-Speed Drives, and Gears (SIC 3566).

generation of electricity . . . which results primarily form a process utilizing fossil-type fuel ... in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium." (In addition, while not primarily engaged in the generation of electricity for distribution and sale, GE Aviation does at times distribute and sell some of the electricity it generates.) As a result, the facility raises largely the same water pollution control issues as facilities that *are* covered by the Steam Electric NELGs.

The Steam Electric NELGs include the following effluent limits based on BPT:

a. for low volume waste sources:
   (1) 100.0 mg/L as a maximum and 30.0 mg/L as a 30-day average for Total Suspended Solids (TSS), and
   (2) 20mg/L as a maximum and 15.0 mg/L as a 30-day average for oil and grease (O&G);
b. for all discharges, except once-through cooling water: 6.0-9.0 SU for pH;
c. for all discharges: no discharge of polychlorinated biphenyl compounds (PCBs); and
d. for once-through cooling water and cooling tower blowdown: 0.5 mg/L as a maximum and 0.2 mg/L as an average for free available chlorine.

Additionally, the NELGs require, based on BAT, that cooling tower blowdown has non-detectable levels of the 126 priority pollutants contained in chemicals added for cooling tower maintenance, except that maximum and average limitations of 0.2 mg/L apply for total chromium, and maximum and average limitations of 1.0 mg/L apply for total zinc. The NELGs state that in the event that waste streams from various sources are combined for treatment or discharge, the quantity of each pollutant attributable to each controlled waste source shall not exceed the specified limitations for that waste source.

The Steam Electric NELGs do not include effluent limitations on the discharge of heat. Therefore, any technology-based thermal discharge limits would be based on a BPJ application of the BAT technology standard, which is applicable to non-conventional pollutants such as heat. (As discussed farther below, however, the permit's thermal discharges limits may, instead, be based on water quality-based requirements or a thermal discharge variance under CWA § 316(a). 33 U.S.C. § 1326(a).

In addition to the Steam Electric NELGs, EPA also considered the Remediation and Miscellaneous Contaminated Sites General Permit (RGP),[19] and its supporting analysis, to assist in determining technology-based limits for the permit because GE Aviation may discharge contaminated groundwater under certain circumstances. The RGP is an appropriate source of information because the groundwater contaminants of concern at GE Aviation are similar to those found in the groundwater at facilities surveyed in development of the RGP. Based on a review of the technology-based and water quality-

[19] In writing this fact sheet, EPA referred to the 2005 RGP and fact sheet. The 2010 RGP, effective September 10, 2010, used the same basis in deriving limits for each of the parameters as the 2005 RGP (*see* Attachment A to the 2010 RGP Fact Sheet for the applicable 2005 RGP Fact Sheet Excerpts: http://www.epa.gov/region1/npdes/remediation/RGP2010_FactSheet_AttachmentA.pdf)

based limits included in the RGP, and other relevant factors, EPA has established BPJ-based effluent limits to address contaminated groundwater at GE Aviation.

c. Flow

While the current permit does not require flow monitoring for wet weather discharges through the Drainage System outfalls, conditions in the draft permit do require monitoring of the daily maximum and monthly average discharge flow during wet weather. Flow shall be estimated daily.

The permittee shall also record the dates and times when an outfall gate is open, along with the corresponding weather conditions at the time of gate opening and during the gate opening, the flow during gate opening, and the time when the gate closes, along with the corresponding weather condition. This information shall be submitted with the DMRs.

Opening of the gates during periods of dry weather is prohibited in the draft permit. The draft permit requires that the gates only open during wet weather, after the first flush of pollutants has been transferred to the CDTS for treatment. The draft permit also requires the permittee to develop and implement site specific BMPs to ensure the gates only open during periods of wet weather, and remain closed during all periods of dry weather.

d. pH

The Massachusetts Water Quality Standards (WQS) (314 CMR 4.05(4)(b)(3)) require that the pH of the receiving water be in the range of 6.5 through 8.5 standard units and not more than 0.2 units outside of the natural background range. The current permit sets a pH limitation range of 6.5 to 8.5 standard units (SU) for each Drainage System Outfall, consistent with State WQS.

Review of DMR data for the time period from October 1998 through October 2008 reveals that the effluent pH for Outfall 001 ranged from 5.3 to 7.9 SU, with five exceedences of the permitted pH limitation. However, during the last four years, the pH limitation range has only been violated on two occasions, with a minimum pH measurement of 5.9 SU. Review of DMR data shows the Outfall 007 pH limitation has been exceeded on four occasions, with the effluent pH ranging from 5.7 – 7.92 SU; the Outfall 010 pH limitation has been exceeded on four occasions, with the effluent pH ranging from 5.9 – 7.93 SU; the Outfall 019 pH limitation has been exceeded on two occasions, with the effluent pH ranging from 5.4 to 8.5 SU; the Outfall 027B pH limitation has been exceeded on one occasion, with the effluent pH ranging from 6.3 – 7.92 SU; the Outfall 028 pH limitation has been exceeded on two occasions, with the effluent pH ranging from 5.8 – 8 SU; the Outfall 030 pH limitation has not been exceeded, with the effluent pH ranging from 6.5 – 7.7 SU; and the Outfall 031 pH limitation has been exceeded on two occasions, with the effluent pH ranging from 6.2 – 7.71 SU.

The permittee has submitted information showing that the pH of precipitation in the vicinity of its facility ranges from 3.6 to 5.3 SU, with a mean pH of 4.44 SU (Page 2-12 of GE Aviation's September 2003 permit application amendment). Based on this new information that was not available at the time of writing the current permit (consistent with antibacksliding exceptions at 40 CFR 122.44(l)(2)(i)(B)(*1*)), EPA has revised the minimum pH limitation range from 6.5 to 6.0 SU. Due to the rapid mixing and neutralization in the Saugus River, EPA believes that the new pH effluent limitation range of 6.0 – 8.5 SU will be protective of the receiving water pH, and will ensure compliance with State WQS, while also satisfying the BCT standard. The new pH limits are also supported by the Steam Electric NELGs, as discussed above.

e. Oil and Grease (O&G)

Massachusetts Water Quality Standards for a Class SB water body (314 CMR 4.05(4)(b)(7)) require that these waters shall be free from oil, grease and petrochemicals (O&G) that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portion of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life. A concentration of oil and grease of 15 mg/L is recognized as a level at which many oils produce a visible sheen.

The current permit requires a monthly average O&G limit of 10 mg/L for each Drainage System Outfall, sampled quarterly during the first 60 minutes of a significant rainstorm event. Review of DMR data for the time period from October 1998 through October 2008 (wet weather sampling) reveals that the monthly average O&G effluent concentration for Outfall 001 has ranged from 5 mg/L to 9 mg/L; for Outfall 007 O&G has ranged from 5 – 8.4 mg/L; for Outfall 010 O&G has ranged from 5 – 8.1 mg/L; for Outfall 019 O&G has ranged from 5 – 10 mg/L; for Outfall 027B O&G has ranged from 5 – 5.2 mg/L; for Outfall 028 O&G has ranged from 0.5 – 5.2 mg/L; for Outfall 030 O&G has ranged from 0.5 – 8.5 mg/L; and for Outfall 031 O&G has ranged from 0.5 – 5.3 mg/L.

The monthly average O&G limit of 10 mg/L shall remain in the permit for each Drainage System outfall, based on anti-backsliding requirements found in 40 CFR §122.44(l). This limit will also satisfy the BAT standard, including Steam Electric NELGs for low volume waste, and State WQS. The draft permit also requires a daily maximum O&G limit of 15 mg/L, consistent with narrative State Water Quality Standards.

f. TSS

Massachusetts WQS (314 CMR 4.05(4)(b)(5)) require that Class SB waters "be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom." Additionally, removing TSS is particularly important to maintaining good operation of subsequent treatment units in the system such as carbon adsorption (e.g., to prevent clogging of pores in the carbon granules) and to aid in the removal of contaminants that are adsorbed to soil particles. Treatment technology for removing TSS is well understood and a properly designed sedimentation and/or filtration system can readily remove TSS to low concentrations. In development of the RGP, EPA considered established effluent limitations from sewage treatment plants, EPA's General Permit for Construction Dewatering, EPA's promulgated NELGs at 40 CFR Part 436 for Mineral Mining, Industrial Sand category, EPA's proposed NELGs for Ore Mining categories, 40 CFR Part 440, standards, and technical factors, and set a technology-based TSS limit of 30 mg/L as a monthly average. The steam electric NELGs include a technology-based maximum daily TSS limit of 100 mg/l and monthly average of 30 mg/l for low volume waste sources (see Section C.b.ii of this fact sheet).

Heavy metals and polynuclear aromatic hydrocarbons (PAHs) are readily adsorbed onto particulate matter and the release of these compounds can be controlled, to an extent, by regulating the amount of suspended solids released into the environment. The collection of stormwater and GE Aviation's storm drain system cleaning procedures, could result in periods of elevated solids concentrations.

Sampling results of one wet weather event submitted by the permittee revealed TSS concentrations of 32 mg/L at Outfall 001; of non-detect (ND) at Outfall 007; of ND at Outfall 010; of 45 mg/L at Outfall 019; of 54 mg/L at Outfall 027B; of 7.5 mg/L at Outfall 028; of 39 mg/L at Outfall 030; and of ND at Outfall 031.[20] Sampling results of non-stormwater flows in the Outfall 001 vault[21] (which may commingle with the first flush of stormwater flows for direct discharge to the receiving water during wet weather) indicated a TSS concentration at the Outfall 001 vault of 41.6 mg/L.

Therefore, to assure that the State narrative standard regarding floating solids is maintained, the draft permit requires a maximum daily effluent limitation for TSS of 100 mg/L and an average monthly effluent limitation of 30 mg/L for the wet weather discharge from the Drainage System Outfalls. The draft permit also prohibits the discharge of drainage system cleaning water through the Drainage System Outfalls and contains a site specific BMP requiring proper disposal of solid waste from drainage system cleaning off-site and to minimize the amount of solids that are left behind in the drain lines.

g. Volatile Organic Compounds, Benzene, Toluene, Ethylbenzene, and Xylene

Groundwater contaminant monitoring data indicate that a variety of chemical contaminants are likely to be present in the groundwater. These chemicals could be present in discharges from the Drainage System outfalls to the extent that such discharges include groundwater infiltration. The data suggests that contaminants of concern include a range of volatile organic compounds (VOCs), including a variety of petroleum products (presumably present as a result of past spills of fuel and other materials).

[20] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

[21] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.

GE Aviation reported that VOCs historically detected in dry weather samples for Outfalls 007, 010, 027, 028, and 031 are likely associated with groundwater infiltration. Review of data submitted by GE Aviation indicates the presence of VOCs in stormwater discharges, with a total VOC concentration of 6.8 ug/L at Outfall 001; of 39 ug/L at Outfall 007; of 1 ug/L at Outfall 010; of 2 ug/L at Outfall 019; of 112.9 ug/L at Outfall 027; of 109 ug/L at Outfall 028; of 1176.4 ug/L at Outfall 030; of 483 ug/L at Outfall 031; and of 5.9 ug/L at Outfall 032.[22] Sampling of the non-stormwater flows in the Drainage System outfall vaults (which are expected to commingle with the first flush of stormwater flows during wet weather) indicates the presence of VOCs at Outfalls 001, 007, 030, and 031,[23] and a vinyl chloride concentration at the Outfall 007 vault of 2.6 ug/L.[24]

The following VOCs have been detected in the groundwater onsite:

> Acetone, benzene, bromodichloromethane, bromoform, bromomethane, 2-butanone, carbon disulfide, carbon tetrachloride (tetrachloromethane), chlorobenzene, chloroethane, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethane, 1,2-dichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,4-dioxane, dichlorodifluoromethane, ethylbenzene, ethylether, 2-hexanone, isopropylbenzene, 4-methyl-2-pentanone, methylene chloride, methyltertbutylether naphthalene, n-butylbenzene, n-propylbenzene, p-cymene, sec-butyl benzene, tert-butyl benzene, tert-amyl methyl ether, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trimethylbenzene, 1,2,4-trichlorobenzene, 1,3,5-trimethylbenzene, tetrachloroethene, toluene, trichloroethene, trichlorofluoromethane, vinyl chloride, m-xylene, m/p-xylene, o-xylene, total xylenes.[25, 26]

VOCs such as benzene, toluene, ethylbenzene, and the three xylene compounds (BTEX), are normally found at relatively high concentrations in gasoline and light distillate products (e.g., diesel fuel). BTEX concentrations typically decrease in the heavier grades of petroleum distillate products (e.g., fuel oils).

Refined petroleum products contain numerous types of hydrocarbons. Individual components partition to environmental media on the basis of their physical/chemical properties (e.g., solubility, vapor pressure). Rather than attempt to establish effluent limits for every compound found in a petroleum release, limits are typically established for the compounds that would be most difficult to remove and that are most toxic. Generally, the higher the solubility of a VOC in water, the more difficult it is to remove.

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[22] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

[23] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.

[24] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.

[25] NPDES Permit Renewal Application Revision, May 2000.

[26] E-mail correspondence from Steven Lewis (GE Aviation) to Nicole Kowalski (EPA), March 25, 2009, Attachment: Complete list of constituents that have been detected in the groundwater at the site.

The traditional approach for limiting effluents contaminated with gasoline or other light distillates is to place limits on the individual BTEX compounds and/or the sum of total BTEX compounds. Since many petroleum spills involve gasoline or diesel fuel, a traditional approach for such spills has been to place limits on the individual BTEX components and/or the sum of total BTEX compounds. Of these four compounds, benzene has the highest solubility, is one of the most toxic constituents, and is found at relatively high concentrations in gasoline and diesel fuel. The concentration of benzene in gasoline is approximately 20,000 parts per million (Potter and Simmons, 1998). For the reasons mentioned above, benzene can be considered one of the most important limiting pollutant parameters found in gasoline or diesel fuel. Building on this premise, benzene can be used as an indicator-parameter for regulatory as well as characterization purposes of stormwater that comes in contact with gasoline and diesel fuel. The primary advantage of using an indicator-parameter is that it can streamline monitoring efforts while simultaneously maintaining an effective level of environmental protection.

To establish effluent limitations for VOCs in the RGP, EPA evaluated both the technology and water quality-based information currently available. EPA reviewed monitoring reports submitted pursuant to approved groundwater site remediation projects in MA, as well as published technology information, and various water quality and cleanup standards published by EPA and the States. In general, the technology-based effluent limitations in the RGP are sufficient to meet the most conservative water quality standards, which are typically human health-based standards.

Specifically, the RGP contains BAT technology-based effluent limits of 100 ug/L for BTEX and 5.0 ug/L for benzene. In development of the RGP, EPA analyzed facilities with groundwater contamination situations similar to GE Aviation. The factors in the RGP analysis are comparable to the factors relevant to this individual permit; therefore, EPA is using similar logic to apply these technology-based limits to wet weather discharges through the Drainage System Outfalls because they are likely to include contaminated groundwater (albeit commingled with stormwater). (As detailed above, dry weather discharges from the Drainage System Outfalls are prohibited.)

Therefore, consistent with the RGP and individual permit effluent limits for contaminated groundwater discharges and combined discharges at similar facilities in Massachusetts, EPA has on a BPJ basis established BAT limits for benzene of 5.0 ug/L and total BTEX of 100 μg/L in wet weather discharges from the Drainage System outfalls. The draft permit also requires reporting without limits of toluene, ethylbenzene, and total xylenes. The technology limits are based on treatability using carbon adsorption, a proven technology capable of removing benzene and other petroleum hydrocarbons from water. As indicated above, however, GE Aviation may also be able to meet these limits during wet weather at the drainage system outfalls by taking steps to prevent or reduce contaminated groundwater infiltration into the Drainage System.

Additionally, the RGP contains the following effluent limits (max daily) for Chlorinated VOCs:

**Table 1. Effluent Limits for Chlorinated VOCs**

| Parameter | Maximum Value (ug/L) |
|---|---|
| 15. Carbon Tetrachloride | 4.4 |
| 16. 1,4 (or p)-Dichlorobenzene (p-DCB) | 5.0 |
| 17. 1,2 (or o)-Dichlorobenzene (o-DCB) | 600 |
| 18. 1,3 (or m)-Dichlorobenzene (m-DCB) | 320 |
| 19. 1,1 Dichloroethane (DCA) | 70 |
| 20. 1,2 Dichloroethane (DCA) | 5.0 |
| 21. 1,1 Dichloroethylene (DCE) | 3.2 |
| 22. cis-1,2 Dichloroethylene (DCE) | 70 |
| 23. Dichloromethane (methylene chloride) | 4.6 |
| 24. Tetrachloroethylene (PCE) | 5.0 |
| 25. 1,1,1 Trichloroethane (TCA) | 200 |
| 26. 1,1,2 Trichloroethane (TCA) | 5.0 |
| 27. Trichloroethylene (TCE) | 5.0 |
| 28. Chloroethene (Vinyl Chloride) | 2.0 |

The anticipated methods for removing benzene and BTEX are the same for removal of chlorinated VOCs (i.e., carbon adsorption treatment or various methods of reducing or preventing groundwater infiltration to the Drainage System); therefore, steps taken to meet the benzene and BTEX limits should also reduce the chlorinated VOCs to levels meeting the BAT standard. Therefore, the draft permit only requires monitoring at the Drainage System outfalls for each of the chlorinated VOCs listed directly above (*see* Table 1). The draft permit shall also require reporting of the total VOCs at the Drainage System Outfalls.

Finally, the draft permit also requires development and implementation of site-specific BMPs, including the elimination to the maximum extent practicable of non-allowable non-stormwater flows through the Drainage System outfalls (*see* the SWPPP, Part V.C.10 of the fact sheet and Part I.B.9 of the draft permit.) The monitoring data collected will help to determine the degree to which the BMPs have been successful at reducing the potential for non-allowable non-stormwater flows and contaminated groundwater infiltration to commingle with stormwater prior to discharge to the receiving water.

h. Cyanide

Compounds containing the cyanide group (CN) are used and readily formed in many industrial processes and can be found in a variety of effluents, such as those from the steel, petroleum, plastics, synthetic fibers, metal plating, and chemical industries. Cyanide occurs in water in many forms, including: hydrocyanic acid (HCN), the cyanide ion ($CN^-$), simple cyanides, metallocyanide complexes, and in organic compounds. "Free cyanide" is defined as the sum of the cyanide present as HCN and $CN^-$. The relative concentrations of these forms depend mainly on pH and temperature.

Both HCN and $CN^-$ are toxic to aquatic life. However, the vast majority of free cyanide usually exists as the more toxic HCN. And, since $CN^-$ readily converts to HCN at pH values that commonly exist in surface waters, EPA's cyanide criteria are stated in terms of free cyanide expressed as $CN^-$. Free cyanide is a more reliable index of toxicity to aquatic life than total cyanide because total cyanides can include nitriles (organic cyanides) and relatively stable metallocyanide complexes.

EPA's national water quality criteria for cyanide in saltwater is 1.0 ug/L (acute and chronic). As previously discussed in Section B.2 of this fact sheet (Water Quality-based Requirements), EPA has conservatively assumed no dilution of the effluent in the receiving water. Wet weather sampling results for Outfall 001 revealed cyanide at a concentration of 15 ug/L, which exceeds the water-quality based limit of 1.0 ug/L.[27] Wet weather sampling results for the other Drainage System Outfalls indicates non-detect for cyanide. Since the concentration of cyanide at Outfall 001 exceeded the water quality-based limit for cyanide, the draft permit requires a maximum daily water quality-based effluent limit of 1.0 ug/L for the discharge through Outfall 001.[28] Additionally, the other Drainage System Outfalls shall be monitored for total cyanide.

Limits for cyanide are based on EPA's water quality criteria expressed as micrograms (ug/L) of free cyanide per liter. There is currently no EPA approved method for free cyanide. Therefore, total cyanide must be reported. Although the effluent limit for cyanide is 1.0 ug/L, the compliance limit is equal to the minimum level (ML) of the test method (i.e., 10 ug/L for Method 335.4).

The development of the cyanide water quality-based effluent limit in the RGP (1.0 ug/L for saltwater), under which EPA analyzed facilities similar to GE Aviation, supports this effluent limitation determination. The factors assessed in the RGP analysis are comparable to the factors considered for this individual permit; therefore, EPA is using similar logic to support applying the saltwater cyanide limit established in the RGP to the discharge through Outfall 001 (stormwater commingled with contaminated groundwater).

Additionally, the draft permit requires development and implementation of site-specific BMPs, including elimination to the maximum extent practicable of non-allowable non-stormwater flows through the Drainage System Outfalls (*see* the SWPPP, Part I.B.9.b of the draft permit.)

i. Total Residual Chlorine (TRC)

The permittee performs periodic cleaning of the Drainage System and currently discharges the water associated with the cleaning through the corresponding Drainage System Outfall location. Potable water, which is expected to contain chlorine, is used for the cleaning. As a result, chlorine could be present in the discharge from the Drainage System outfalls if water associated with the cleaning process is discharged.

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[27] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

[28] USEPA, Technical Support Document for Water Quality-based Toxics Control, p. 49.

The draft permit, however, prohibits the discharge of drain system cleaning water directly to the receiving water. All drain system cleaning water must be transferred offsite or to the CDTS for treatment. This requirement satisfies both the BAT standard and State WQS.

In addition to drain system cleaning, the facility also uses potable water (which could contain chlorine) throughout the plant for small NCCW operations, which discharge through Outfalls 001, 007, 027B, 028, and 030.

EPA's national water quality criteria for TRC in saltwater is 13 ug/L (acute) and 7.5 ug/L (chronic). As previously discussed above, EPA has conservatively assumed no dilution. The RGP sets effluent limits based on the EPA recommended water quality criteria of 7.5 ug/L for saltwater (chronic).

Sampling results of non-stormwater flows in the Drainage System outfall vaults[29] indicate TRC concentrations in the vaults at Outfalls 007, 019, 027, 028, 030, and 031 greater than 13 ug/L, the acute water quality criterion. This non-stormwater flow in the Drainage System vaults is expected to commingle with the first flush of stormwater flows. While this wastewater is currently discharged directly to the Saugus River, the draft permit calls for implementation of BMPs to prevent the discharge of the first flush of stormwater (commingled with various non-allowable non-stormwater flows) and, instead, to transfer it to the CDTS for treatment. Wet weather flows at the Drainage System outfall vaults have not been analyzed for TRC.

The draft permit requires development and implementation of site-specific BMPs, including elimination to the maximum extent practicable of non-allowable non-stormwater flows through the Drainage System outfalls (*see* the SWPPP, Part V.C.10 of the fact sheet and Part I.B.9 of the draft permit.) The draft permit also requires monthly monitoring of the monthly average and daily maximum TRC levels at the Drainage System outfalls. The results of monitoring will be useful in evaluating the effectiveness of the site-specific BMPs, which prohibit drain system cleaning during wet weather conditions and prior to periods of forecasted wet weather conditions, and require prevention of commingling of drainage system cleaning water with stormwater for discharge through the Drainage System outfalls. The monitoring will also be useful in evaluating the effectiveness of the BMPs at eliminating the discharge of non-allowable non-stormwater flows (specifically, potable NCCW) from the Drainage System outfalls.

j. Metals

Wet weather sampling results submitted by the permittee reveal elevated levels of metals in the discharges from several Drainage System Outfalls. [30]

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[29] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[30] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

Specifically, the wet weather discharge through Outfall 001 has contained elevated levels of metals that exceed EPA's National Water Quality Criteria for cadmium, copper, lead, and zinc. Sampling results of non-stormwater flows in the Outfall 001 vault[31] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels of antimony, copper, iron, and zinc.

The wet weather discharge through Outfall 007 has contained elevated levels of metals that exceed National Water Quality Criteria for cadmium and copper. Sampling results of non-stormwater flows in the Outfall 007 vault[32] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels of copper and iron.

The wet weather discharge through Outfall 010 has contained elevated levels of metals that exceed National Water Quality Criteria for cadmium, copper, lead, and silver. Sampling results of non-stormwater flows in the Outfall 010 vault[33] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels of copper, iron, and nickel.

The wet weather discharge through Outfall 019 has contained elevated levels of metals that exceed National Water Quality Criteria for cadmium, copper, lead, silver, and zinc. Sampling results of non-stormwater flows in the Outfall 019 vault[34] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels of copper and nickel.

The wet weather discharge through Outfall 027B has contained elevated levels of metals, which exceed National Water Quality Criteria for cadmium, copper, lead, silver, and zinc.

The wet weather discharge through Outfall 028 has contained elevated levels of metals, which exceed National Water Quality Criteria for cadmium, copper, lead, silver, and zinc. Sampling results of non-stormwater flows in the Outfall 028 vault[35] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels antimony, copper, iron, lead, nickel, and zinc.

The wet weather discharge through Outfall 030 has contained elevated levels of metals, which exceed National Water Quality Criteria for copper, lead, and zinc. Sampling results of non-stormwater flows in the Outfall 030 vault[36] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels of copper, iron, and lead.

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[31] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[32] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[33] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[34] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[35] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[36] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.

The wet weather discharge through Outfall 031 has contained elevated levels of metals, which exceed National Water Quality Criteria for cadmium and copper. Sampling results of non-stormwater flows in the Outfall 031 vault[37] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate elevated levels of copper, iron, nickel, and zinc.

The draft permit prohibits non-stormwater discharges from the Drainage System outfalls, and requires implementation of site-specific BMPs to eliminate to the maximum extent practicable the discharge of non-allowable non-stormwater flows (commingled with stormwater) from the Drainage System outfalls. EPA has determined that this combination of permit requirements should either eliminate, or reduce as much as possible, the discharge of untreated metals from the Drainage System outfalls and should, therefore, satisfy the BAT technology standard and State WQS, including antidegradation requirements.

Therefore, the draft permit calls for monitoring of the metals which have been detected at elevated concentrations in the Drainage System outfalls. The draft permit requires monitoring of the Drainage System outfalls for antimony, cadmium, copper, iron, lead, nickel, silver, and zinc, all monitored at a frequency of 1/month. These monitoring requirements are for wet weather discharges, since discharge during dry weather conditions through the Drainage System outfalls is prohibited in the draft permit. The monitoring results may be used to determine whether the the site-specific BMPs have been effective at eliminating commingling of non-allowable non-stormwater flows and groundwater infiltration containing metals with wet weather flows prior to discharge to the receiving water. If toxic levels of metals continue to be discharged to the Saugus River after the implementation of the BMPs, further steps may be required to eliminate toxic discharges.

k. Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of chemicals formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. There are more than 100 different PAHs. PAHs generally occur as complex mixtures (for example, as part of combustion products such as soot), not as single compounds. A few PAHs are used in medicines and to make dyes, plastics, and pesticides, whereas others are contained in asphalt used in road construction and in substances such as crude oil, coal, coal tar pitch, creosote, and roofing tar.

PAHs are found throughout the environment in the air, water, and soil. They can occur in the air attached to dust particles, or in the soil or sediment as solids.[38]

PAHs can enter surface water through discharges from industrial plants and wastewater treatment plants, and they can be released to soils at hazardous waste sites if they escape

[37] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.
[38] Agency for Toxics Substances and Disease Registry (ATSDR), 1995, *Toxicological Profile for Polycyclic Aromatic Hydrocarbons* (PB/95/264370), August 1995.

from storage containers. The movement of PAHs in the environment depends on various properties, such as how easily they dissolve in water or evaporate into the air. PAHs in general do not easily dissolve in water and may be present in air as vapors or adhered to the surfaces of small solid particles. Some PAHs evaporate into the atmosphere from surface waters, but most stick to solid particles and settle to the bottoms of rivers or lakes. PAHs can also bio-accumulate in fish and shellfish.

There are sixteen (16) PAH compounds identified as priority pollutants under the CWA (*See* 40 CFR Part 423 - Appendix A). "Group I" PAHs are the following seven carcinogens: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. "Group II" PAHs are the following nine priority pollutant PAHs, which are not considered carcinogenic alone but can enhance or inhibit the response of the carcinogenic PAHs: acenaphthene, acenaphthylene, anthracene, benzo(ghi)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. Typically, PAH exposure would be to a mixture of PAHs rather than to an individual PAH.

EPA's National Recommended Water Quality Criteria include human health criteria of 0.0038 ug/L (water + organism) and 0.018 ug/L (organism only) for each individual Group I PAH. As previously discussed above, EPA has conservatively assumed no dilution.

The RGP establishes a water quality-based effluent limit of 0.0038 ug/L for each individual Group I PAH compound, with the compliance limit equal to the ML of the test method used. The RGP was developed based on analysis of facilities with groundwater contamination situations similar to GE Aviation; therefore, the factors in the RGP analysis are comparable to the factors in this individual permit.

Sampling results of non-stormwater flows in the Drainage System Outfall vaults[39] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicate PAH concentrations at the vaults for Outfalls 001, 007, 010, 019, 028, and 031 greater than both the National Recommended Water Quality Criteria human health criteria of 0.0038 ug/L and 0.018 ug/L. Specifically, high levels of indeno(1,2,3-cd)pyrene for Outfalls 001; high levels of dibenzo(a,h)antracene for Outfalls 001; high levels of benzo(k)fluoranthene for Outfalls 019 and 028; and high levels of benzo(b)fluoranthene at Outfall 028. The draft permit prohibits discharges during dry weather conditions from the Drainage System outfalls.

Wet weather flows at the Drainage System outfall vaults have not been analyzed for PAHs. Therefore, the draft permit requires development and implementation of site-specific BMPs, including the elimination to the maximum extent practicable of non-allowable non-stormwater flows through the Drainage System Outfalls (*see* the SWPPP, Part I.B.9.b of the draft permit). The draft permit also requires monthly monitoring for each individual Group I PAH, along with reporting of total PAHs, at each Drainage System Outfall. The results of monitoring will be useful in evaluating the extent to which

[39] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.

the BMPs have been effective at eliminating the discharge of PAHs with stormwater discharges (commingled with non-allowable non-stormwater flows) from the Drainage System outfalls. EPA has determined that these permit limits will satisfy the BAT standard and State WQS.

l. Polychlorinated Biphenyls (PCBs)

EPA's National Recommended Water Quality Criteria require a saltwater criterion continuous concentration (CCC) for PCBs of 0.03 ug/L, measured as total PCBs, as well as a human health criterion of 0.00064 ug/L (organism + water and organism only). For this draft permit, EPA has conservatively assumed no dilution in evaluating the water quality-based criteria, as previously discussed above.

In setting the effluent limits for PCBs in the RGP, EPA-NE took into consideration the toxicity, persistence and potential for bio-accumulation of PCBs in the environment. Therefore, the RGP requires an effluent limitation for total PCBs based on the current human health criterion of 0.000064 ug/L, with the compliance limit equal to the minimum level (ML) of the test method used. The development of this effluent limit in the RGP is based on past performance data for control technology. EPA anticipates that discharges containing PCBs can adequately be treated to "non-detection" levels using carbon adsorption.

Sampling results of one wet weather discharge event through each Drainage System Outfall vault indicated non-detect for total PCBs.[40] However, sampling results of non-stormwater flows in the Drainage System outfall vaults[41] (which are expected to commingle with the first flush of stormwater flows during wet weather) indicated a PCB concentration at the Outfall 001 vault of 0.11 ug/L, which is greater than EPA's National Recommended Water Quality Criteria (saltwater CCC) for PCBs of 0.03 ug/L.

Therefore, the draft permit prohibits discharges during dry weather conditions from the Drainage System outfalls and requires development and implementation of site-specific BMPs, including elimination to the maximum extent practicable of non-allowable non-stormwater flows through the Drainage System outfalls (*see* the SWPPP, Part I.B.9.b of the draft permit). The draft permit also requires monthly monitoring of total PCBs at the Drainage System outfalls, to help determine the effectiveness of the BMPs at eliminating the commingling of non-allowable non-stormwater flows with stormwater for direct discharge to the receiving water through the Drainage System outfalls. EPA has determined that the requirements in the draft permit will satisfy the BAT standard and State water quality standards.

m. Whole Effluent Toxicity Testing Requirements

[40] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

[41] *Response to Request for Information, Section 308(a) of the Clean Water Act (CWA)*, July 10, 2009.

Section 101(a)(3), 33 U.S.C. § 1251(a)(3), declares that "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." EPA's Technical Support Document for Water Quality-Based Toxics Control, March 1991, EPA/505/2-90-001, recommends using an "integrated strategy" containing both pollutant- specific (chemical) approaches and whole effluent (biological) toxicity approaches to better detect toxics in effluent discharges. Pollutant-specific approaches, such as those in EPA's Gold Book (ambient water quality criteria) and State regulations, address individual chemicals, whereas whole effluent toxicity (WET) approaches evaluate interactions between pollutants (e.g., the "additive" and/or "synergistic" effects of pollutants), and can reveal the possible presence of unidentified pollutants. Region 1 adopted this "integrated strategy" on July 1, 1991, for use in permit development and applies it to protect aquatic life and human health in a manner that is cost-effective as well as environmentally protective.

Beyond the national policy of prohibiting the discharge of toxic pollutants in toxic amounts as declared in CWA § 101(a)(3), additional legal authority supports the imposition of toxicity testing requirements in NPDES permits. Sections 402(a)(2) and 308(a) of the CWA provide EPA and States with the authority to require a permittee to collect and submit toxicity testing data. Furthermore, Section 308(a)(A)(iii) of the statute specifies that EPA may require the application of biological monitoring methods where appropriate. At the same time, the Massachusetts Surface Water Quality Standards include the following narrative criterion for toxicity applicable to all the State's waters: "All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife." 314 CMR 4.05(5)(e). The WQS also specify that:

> [f]or pollutants not otherwise listed in 314 CMR 4.00, the *National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002* published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher.

*Id.* Section 301(b)(1)(C) of the CWA, in turn, specifies that discharges must meet effluent limits needed to satisfy applicable State WQS. In addition, it is common knowledge that point sources (including stormwater or groundwater) can contribute toxic pollutants to receiving waters. These pollutants can include metals, chlorinated solvents, PAHs and others. Furthermore, as discussed above, wastewater at GE Aviation (which can include contaminated groundwater) has been shown to contain toxic contaminants. In light of all this, the Region has included toxicity monitoring requirements in the draft permit.

Based on the possibility of toxicity resulting from both stormwater and groundwater in this case, the draft permit includes acute and chronic toxicity monitoring requirements. (See Policy for the Development of Water Quality-Based Permit Limitations for Toxic

Pollutants,50 Fed. Reg. 30,784 (July 24, 1985); EPA's *Technical Support Document for Water Quality-Based Toxics Control* on September, 1991; and MassDEP's Implementation Policy for the Control of Toxic Pollutants in Surface Waters (February 23, 1990).

The draft permit requires that the permittee conduct quarterly marine chronic (and modified acute) WET tests for each Drainage System Outfall. The chronic test may be used to calculate the acute $LC_{50}$ at a 48-hour exposure interval. The permittee shall test the marine species Inland silverside, *Menidia beryllina* and the Sea Urchin, *Arbacia punctulata*. Toxicity test samples shall be collected and tests completed during the calendar quarters ending March 31st, June 30th, September 30th, and December 31st each year. Toxicity test results are to be submitted by the 15th day of the month following the end of the quarter sampled. The tests must be performed in accordance with test procedures and protocols specified in Attachment 1 of the permit.

After submitting one year and a minimum of four consecutive sets of WET test results, all of which demonstrate no toxicity, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from EPA that the WET testing requirement has been changed.

2. Outfall 027A – Consolidated Drains Treatment System – treated non-stormwater flows and first flush of stormwater from Drainage System Outfalls

As explained earlier, the Consolidated Drains Treatment System (CDTS) is a collection and treatment system designed to eliminate the discharge of untreated non-stormwater flow, including groundwater infiltration, and to reduce the discharge of untreated infiltration during wet weather from the following seven existing storm drains: Outfalls 001, 007, 010, 019, 028, 030 and 031. In February 1999, MassDEP issued GE Aviation an ACO approving construction and operation of the CDTS.

The CDTS uses a combination of treatment steps. The contract operator of the CDTS determines the level of treatment based on the applicable permit limits and the quality of the non-stormwater flow or stormwater being treated at the time. The CDTS has two 450,000-gallon underground tanks that act as receiving, storage, and equalization tanks for the treatment system. These tanks provide initial phase separation, since the working volume in the tanks consists of the center volume (above any solids in the layer at the bottom of the tank, and below the light phase layer). On an annual basis, the equalization tanks are pumped down, cleaned, and inspected. The CDTS also has a dissolved air flotation (DAF) system. The DAF system doses influent with polymer and flocculent and micro bubble injection is used to float the suspended solids and the lighter O&G. Floating solids are then removed and directed to the waste storage tank. Finally, the CDTS also has carbon adsorption; specifically, a granulated activated carbon (GAC) system. When the GAC system is in use, treated or untreated process water is piped to two GAC canisters in series. This polishing step is capable of removing trace concentrations of organics. Process control and monitoring samples/readings are taken at transition points between process steps to track treatment results and enable the facility to maximize final effluent quality.

Along with the treated, combined non-stormwater flows, this outfall also discharges separate wet weather flows (without treatment) directly to the receiving water, similar to the other drainage system outfalls. Therefore, the draft permit includes two separate monitoring requirements for this outfall, one for treated non-stormwater flows, Outfall 027A (discussed directly below), and one for stormwater, Outfall 027B (discussed above in the Drainage System Outfalls section).

Outfall 027A discharges treated non-stormwater flows mixed with the first flush of stormwater from Outfalls 001, 007, 010, 019, 027, and 028, 030, and 031.

Non-stormwater flows originating in the Outfall 007 portion of the Drainage System (consisting of dynamometer NCCW, groundwater, condensate from steam heating and air conditioning systems, steam conduit water, emergency NCCW, and infiltrated groundwater) collect in the outfall vault and are directed to the CDTS for treatment. Non-stormwater flows originating in the Outfall 001 portion of the Drainage System (consisting of NCCW, referred to as "bypass overflows from dynamometers," and infiltrated groundwater) collect in the Outfall 001 vault and are pumped to the vault at Outfall 007, where they commingle with Outfall 007 non-stormwater flows for transfer to the CDTS.

Non-stormwater weather flows from the Outfall 010 portion of the Drainage System consist of condensate from steam heating and air conditioning systems, NCCW from industrial heat exchangers, and infiltrated groundwater.

Non-stormwater flows from the Outfall 019 portion of the Drainage System consist of steam condensate return from steam users, emergency steam condensate from small engine component testing, boiler filter backwash, ion exchange regeneration and backwash, condensate from steam heating and air conditioning systems, and infiltrated groundwater.

Non-stormwater flows originating in the Outfall 030 and Outfall 028 portions of the Drainage System consist of NCCW from heat exchangers and steam condensate and emergency NCCW from the Nitriding/Carburizing process, respectively, along with infiltrated groundwater. Non-stormwater flows originating in the Outfall 028 portion of the Drainage System collect in the Outfall 028 vault and are pumped to the vault at Outfall 030, where they commingle with Outfall 030 non-stormwater flows. The combined flows are then transferred to the CDTS for treatment.

Non-stormwater flows from the Outfall 031 portion of the Drainage System consist of steam conduit discharge, cooling tower blowdown, test cell washdown water, condensate from air receivers, and infiltrated groundwater.

Non-stormwater flow from the Outfall 027 drainage area consists of Building 64-A sump discharges, steam condensate return from steam users, oil cooler non-contact cooling water, air vacuum non-contact cooling water, steam conduit water, cooling tower blowdown, stormwater collected in secondary containment dikes and truck loading areas, and infiltrated groundwater. These flows are combined with flow from other outfalls in the equalization tank for treatment in the CDTS.

The draft permit requires development and implementation of BMPs to operate the Drainage System Outfall vault system to capture the first-flush of stormwater which flows through the Drainage System Outfalls for transfer and subsequent treatment in the CDTS. Therefore, the first-flush of stormwater is also expected to be discharged (along with the treated non-allowable non-stormwater flows) through Outfall 027A, after treatment in the CDTS. The BMPs include 1) evaluating the possibility of increasing the treatment capacity of the CDTS so that it is capable of treating commingled non-allowable non-stormwater flows (including contaminated groundwater) and the first-flush of stormwater flow (first 30 minutes of discharge) and 2) evaluating the feasibility of operating the Drainage System Outfall vault gates so that they remain closed when the water reaches the high-high level in the vault, and the pumps continue to transfer the water to the CDTS for treatment, to the maximum extent practicable.

The draft permit includes effluent limits, and associated monitoring requirements, based on the treatment capabilities of the CDTS (with an optimized combination of DAF and carbon adsorption) and State WQS. EPA has determined that these permit requirements will satisfy the BAT and BCT technology standards, as applicable, as well as State WQS.

a. Flow

The current permit includes a monthly average discharge flow limit of 0.3 MGD and a daily maximum flow limit of 0.83 MGD. These limits were based, however, on flow through former Outfall 027D, which consisted of stormwater runoff (from roof and yard drains), steam condensate, oil coolers, and floor drains. Under the draft permit, flow through this outfall consists of non-stormwater flows and first-flush of stormwater combined from multiple outfalls and treated in the CDTS prior to discharge through Outfall 027A.

Based on this re-routing of the non-stormwater flows from various outfalls for treatment in the CDTS and discharge through Outfall 027A, and the draft permit BMP requirement to increase the treatment capacity of the CDTS and applicable pumping capacity so that it is capable of treating commingled non-stormwater flows and the first-flush of stormwater flow, the draft permit shall require reporting only of the monthly average flow and maximum daily flow. Additionally, the draft permit requires that the flow through Outfall 027A shall not exceed the design capacity of the treatment system. The current design capacity is 500 gpm (0.72 MGD) as a maximum and 300 gpm (0.43 MGD) as an average, based on the pumping capacity from the equalization tanks.

EPA concludes that the new flow scheme for Outfall 027A represents a material and substantial change in the circumstances underlying this permit limit, and that this change justifies the requested new limit. As a result, the removal of the flow limit would not violate the CWA's anti-backsliding requirements. *See* 33 U.S.C. §§ 1342(o)(1) and (o)(2)(A); 40 CFR §§ 122.44(l)(2) and 122.62(a)(1). *See also* 33 U.S.C. § 1313(d)(4).

b. pH

The current permit imposes a pH effluent limit of 6.5 – 8.5 SU consistent with Massachusetts WQS. Review of DMR data for former Outfall 027D reveals that the pH effluent limit has been violated on only one occasion, with a range of 6.4 – 7.8 SU. The draft permit retains the pH limit of 6.5 – 8.5 SU, based on State WQS and anti-backsliding requirements found in 40 CFR §122.44(l).

c. Oil and Grease (O&G)

Massachusetts Water Quality Standards for a Class SB water body (314 CMR 4.05(4)(b)(7)) require that these waters shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portion of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life. A concentration of oil and grease of 15 mg/L is recognized as a level at which many oils produce a visible sheen.

The current permit includes a monthly average O&G limit of 10 mg/L, and a daily maximum limit of 15 mg/L, for former Outfall 027D. Review of DMR data reveals that the O&G limit has not been exceeded. The monthly average O&G has ranged from 4 – 6.2 mg/L and the daily maximum O&G has ranged from 5 – 12.7 mg/L. The draft permit retains the monthly average O&G limit of 10 mg/L from the existing permit, based on anti-backsliding requirements found in 40 CFR §122.44(l), and also retains the daily maximum limit of 15 mg/L, consistent with narrative State Water Quality Standards.

d. TSS

Massachusetts Water Quality Standards (314 CMR 4.05(4)(b)(5)) require that Class SB waters "be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom."

Additionally, a TSS limit is particularly important to maintaining good operation of subsequent treatment units in the system such as carbon adsorption (e.g. clogging of pores in the carbon granules) and to aid in the removal of contaminants that are adsorbed to soil particles. Treatment technology is well understood and a properly designed sedimentation and/or filtration system can readily remove TSS to low concentrations. Heavy metals and polynuclear aromatic hydrocarbons (PAHs) are readily adsorbed onto particulate matter and the release of these compounds can be controlled, to an extent, by regulating the amount of suspended solids released into the environment.

The current permit did not require monitoring for TSS at former Outfall 027D. Therefore, this discharge has not been sampled for TSS. However, to assure that the State narrative standard regarding floating solids is maintained, as well as to ensure proper operation of the treatment system, the draft permit establishes a BPJ-based maximum daily effluent limitation of 100 mg/L and an average monthly effluent limitation of 30 mg/L for the discharge from CDTS (Outfall 027A) consistent with the effluent limitations from the RGP and steam electric NELGs (see Section .C.1.b.ii.f).

e. Temperature

The current permit contains monthly average temperature limit of 85°F and a daily maximum limit of 90°F. Previous dry weather discharges from this outfall consisted of non-stormwater flows specific to the 027 drainage area, however, the dry weather discharges through Outfall 027A now consist of a mixture of treated non-stormwater flows collected from the vaults located at outfalls throughout the sites. These non-stormwater flows are collected and piped to equalization tanks prior to batch treatment in the CDTS. Since installation of the CDTS in 2000, the dry weather discharges through Outfall 027A have ranged in temperature from 43°F – 74°F on an average monthly basis, and from 46°F – 76°F on a daily maximum basis.

The Saugus River is a Class SB water under the Massachusetts WQS and the applicable numeric thermal criteria for SB waters provide that discharges may not cause ambient water temperatures to exceed either a daily maximum of 85°F (29.4°C) or a maximum daily mean of 80°F (26.7°C), and also may not cause a rise in temperature of more than 1.5°F (0.8° C) during the summer months (July through September) or 4° F (2.2° C) during the winter months (October through June). However, due to the residence time of the water in the equalization basins at the CDTS, the discharge is not expected to cause a rise in ambient water temperature. Therefore, the draft permit requires a reduced temperature limit at Outfall 027A of 85°F as a daily maximum, consistent with these WQS. This daily maximum limit of is more stringent than the current permit monthly average limit; therefore, compliance with this more stringent daily maximum limit of 85°F will ensure compliance with the current permit monthly average limit of 85°F. Thus, the draft permit requires the monthly average temperature to be monitored without limits.

f. Polychlorinated Biphenyls (PCBs)

PCBs have been detected in groundwater investigations conducted in connection with site investigations under the Massachusetts Contingency Plan. The current permit contains a limit of "< detectable limit" for the discharge through former Outfall 027D. Review of DMR data reveals that PCBs in the discharge through former Outfall 027D have been detected on 7 occasions, all at a concentration of 1 μg/L, and that monitoring for PCBs ceased on July 1999. In DMR cover letters, GE Aviation contends that a treatment system from which these pollutants originated was tied-in to the city sewer as of April 1999.

EPA's National Recommended Water Quality Criteria require a saltwater chronic criterion for PCBs of 0.03 ug/L, measured as total PCBs, as well as a human health criterion of 0.00064 ug/L. As previously discussed in Section B.2 of this fact sheet (Water Quality-based Requirements), EPA has conservatively assumed no dilution.

The draft permit requires a water-quality based monthly average limit of 0.03 ug/L, measured as total PCBs. EPA anticipates that discharges containing PCBs can adequately be treated to "non-detection" levels using carbon adsorption. The RGP requires a compliance limit equal to the minimum level (ML) associated with federally approved test method (Method 608). EPA approved Method 608 only has a detection level of 0.5 ug/l which may result in an incomplete quantification of total PCBs compared to other available methods with lower detection levels. For example, Method 8082 (and Modified Method 8082 which has a lower detection limit) is widely used for in-stream surface water analysis and is widely accepted in the scientific community. Although Method 8082 (and Modified Method 8082) is not, at this time, an EPA NPDES- approved method, it can be required by the Region in accordance with CFR 136.3 (c) as necessary for a more complete quantification of PCBs.

Therefore, the draft permit requires use of Method 8082, and a total PCB monthly average compliance limit equal to 0.065 ug/L, the ML of the test method used (Method 8082). Additionally, the permittee will: 1) use Modified Method 8082, (2) meet all the specifications within Modified Method 8082, (3) make every effort to achieve a minimum detection level (MDL) of 0.03 ug/L using Modified Method 8082, and (4) provide the result of total PCBs as the sum of all Aroclors. Sample results of less than 0.065 ug/L shall be reported as zero on the discharge monitoring report (DMR); numerical results of all samples, including results less than the ML, shall be reported in an attachment to the DMR.

g. Total Residual Oxidants (TRO)

The discharge through Outfall 027A contains commingled non-stormwater flows, several of which contain potable water (which is expected to contain chlorine). GE Aviation reports that potable water is used throughout the plant for several purposes, including steam generation, non-contact cooling, water treatment system regeneration, and cooling tower blowdown. Therefore, the draft permit contains a monitoring requirement for TRO at Outfall 027A, since the potential for discharge of potable water commingled with marine water exists.

h. Total Petroleum Hydrocarbons (TPH)

Outfall 027A discharges treated non-stormwater flows, including contaminated groundwater, along with the first-flush of stormwater from the Drainage System Outfalls.

TPH has been detected in groundwater investigations conducted at GE Aviation in connection with site investigations under the Massachusetts Contingency Plan.

According to the RGP, "Oil & Grease" was the primary petroleum related parameter used in many of EPA-NE's individual NPDES permits and is a common parameter in many of EPA's promulgated industrial effluent guidelines. The "hydrocarbon" fraction of the oil and grease parameter, or TPH, was determined to be the most appropriate parameter for inclusion in the RGP. EPA-NE has been incorporating TPH as a parameter at all petroleum related site remediation projects.

In setting the technology-based effluent limits for TPH in the RGP, EPA reviewed a number of sources. As stated in the RGP, site remediation projects in Massachusetts and New Hampshire have consistently set a maximum value of 5.0 mg/l for the discharge of TPH. The RGP indicates that this limit is readily attainable with standard treatment technology, with reported results typically "less than" the laboratory reporting levels (0.2 - 0.5 mg/l).

The factors in the RGP analysis are comparable to the factors in this individual permit; therefore, EPA is using similar logic to support the TPH limit established for Outfall 027A, which discharges treated non-stormwater flows, including contaminated groundwater. Therefore, the draft permit requires a technology-based TPH limit of 5.0 mg/L, as a daily maximum, monitored monthly.

i. Polycyclic Aromatic Hydrocarbons (PAHs)

There are sixteen (16) PAH compounds identified as priority pollutants under the CWA (*See* 40 CFR Part 423 - Appendix A). "Group I" PAHs are the following seven carcinogens: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. "Group II" PAHs are the following nine priority pollutant PAHs, which are not considered carcinogenic alone but can enhance or inhibit the response of the carcinogenic PAHs: acenaphthene, acenaphthylene, anthracene, benzo(ghi)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. Typically, PAH exposure would be to a mixture of PAHs rather than to an individual PAH.

The above listed PAHs have been detected in groundwater investigations conducted at GE Aviation in connection with site investigations at the facility under the Massachusetts Contingency Plan. The current permit did not require monitoring for PAHs at former Outfall 027D. Therefore, this discharge has not been sampled for PAHs.

EPA's National Recommended Water Quality Criteria require human health criteria of 0.0038 ug/L (water + organism) and 0.018 ug/L (organism only) for each individual Group I PAH. Similarily, the RGP contains a water-quality based limit for individual Group I PAH compounds of 0.0038 ug/L, with the compliance limit equal to the ML of the test method used. The RGP also sets technology-based limits of 10.0 ug/L for total Group I PAHs (sum of the individual isomers) and 100.0 ug/L for total Group II PAHs;

since typical treatment technology is expected to remove these compounds to below detection levels.

The factors in the RGP analysis are comparable to the factors in this individual permit; therefore, EPA is using similar logic to support the PAH limits for Outfall 027A, which discharges treated non-stormwater flows, including contaminated groundwater. Therefore, this permit shall require monthly monitoring of individual Group I PAHs at Outfall 027A. Additionally, the draft permit shall require technology-based effluent limits of 10.0 ug/L for total Group I PAHs and 100.0 ug/L for total Group II PAHs.

j. Metals

The non-stormwater flows treated by the CDTS and discharged through Outfall 027 may contain metals due to the contaminated groundwater infiltration. GE Aviation acknowledges that prior groundwater investigations conducted in connection with site investigations under the Massachusetts Contingency Plan have detected the presence of the following metals: antimony, arsenic, beryllium, cadmium, calcium, chromium, copper, iron, ferrous iron, lead, magnesium, manganese, mercury, nickel, selenium, silver, sodium, thallium, and zinc. The current permit did not require monitoring for metals at former Outfall 027D. Therefore, this discharge has not been sampled for metals. The draft permit requires monitoring at Outfall 027A for these metals, all monitored at a frequency of 1/month.

k. Volatile Organic Compounds (VOCs), Benzene, Toluene, Ethylbenzene, Xylene (BTEX), and Methyl-tert-butyl Ether (MTBE)

Review of DMR data reveals that monitoring for benzene, toluene, ethylbenzene, xylene, total BTEX, and methyl tert-butyl ether (MTBE) ceased on July 1999. In DMR cover letters, GE Aviation contends that a treatment system from which these pollutants originated has been tied in to the city sewer as of April 1999. This permit shall continue to require sampling of these parameters, some with effluent limits as outlined below, to confirm their absence. The permittee may request a reduction in monitoring frequency after 1 year (a minimum of 4 samples) of sampling data showing non-detect for any parameter. The permittee is required to continue testing at the frequency specified in the permit until the permittee receives a certified letter from EPA indicating a change in the permit conditions.

Monitoring data submitted by GE Aviation reveals that a number of VOCs have been detected in the discharge from Outfall 027, specifically, chloroethane, 1,1-dichloroethane, toluene, 1,1,1-trichloroethane, trichloroethene, vinyl chloride (chloroethene), 1,2-dichloroethene, bromodichloromethane, chloroform, and tetrachloroethene. The RGP requires effluent limitations for contaminated groundwater of 70 ug/L for 1,1-dichlorethane, of 200 ug/L for 1,1,1-trichlorethane, and 2.0 ug/L for vinyl chloride (chloroethene). The levels of vinyl chloride in the discharge from Outfall 027 exceeded

2.0 ug/L on two occasions, with the concentration ranging from 1.7 – 2.3 ug/L during monthly samples collected in 2006. [42]

Regarding the specific VOC compounds detected, the following VOCs have been detected in the groundwater onsite:

> Acetone, benzene, bromodichloromethane, bromoform, bromomethane, 2-butanone, carbon disulfide, carbon tetrachloride (tetrachloromethane), chlorobenzene, chloroethane, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethane, 1,2-dichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,4-dioxane, dichlorodifluoromethane, ethylbenzene, ethylether, 2-hexanone, isopropylbenzene, 4-methyl-2-pentanone, methylene chloride, methyltertbutylether naphthalene, n-butylbenzene, n-propylbenzene, p-cymene, sec-butyl benzene, tert-butyl benzene, tert-amyl methyl ether, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trimethylbenzene, 1,2,4-trichlorobenzene, 1,3,5-trimethylbenzene, tetrachloroethene, toluene, trichloroethene, trichlorofluoromethane, vinyl chloride, m-xylene, m/p-xylene, o-xylene, total xylenes.[43,44]

VOCs such as benzene, toluene, ethylbenzene, and the three xylene compounds (BTEX) are normally found at relatively high concentrations in gasoline and light distillate products (e.g., diesel fuel). BTEX concentrations typically decrease in the heavier grades of petroleum distillate products (e.g., fuel oils). The traditional approach for limiting effluents contaminated with gasoline or other light distillates is to place limits on the individual BTEX compounds and/or the sum of total BTEX compounds. As described previously in this fact sheet, benzene can be used as an indicator-parameter for regulatory as well as characterization purposes of stormwater that comes in contact with gasoline and diesel fuel. The primary advantage of using an indicator-parameter is that it can streamline monitoring efforts while simultaneously maintaining an effective level of environmental protection.

To establish appropriate effluent limitations in the RGP for VOCs, EPA evaluated both the technology and water quality-based information currently available. During development of the RGP, EPA reviewed the substantial number of monitoring reports submitted pursuant to approved site remediation projects in MA, as well as the published technology information available on various EPA and other internet sites, and the various water quality and cleanup standards published by EPA and the States. In general, the technology-based effluent limitations in the RGP are sufficient to meet the most conservative water quality standards, typically, human health based standards.

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[42] E-mail correspondence from Steven Lewis (GE Aviation) to George Papadopoulos (EPA), May 20, 2007, Attachment: VOC laboratory analyticals for fiscal year 2006.
[43] NPDES Permit Renewal Application Revision, May 2000.
[44] E-mail correspondence from Steven Lewis (GE Aviation) to Nicole Kowalski (EPA), March 25, 2009, Attachment: Complete list of constituents that have been detected in the groundwater at the site.

Specifically, the RGP contains technology-based effluent limits of 100 ug/L for BTEX, 5.0 ug/L for benzene, and the technology-based limits listed below for chlorinated VOCs (*see* Table 1). In development of the RGP, EPA analyzed facilities with contaminated groundwater remediation situations similar to GE Aviation. The factors in the RGP analysis are comparable to the factors in this individual permit; therefore, EPA is using similar logic to apply these technology-based limits to the discharge through Outfall 027A (which treats contaminated groundwater).

Therefore, consistent with the RGP and individual permit effluent limits for contaminated groundwater discharges and combined discharges at similar facilities in Massachusetts, EPA has, based on BPJ, established technology-based effluent limits in the draft permit for benzene of 5.0 ug/L, total BTEX of 100 μg/L, and chlorinated VOCs, as listed below in Table 1. The draft permit also continues a maximum daily limit of 100 ug/L for MTBE from the current permit consistent with antibacksliding, and requires reporting without limits for toluene, ethylbenzene, total xylenes, and total VOCs at Outfall 027A.

**Table 1. Effluent Limits for Chlorinated VOCs**

| Parameter | Maximum Value (ug/L) |
|---|---|
| 15. Carbon Tetrachloride | 4.4 |
| 16. 1,4 (or p)-Dichlorobenzene (p-DCB) | 5.0 |
| 17. 1,2 (or o)-Dichlorobenzene (o-DCB) | 600 |
| 18. 1,3 (or m)-Dichlorobenzene (m-DCB) | 320 |
| 19. 1,1 Dichloroethane (DCA) | 70 |
| 20. 1,2 Dichloroethane (DCA) | 5.0 |
| 21. 1,1 Dichloroethylene (DCE) | 3.2 |
| 22. cis-1,2 Dichloroethylene (DCE) | 70 |
| 23. Dichloromethane (methylene chloride) | 4.6 |
| 24. Tetrachloroethylene (PCE) | 5.0 |
| 25. 1,1,1 Trichloroethane (TCA) | 200 |
| 26. 1,1,2 Trichloroethane (TCA) | 5.0 |
| 27. Trichloroethylene (TCE) | 5.0 |
| 28. Chloroethene (Vinyl Chloride) | 2.0 |

The technology limits are based on treatability using carbon adsorption, a proven technology capable of removing benzene and other petroleum hydrocarbons from water. The data collected will be useful in characterizing the discharge through Outfall 027A and ensuring proper operation of the treatment system.

l. Cyanide

Compounds containing the cyanide group (CN) are used and readily formed in many industrial processes and can be found in a variety of effluents, such as those from steel, petroleum, plastics, synthetic fibers, metal plating, and chemical industries. Cyanide occurs in water in many forms, including: hydrocyanic acid (HCN), the cyanide ion

($CN^-$), simple cyanides, metallocyanide complexes, and as organic compounds. "Free cyanide" is defined as the sum of the cyanide present as HCN and $CN^-$. The relative concentrations of these forms depend mainly on pH and temperature.

EPA's national water quality criteria for cyanide in saltwater is 1.0 ug/L (acute and chronic). Cyanide has been detected in wet weather discharges onsite at a concentration exceeding the water quality criteria, specifically at Outfall 001. The draft permit requires development and implementation of BMPs to ensure treatment of the first-flush of stormwater through the Drainage System Outfalls by the CDTS. Therefore, since Outfall 027A discharges the treated non-allowable non-stormwater flows, including contaminated groundwater, commingled with the first-flush of stormwater from the Drainage System Outfalls, the draft permit requires monitoring for total cyanide at Outfall 027A.

The development of the cyanide water quality-based effluent limit in the RGP (1.0 ug/L for saltwater), under which EPA analyzed facilities with contaminated groundwater remediation situations similar to GE Aviation, supports this determination. The factors in the RGP analysis are comparable to the factors in this individual permit; therefore, EPA is using similar logic to support the cyanide monitoring requirements at Outfall 027A.

m. Whole Effluent Toxicity Testing Requirements

The general bases for the draft permit's whole effluent toxicity testing requirements for Outfall 027A and the CDTS are the same as those presented above with regard to the Drainage System Outfalls. As explained above, it is common knowledge that stormwater and groundwater discharges may contain toxic constituents. These constituents can include metals, chlorinated solvents, aromatic hydrocarbons and others. Indeed, as discussed above, contaminated stormwater and groundwater has been a particular problem at the GE Aviation site.

Therefore, based on the possibility of toxicity resulting from discharges of both stormwater and groundwater, the draft permit includes acute and chronic toxicity monitoring requirements in accordance with EPA national and regional policy and MassDEP policy. (See Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants,50 Fed. Reg. 30,784 (July 24, 1985); EPA's *Technical Support Document for Water Quality-Based Toxics Control* on September, 1991; and MassDEP's Implementation Policy for the Control of Toxic Pollutants in Surface Waters (February 23, 1990). Specifically, the draft permit requires that the permittee conduct quarterly marine chronic (and modified acute) WET tests for this outfall. The chronic test may be used to calculate the acute $LC_{50}$ at the 48-hour exposure interval. The permittee shall test the following marine species: Inland silverside (*Menidia beryllina*) and the Sea Urchin (*Arbacia punctulata*). Toxicity test samples shall be collected and tests completed during the calendar quarters ending March 31st, June 30th, September 30th, and December 31st each year. Toxicity test results are to be submitted by the 15th day of the month following the end of the quarter sampled. The tests must be performed in accordance with test procedures and protocols specified in Attachment 1 of the permit.

After submitting one year and a minimum of four consecutive sets of WET test results, all of which demonstrate no toxicity, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from EPA that the WET testing requirement has been changed.

3. Outfall 014 – Engine Testing Facility

Non-stormwater flows through this outfall consist of NCCW from aircraft engine test facility heat exchangers, condensate blowdown, and engine and compressor test facility NCCW. Additionally, groundwater infiltration into the pipe system which discharges through this outfall is expected. These non-stormwater flows currently discharge directly to the receiving water without treatment.

Under the current configuration at Outfall 014, contaminated groundwater potentially discharges directly to the receiving water. However, the draft permit prohibits the discharge of contaminated groundwater directly to the receiving water. Unlike the Drainage System Outfalls, Outfall 014 does not contain an outfall vault which pumps to the CDTS. Therefore, the site specific BMPs, which attempt to eliminate the discharge of contaminated groundwater directly to the receiving water by ensuring manual operation of the transfer pumps at the Drainage System Outfall vaults to capture the first flush of stormwater, are not practicable for implementation at this Outfall. The draft permit requires development and implementation of site specific BMPs to eliminate, to the maximum extent practicable, the discharge of contaminated groundwater directly to the receiving water from this Outfall.

The BMPs include, at a minimum, inspection of the outfall pipelines to determine the extent of contaminated groundwater infiltration, development and implementation of a pipe lining project to eliminate potential contaminated groundwater infiltration to this outfall (to supplement the previously completed pipe lining project of a portion of the Outfall 014 drainage system),[45] and reconfiguration of the outfall piping to eliminate the discharge of untreated non-allowable non-stormwater flows directly to the receiving water. The site specific BMPs are described in the SWPPP, Part I.B.9 of the permit and Part V.C.9 of this fact sheet, below.

Additionally, the draft permit shall require monitoring at Outfall 014 based on the current configuration, which allows commingling of contaminated groundwater for discharge to the receiving water. The results of the samples collected from the Outfall 014 discharge may be used to determine the extent to which the site specific BMPs have eliminated the discharge of contaminated groundwater directly to the receiving water.

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[45] NPDES Permit Renewal Application Amendment, September 2003.

a. Flow

The Test Cell CWIS associated with this outfall consists of an intake channel recessed approximately 150 feet into the Saugus River bank. This CWIS is described in Attachment J to this fact sheet. The Engine Test Facility operates intermittently (an average of about 60 hours per month) at a capacity utilization rate of approximately 5 to 8%. The intake channel has accumulated silt over time, and therefore, flows at this point are restricted. As little as about 12 inches of cooling water depth is available above the silt layer within an hour of slack low tide. Accordingly, engine tests must be coordinated with higher tide periods to allow for adequate testing time and cooling water flow.

Effluent flow at Outfall 014 is calculated based on the runtime operation of each pump, with pump on and off times electronically monitored, and the pump capacity curves for these pumps. Actual flows from this outfall have ranged from 0.00002 MGD to 40.3 MGD as a daily maximum and 0.00002 to 9.3 MGD as a monthly average (during the time period of October 1998 through July 2008). This reflects the occasional and intermittent use of the engine test facility and use of the Test Cell CWIS.

The draft permit requires reduction in the monthly average effluent flow from Outfall 014 to 5 MGD from March 1 to July 31, as explained in the Section 316(b) determination, Attachment J to this fact sheet. The monthly average flow limit from August 1 to February 28 remains unchanged at 27 MGD and the daily maximum limit remains unchanged at 45 MGD, to reflect actual operating conditions expected over a long period.

b. Temperature

In developing limits for thermal discharge, EPA and MassDEP must consider applicable technology-based requirements, water quality-based requirements, and any request for a CWA §316(a) variance. The development of the thermal discharge limits based on a CWA §316(a) variance are discussed below in Part V.C.8, below.

The current permit requires temperature effluent limitations of 90°F as a monthly average and 95°F as a daily maximum. The effluent temperature is measured with a temperature probe toward the end of the effluent pipe. Review of DMR data shows that there have not been any exceedences of the temperature limits, as the daily maximum effluent temperature has ranged from 35°F – 86°F and the monthly average effluent temperature has ranged from 32.1 – 84°F. As explained under 316(a), Part V.C.8 of this fact sheet, the maximum daily temperature limit in the current permit has been reduced to 90°F. Compliance with a daily maximum limit of 90°F will ensure compliance with the monthly average limit of 90°F in the current permit. Review of DMR data shows that the discharge has not exceeded 90°F on any occasion (during the time period of October 1998 through July 2008). A limit of 90°F is also consistent with the limit included under CWA § 316(a) in the NPDES permit recently issued to Wheelabrator Saugus, a facility whose discharge to the Saugus River is located across the river and a bit upstream of GE Aviation's discharge.

c. pH

The current permit requires a pH limitation range of 6.5 – 8.5 SU. Review of DMR data reveals that the daily maximum pH has ranged from 7.4 – 8.58 SU, with 3 exceedences of the high-end pH range. This permitted pH range will remain in the permit to maintain adherence to State Water Quality Standards.

d. Oil and Grease (O&G)

The current permit requires a narrative limit for O&G, that there shall be no discharge of oil sheen in other than trace amounts. Massachusetts Water Quality Standards for Class SB water bodies (314 CMR 4.05(4)(b)(7)) specify narrative criteria for O&G, requiring these waters to be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portion of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life. A concentration of oil and grease of 15 mg/L is recognized as a level at which many oils produce a visible sheen.[46] Therefore, in order to satisfy the narrative criteria from the WQS, the draft permit includes for this outfall a maximum daily oil and grease limit of 15 mg/L, monitored monthly.

e. TSS

Massachusetts Water Quality Standards (314 CMR 4.05(4)(b)(5)) require that Class SB waters "be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom."

Heavy metals and PAHs are readily adsorbed onto particulate matter and the release of these compounds can be controlled, to an extent, by regulating the amount of suspended solids released into the environment. Sampling results submitted by the permittee reveals a TSS concentration of 14 mg/L in the discharge through Outfall 014 (see Attachment I).[47]

In order to assure that the State narrative standard regarding floating solids is maintained, and since metals and other contaminants often adhere to solids, the draft permit includes a maximum daily effluent limitation of 100 mg/L and an average monthly effluent limitation of 30 mg/L for total suspended solids from this outfall, sampled monthly.

f. Total VOCs, Total BTEX, Benzene, Toluene, Ethylbenzene, Total Xylenes

Groundwater contaminant monitoring data indicate that a variety of chemical contaminants are likely to be present in the groundwater. These chemicals could be

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[46] USEPA. 1976. *The Red Book – Quality Criteria for Water.* July 1976.

[47] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.

present in discharges from this outfall to the extent that it potentially includes groundwater infiltration. The data suggests that contaminants of concern include a range of volatile organic compounds (VOCs), including a variety of petroleum products (presumably present as a result of past spills of fuel and other materials). VOCs such as benzene, toluene, ethylbenzene, and the three xylene compounds (BTEX), are normally found at relatively high concentrations in gasoline and light distillate products (e.g., diesel fuel).

Therefore, the permittee shall monitor for the presence of total VOCs, total BTEX, benzene, toluene, ethylbenzene, and total xylenes to help determine whether the previously completed pipe lining project at Outfall 014 was successful at eliminating the infiltration of contaminated groundwater into the drainage system. Monitoring for each parameter is required on a quarterly basis.

g. Metals

The permittee shall monitor for the presence of metals to help determine whether the previously completed pipe lining project at Outfall 014 was successful at eliminating the infiltration of contaminated groundwater into the drainage system.

The permittee reports that during downtime events, near-zero flow results in a reduced wetted internal surface area throughout the cooling water channel. Smaller wetted surface area generally means more internal iron surface area of pipes, pumps, valves, etc., exposed to moist air and prone to oxidation. Therefore, when the outfall is put back online and cooling water pumping begins, the first flush of discharge has the potential to contain elevated levels of iron.[48] Additionally, condensate blowdown, which has the potential to contain elevated levels of iron, discharges through Outfall 014. Sampling results submitted by the permittee reveals an iron concentration of 0.13 mg/L in the discharge through Outfall 014 (see Attachment I).[49]

Additionally, sampling results submitted by the permittee reveal the presence of metals in the discharge through Outfall 014 (see Attachment I).[50] Specifically, iron, chromium, and lead have been detected in the Outfall 014 discharge. Therefore, monitoring for iron, chromium, and lead is required at Outfall 014, on a monthly basis. .

h. PAHs

The permittee shall monitor for the presence of total PAHs to help determine whether the previously completed pipe lining project at Outfall 014 was successful at eliminating the infiltration of contaminated groundwater into the drainage system. Monitoring for total PAHs is required on a quarterly basis.

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[48] NPDES Permit Renewal Application Amendment, September 2003.
[49] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.
[50] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.

i. PCBs

The permittee shall monitor for the presence of total PCBs to help determine whether the previously completed pipe lining project at Outfall 014 was successful at eliminating the infiltration of contaminated groundwater into the drainage system. Monitoring for total PCBs is required on a quarterly basis.

j. Whole Effluent Toxicity Testing Requirements

The general bases for the draft permit's whole effluent toxicity testing requirements for Outfall 014 are the same as those presented above with regard to the Drainage System Outfalls.

Based on the possibility of toxicity in the discharge from Outfall 014 resulting from groundwater, and in accordance with EPA national and regional policy as well as MassDEP policy, the draft permit includes acute and chronic toxicity testing requirements. (See Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants,50 Fed. Reg. 30,784 (July 24, 1985); EPA's *Technical Support Document for Water Quality-Based Toxics Control* on September, 1991; and MassDEP's Implementation Policy for the Control of Toxic Pollutants in Surface Waters (February 23, 1990).

The draft permit requires that the permittee conduct quarterly marine chronic (and modified acute) WET tests for this outfall. The chronic test may be used to calculate the acute $LC_{50}$ at the 48-hour exposure interval. The permittee shall test the marine species Inland silverside, *Menidia beryllina* and the Sea Urchin, *Arbacia punctulata*. Toxicity test samples shall be collected and tests completed during the calendar quarters ending March 31st, June 30th, September 30th, and December 31st each year. Toxicity test results are to be submitted by the 15th day of the month following the end of the quarter sampled. The tests must be performed in accordance with test procedures and protocols specified in Attachment 1 of the permit.

After submitting one year and a minimum of four consecutive sets of WET test results, all of which demonstrate no toxicity, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from EPA that the WET testing requirement has been changed.

4. Outfall 018 – Power Plant (018A-dry weather / 018B-wet weather / 018C - internal outfall)

Non-stormwater flows through this outfall consist of NCCW (river water) from power plant generating equipment, turbine condensate, boiler startup/soot blower drains/boiler draining for maintenance, boiler filter backwash, ion exchange regeneration and backwash, de-aerator storage tanks, steam condensate return from steam users, and boiler blowdown. Additionally, groundwater infiltration into the pipe system which discharges through this outfall is expected. The non-stormwater discharge to the receiving water during dry weather conditions through this outfall shall be identified as Outfall 018A.

This outfall also discharges stormwater during wet weather directly to the receiving water, which shall be identified as Outfall 018B. As explained for the Drainage System Outfalls, it is expected that an indeterminate percentage of stormwater discharges consist of infiltrated groundwater. As the water table rises in wet weather, the static pressure of the groundwater surrounding partially filled drain pipes forces groundwater through seams and cracks into the pipes and out the outfall with the stormwater. Therefore, the draft permit also includes wet weather monitoring requirements for this Outfall.

Allowable non-stormwater flows, as defined by EPA's 2008 MSGP, discharging through this outfall include turbine condensate and steam condensate. Additionally, this outfall discharges non-stormwater flows of other types than those authorized under the MSGP. These flows consist of boiler startup/soot blower drains/boiler draining for maintenance, boiler filter backwash and ion exchange regeneration and backwash, de-aerator storage tanks, and boiler blowdown. Therefore, the draft permit requires internal sampling of these non-allowable non-stormwater flows. This internal outfall shall be identified as Outfall 018C.

Unlike the Drainage System Outfalls, Outfall 018 does not contain an outfall vault. Therefore, the site specific BMPs which attempt to eliminate the discharge of contaminated groundwater to capture the first flush of stormwater are not practicable for implementation at this Outfall. Under the current configuration at Outfall 018B, the first flush of stormwater commingled with contaminated groundwater is discharged directly to the receiving water. Additionally, infiltrated contaminated groundwater potentially discharges during dry weather through Outfall 018A.

Therefore, the draft permit requires development and implementation of alternate BMPs at Outfall 018, to eliminate the discharge of contaminated groundwater directly to the receiving water through this Outfall. The BMPs include inspection of the outfall pipelines to determine the extent of contaminated groundwater infiltration, development and implementation of a pipe lining project to eliminate potential contaminated groundwater infiltration to this outfall, and if pipeline rehabilitation is infeasible, pipeline replacement. The site specific BMPs are described in the SWPPP, Part I.B of the permit and Part V.C.9 of this fact sheet, below.

Additionally, the draft permit requires monitoring at Outfall 018 based on the current configuration, which allows commingling of contaminated groundwater for discharge to the receiving water. The results of the samples collected from the Outfall 018 discharge may be used to determine the extent to which the site specific BMPs have eliminated the discharge of contaminated groundwater directly to the receiving water.

a. Flow

This outfall discharges NCCW more or less continuously in support of electricity production needs of this facility. The CWIS associated with this outfall has three intake bays, each with single-entry, single-exit vertical traveling screens. Water is pumped through these screens by three variable speed pumps – one pump for each traveling screen. The actual intake of water from the Saugus River is at a depth of approximately 12 feet below mean low water. *See* Attachment J to this fact sheet for a description of this CWIS. The permittee states that the design flow for Outfall 018A is 57.6 MGD and the typical flow is 28.0 MGD.

As explained in Part V.C.10.a, below, the monthly average effluent flow limit for Outfall 018A will be reduced approximately 20%, from 35.6 MGD to 28.7 MGD. The daily maximum limit will remain 35.6 MGD. This flow reduction is a component of the BTA that EPA has determined for the Power Plant CWISs for this permit. Effluent flows are calculated based on the runtime operation of each pump, with pump on and off times electronically monitored, and the pump capacity curves for these pumps. Average monthly flows from Outfall 018A have ranged from 20.9 to 32.1 MGD during the period from October 1998 to October 2008. Maximum daily flows have ranged from 21.36 to 35.5 MGD during the same monitoring period. Additionally, during wet weather discharges through Outfall 018B and during dry weather discharges through Internal Outfall 018C, the draft permit requires monitoring of flow, without limits.

b. pH

The current permit requires a pH effluent limitation range of 6.5 – 8.5 SU. Review of DMR data shows that the effluent pH has ranged from 7.02 to 8.8 SU, with 1 violation of the pH limitation range. This permitted pH range will remain in the permit based on anti-backsliding requirements found in 40 CFR §122.44(l) and to maintain consistency with State Water Quality Standards. This limit shall be required for both dry and wet weather discharges (both Outfall 018A and 018B). The draft permit also establishes BPJ-based numeric limits for Outfall 018C (6.0 – 9.0 SU) consistent with the steam electric NELGs discussed in Section C.1.b.ii of this fact sheet.

c. Temperature

In developing limits for thermal discharge, EPA and MassDEP must consider applicable technology-based requirements, water quality-based requirements, and any request for a CWA §316(a) variance. The development of the thermal discharge limits based on a CWA §316(a) variance are discussed below in Part V.C.8, below.

The current permit contains effluent limitations of 90°F for monthly average and 95°F for daily maximum temperature in the current permit. The effluent temperature is electronically sampled at regular intervals using a probe embedded at about the center of the discharge flow pipe and plotted on a chart recorder. There have been no violations of these temperature limits, as the maximum daily effluent temperature has ranged from 50

– 95°F and the average monthly temperature has ranged from 43.7 – 86.4°F during the period from October 1998 to October 2008. Review of DMR data shows that the last time the discharge exceeded 90°F was in August 2002. The maximum daily temperature limit for Outfall 018A shall be reduced to 90°F, as explained in Part V.C.8 of this fact sheet. Compliance with this daily maximum limit of 90°F will ensure compliance with the monthly average temperature limit in the current permit of 90°F at Outfall 018A.

During wet weather discharges through Outfall 018B, the draft permit shall require monitoring of temperature, without limits.

d. Oil and Grease (O&G)

The current permit includes a narrative limit for O&G specifying that there shall be no discharge of oil sheen in other than trace amounts. Sampling results submitted by the permittee reveals an O&G concentration of 1 mg/L in the discharge through Outfall 018A (see Attachment I).[51] The discharge through Outfall 018B has not been sampled for O&G.

Massachusetts Water Quality Standards for Class SB water bodies (314 CMR 4.05(4)(b)(7)) require these waters to be free from oil, grease or petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portion of aquatic life, coat the banks or bottom of the water course, or are toxic or otherwise deleterious to aquatic life. A concentration of oil and grease of 15 mg/L is recognized as a level at which many oils produce a visible sheen. Therefore, in order to satisfy the narrative criteria from the WQS, the draft permit requires a maximum daily oil and grease limit of 15 mg/L, monitored monthly, at both Outfall 018A and 018B.

EPA has promulgated NELGs for certain pollutants commonly discharged by the Steam Electric Power Generating Point Source Category (Steam Electric NELGs), *see* 40 CFR Part 423. Specifically, Part 423.12 requires an O&G limit for low-volume waste sources[52] of 15 mg/L as a monthly average and 20 mg/L as a maximum daily.
The flows through Outfall 018C (boiler startup/soot blower drains/boiler draining for maintenance, boiler filter backwash and ion exchange regeneration and backwash, de-aerator storage tanks, and boiler blowdown) are comparable to these low-volume waste sources; therefore, EPA has used BPJ in applying these O&G limits to internal Outfall 018C.

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[51] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.

[52] Low volume wastes sources (as defined in 40 CFR Part 423.11) include, but are not limited to: wastewaters from wet scrubber air pollution control systems, ion exchange water treatment system, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house service water systems. Sanitary and air conditioning wastes are not included.

e. TSS

Massachusetts Water Quality Standards (314 CMR 4.05(4)(b)(5)) require that Class SB waters "be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom."

Heavy metals and PAHs readily adhere to particulate matter and the discharge of these compounds can be controlled, to an extent, by regulating the amount of suspended solids discharged. Sampling results submitted by the permittee reveal a TSS concentration of 9 mg/L in the discharge through Outfall 018A (see Attachment I).[53] The discharge through Outfall 018B has not been sampled for TSS.

In order to assure that the State narrative standard regarding floating solids is maintained, and since metals and other contaminants often adhere to solids, the draft permit includes a maximum daily effluent limitation of 100 mg/L, and an average monthly effluent limitation of 30 mg/L, for total suspended solids (TSS) from this outfall, for both dry and wet weather discharges (i.e., Outfalls 018A and 018B), sampled monthly.

Additionally, EPA has used BPJ in applying the Steam Electric Power Generating Point Source Category (Steam Electric NELGs) for low volume waste sources (*see* 40 CFR Part 423.12). Specifically, Part 423.12 requires a TSS limit for low-volume waste sources[54] of 30 mg/L as a monthly average and 100 mg/L as a maximum daily. The flows through Outfall 018C (boiler startup/soot blower drains/boiler draining for maintenance, boiler filter backwash and ion exchange regeneration and backwash, de-aerator storage tanks, and boiler blowdown) are comparable to these low-volume waste sources; therefore, EPA has used BPJ in applying these TSS limits to internal Outfall 018C.

f. Metals

The discharge through Outfall 018 has the potential to contain contaminated groundwater infiltration. Additionally, steam condensate, one of the non-stormwater flows which currently discharges through Outfall 018A, has the potential to contain elevated levels of iron. Sampling results submitted by the permittee reveal elevated levels of metals in the discharge from Outfall 018A (see Attachment I).[55] Specifically, the discharge through Outfall 018A has contained elevated levels of metals which exceed National Water Quality Criteria for copper and selenium. Therefore, the draft permit requires daily

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[53] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.

[54] Low volume wastes sources include, but are not limited to: wastewaters from wet scrubber air pollution control systems, ion exchange water treatment system, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house service water systems. Sanitary and air conditioning wastes are not included.

[55] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.

maximum limits consistent with the National Water Quality Criteria CMCs for copper and selenium, at a frequency of 1/month. The discharge through Outfall 018A has also detected arsenic, cadmium, aluminum, cobalt, iron, titanium, chromium, lead, mercury, and zinc. These metals shall also be monitored at a frequency of 1/month.

The metals data collected will help determine the effectiveness of the site specific BMPs at eliminating the discharge of contaminated groundwater directly to the receiving water through Outfall 018. Specifically, the draft permit requires a BMP to develop and implement a pipe lining project to eliminate potential contaminated groundwater infiltration to this outfall, which discharges non-stormwater flows directly to the receiving water.

The discharge through Outfall 018B has not been sampled for metals. Therefore, during wet weather discharges through Outfall 018B, the draft permit requires the same metal monitoring requirements outlined above (without limits) for dry weather, as there is potential for contaminated groundwater infiltration during wet weather discharges as well.

g. VOCs

Groundwater contaminant monitoring data indicate that a variety of chemical contaminants are likely to be present in the groundwater. These chemicals could be present in discharges from this outfall to the extent that it potentially includes groundwater infiltration. The data suggests that contaminants of concern include a range of volatile organic compounds (VOCs), including a variety of petroleum products (presumably present as a result of past spills of fuel and other materials). VOCs such as benzene, toluene, ethylbenzene, and the three xylene compounds (BTEX), are normally found at relatively high concentrations in gasoline and light distillate products (e.g., diesel fuel).

Therefore, the permittee shall monitor for the presence of total VOCs, total BTEX, benzene, toluene, ethylbenzene, and total xylenes during both dry and wet weather (Outfall 018A and 018B) to help determine the extent to which site-specific BMPs have been successful at eliminating the infiltration of contaminated groundwater into the drainage system. Monitoring for each parameter is required on a quarterly basis.

h. PAHs

The permittee shall monitor for the presence of total PAHs, during both dry and wet weather (Outfall 018A and 018B), to help determine the extent to which site-specific BMPs have been successful at eliminating the infiltration of contaminated groundwater into the drainage system. Monitoring for total PAHs is required on a monthly basis.

j. PCBs

The permittee shall monitor for the presence of total PCBs, during both dry and wet weather (Outfall 018A and 018B), to help determine the extent to which site-specific BMPs have been successful at eliminating the infiltration of contaminated groundwater into the drainage system. Monitoring for total PCBs is required on a monthly basis.

h. Total Residual Oxidants (TRO)

The discharge through Outfall 018A contains several non-stormwater flows, one of which is steam condensate composed of potable water (which is expected to contain chlorine). Therefore, the draft permit contains a dry weather monthly monitoring requirement for TRO at Outfall 018A, since the potential for discharge of potable water commingled with marine water exists.

i. Whole Effluent Toxicity Testing Requirements

The general bases for the draft permit's whole effluent toxicity testing requirements for Outfalls 018A and 018B are the same as those presented above with regard to the Drainage System Outfalls.

Based on the possibility of toxicity resulting from both stormwater and groundwater, in accordance with EPA national and regional policy, and in accordance with MassDEP policy, the draft permit includes acute and chronic toxicity testing requirements. (See Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants,50 Fed. Reg. 30,784 (July 24, 1985); EPA's *Technical Support Document for Water Quality-Based Toxics Control* on September, 1991; and MassDEP's Implementation Policy for the Control of Toxic Pollutants in Surface Waters (February 23, 1990).

The draft permit provides that the permittee must conduct quarterly marine chronic (and modified acute) WET tests for this outfall. The chronic test may be used to calculate the acute $LC_{50}$ at the 48-hour exposure interval. The permittee shall test the marine species Inland silverside, *Menidia beryllina* and the Sea Urchin, *Arbacia punctulata*. Toxicity test samples shall be collected and tests completed during the calendar quarters ending March 31st, June 30th, September 30th, and December 31st each year. Toxicity test results are to be submitted by the 15th day of the month following the end of the quarter sampled. The tests must be performed in accordance with test procedures and protocols specified in Attachment 1 of the permit.

The draft permit requires both wet and dry weather toxicity monitoring (both Outfall 018A and 081B), since the potential for contaminated groundwater infiltration exists during both dry and wet weather.

After submitting one year and a minimum of four consecutive sets of WET test results, all of which demonstrate no toxicity, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from EPA that the WET testing requirement has been changed.

5. Outfall 020

A feature of the power house intake is the presence of a wide, shallow concrete trough that returns overflow from the intake equalization basin to the Saugus River about 50 feet downstream of the end of the debris/fish return trough. According to the permittee, current operations attempt to minimize the amount of cooling water which spills into this trough.

The 1993 permit authorized the discharge of river water not used in cooling, as well as stormwater and NCCW from rotor testing through this outfall. In June of 2000, the permittee discontinued dry and wet weather discharges through Outfall 020 with the exception of the discharges of unused river water. There is also a potential, however, for groundwater infiltration to this outfall. Therefore, at present, this outfall discharges unused river water potentially mixed with contaminated groundwater infiltration.

The draft permit calls for development and implementation of site-specific BMPs for outfalls which discharge during dry weather and whose effluent potentially includes contaminated groundwater. These BMPs include steps such as pipe lining to eliminate potential infiltration by contaminated groundwater, similar to that completed for the Outfall 014 drainage system. The site-specific BMPs are described in the SWPPP, Part I.B of the permit, and Part V.C.9 of this fact sheet.

Additionally, the draft permit shall require monitoring at Outfall 020 based on the current configuration, which allows commingling of contaminated groundwater for discharge to the receiving water. The results of the samples collected from the Outfall 020 discharge may be used to determine the extent to which the site specific BMPs have eliminated the discharge of contaminated groundwater directly to the receiving water.

a. Flow

The current permit limits average monthly flow from this outfall to 16.9 MGD. This flow limit, however, was based on contributions from several other sources in addition to the discharge of un-used water. DMR data shows no exceedances of the effluent flow limit (all flows have been reported as 16.9 MGD). GE Aviation has not reported flows from Outfall 020 since March 2004. In addition, GE Aviation states that it attempts to operate the pump intake system to minimize overflows to the maximum extent possible. The average monthly flow limit in the current permit shall be retained in the draft permit. The draft permit also specifies reporting of the daily maximum flow through Outfall 020.

b. pH

The current permit requires a pH effluent limitation range of 6.5 – 8.5 SU. DMR data for dry weather discharges reveals no violations, with pH values ranging from 6.8 to 8.49 SU. The draft permit retains the same pH limits to maintain consistency with Massachusetts WQS and federal anti-backsliding requirements.

c. Oil and Grease (O&G)

The draft permit includes a maximum daily O&G limit of 15 mg/L for this outfall to comply with Massachusetts WQS. The WQS require Class SB waters to be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portion of aquatic life, coat the banks or bottom of the water course, or are toxic or otherwise deleterious to aquatic life. 314 CMR 4.05(4)(b)(7). Sampling results submitted by the permittee reveals an O&G concentration of 1 mg/L in the discharge through Outfall 020 (see Attachment I).[56] The draft permit sets 15 mg/L as the maximum daily limit for O&G because 15 mg/L is a recognized level at which many oils produce a visible sheen.

d. TSS

Massachusetts WQS, *see* 314 CMR 4.05(4)(b)(5), require that Class SB waters "be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom." Heavy metals and PAHs are readily adsorbed onto particulate matter and the release of these compounds can be controlled, to an extent, by regulating the amount of suspended solids released into the environment.

Sampling results from one wet weather event submitted by the permittee showed a TSS level at Outfall 020 of 26 mg/L.[57] In order to assure compliance with the State's narrative criterion for floating solids, and since metals and other contaminants often adhere to solids, the draft permit sets the following limits on discharges of Total Suspended Solids (TSS) from this outfall: (a) a maximum daily limit of 100 mg/L; and (b) an average monthly limit of 30 mg/L.

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[56] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2C: Wastewater Discharge Information.

[57] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

e. VOCs

The permittee shall monitor for total VOCs to help determine whether the site-specific BMPs have eliminated infiltration of contaminated groundwater into the drainage system. Monitoring for total VOCs is required on a quarterly basis.

f. PAHs

The permittee shall monitor for the presence of total PAHs to help determine whether the site-specific BMPs have eliminated infiltration of contaminated groundwater into the drainage system. Monitoring for total PAHs is required on a quarterly basis.

g. PCBs

The permittee shall monitor for the presence of total PCBs to help determine whether the site-specific BMPs have eliminated infiltration of contaminated groundwater into the drainage system. Monitoring for total PCBs is required on a quarterly basis.

h. Metals

Sampling results submitted by the permittee reveal elevated levels of metals in the discharge from several outfalls.[58] Specifically, discharges through Outfall 020 have contained levels of metals exceeding the National Water Quality Chronic Criteria CMCs for arsenic, cadmium, copper, and selenium. High levels of aluminum, cadmium, iron, and antimony were also detected in this discharge. Therefore, the draft permit requires requires monthly monitoring of arsenic, copper, selenium, aluminum, cadmium, iron, and antimony at Outfall 020.

The metals data collected will help determine the effectiveness of the site specific BMPs at eliminating the discharge of contaminated groundwater directly to the receiving water through Outfall 020. Specifically, the BMP to development and implementation a pipe lining project to eliminate potential contaminated groundwater infiltration to this outfall, which discharges non-stormwater flows directly to the receiving water.

i. Whole Effluent Toxicity Testing Requirements

The general bases for the draft permit's whole effluent toxicity testing requirements for Outfall 020 is the same as those presented above with regard to the Drainage System Outfalls.

Based on the possibility of toxicity resulting from both stormwater and groundwater, in accordance with EPA national and regional policy, and in accordance with MassDEP policy, the draft permit includes acute and chronic toxicity testing requirements. (See <u>Policy for the Development of Water Quality-Based Permit Limitations for Toxic</u>

[58] NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information.

Pollutants,50 Fed. Reg. 30,784 (July 24, 1985); EPA's *Technical Support Document for Water Quality-Based Toxics Control* on September, 1991; and MassDEP's Implementation Policy for the Control of Toxic Pollutants in Surface Waters (February 23, 1990).

The draft permit provides that the permittee must conduct quarterly marine chronic (and modified acute) WET tests for this outfall. The chronic test may be used to calculate the acute $LC_{50}$ at the 48-hour exposure interval. The permittee shall test the marine species Inland silverside, *Menidia beryllina* and the Sea Urchin, *Arbacia punctulata*. Toxicity test samples shall be collected and tests completed during the calendar quarters ending March 31st, June 30th, September 30th, and December 31st each year. Toxicity test results are to be submitted by the 15th day of the month following the end of the quarter sampled. The tests must be performed in accordance with test procedures and protocols specified in Attachment 1 of the permit.

After submitting one year and a minimum of four consecutive sets of WET test results, all of which demonstrate no toxicity, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from EPA that the WET testing requirement has been changed.

6. Outfall 032 - Internal Outfall

Stormwater regularly collects within the secondary containment areas at the jet fuel farm, around tanks, in the truck unloading ramps, and in other areas. Since the approved closing of Outfall 32W in February 2002 (letter from Rachel Becker, GE Aviation, 2/8/2002), stormwater accumulation in these containment areas has reportedly been collected and transferred via underground piping to the CDTS for treatment prior to discharge to the river. The transfer process is manually initiated, allowing the permittee to inspect the containment areas for excessive oil accumulation due potentially to tank, truck, or filter leak or failure. Therefore, this permit requires that any such containment water shall be inspected for evidence of an oil sheen or other contamination prior to such water being routed to the CDTS. In the event that a sheen is observed, the permittee shall eliminate the sheen prior to discharging the water from the containment area to the CDTS, or appropriately dispose of this water off-site.

7. Unauthorized Discharges

a. Outfalls 003 and 005

In the current permit, Outfalls 003 and 005 are emergency discharges, only used in the case of a cooling tower failure. These outfalls are currently sealed and have not been used since 1994.[59] Therefore, discharge through these outfalls is not authorized by the draft permit. Any discharge through these outfalls shall be reported as a bypass, in accordance with Part II.B.4, Standard Conditions.

[59] NPDES Permit Renewal Application, June 1998.

b. Outfall 029 - Gear Plant (Steam Turbine Test Facility)

This outfall is located downstream of Outfalls 014 and 018, the other two large NCCW outfalls, in an area of generally less deep water. The CWIS associated with this facility is located at the end of a long wooden pier that crosses shallow water flats. It pumps cooling water from the edge of the main Saugus River channel and lies in relatively deeper water than the outfall location. Redundant pumps at the CWIS, with a combined design capacity of 57.6 MGD, have not been operated for over 10 years. Therefore, there has not been a discharge of NCCW or other water from this outfall in the last 10 years or more. The permittee plans to demolish the Gear Plant intake and thus eliminate the associated discharge through Outfall 029. Therefore, this permit does not authorize the discharge of NCCW (or any other pollutant) from this outfall.

8. Thermal Discharge Limits (Outfalls 014 & 018)

In developing thermal discharge limits for Outfalls 014 and 018A, EPA must consider applicable technology-based requirements, water quality-based requirements, and any request for a CWA §316(a) variance. As noted above, this segment of the Saugus River is on the MassDEP's 2006 303(d) list of impaired waters for thermal modifications.

a. Technology-Based Requirements

As previously discussed, given the absence of an applicable ELG for the thermal discharge from this facility, the permit writer is authorized under Section 402(a)(1)(B) of the CWA and 40 C.F.R § 125.3 to establish technology-based thermal discharge limits by applying the BAT standard on a case-by-case, BPJ basis.

In setting a BAT effluent limit on a BPJ basis, EPA considers the relative capability of available technological alternatives and seeks to identify the best performing technology for reducing pollutant discharges (i.e., for approaching or achieving the national goal of eliminating the discharge of pollutants). In addition, before determining the BAT, EPA also considers the following factors : (1) the age of the equipment and facilities involved; (2) the process employed; (3) the engineering aspects of the application of various control techniques; (4) process changes; (5) the cost of achieving such effluent reduction; (6) non-water quality environmental impacts (including energy requirements); (7) the appropriate technology for the category or class of point sources of which the applicant is a member based upon all available information; and (8) any unique factors relating to the applicant. *See* 33 U.S.C. § 1314(b)(2)(B); 40 C.F.R. §§125.3(c)(2)(i) and (ii), and 125.3(d)(3). EPA has considered each of these factors in the context of this BPJ determination of the BAT for controlling thermal discharges at GE Aviation.

Although GE Aviation is a manufacturing facility, the power generating capability at the Power Plant, along with the operation of the CWISs and discharge of NCCW, make GE Aviation similar in important ways to steam electric power plants. The generation of power at GE's Power Plant requires some sort of cooling system for condensing the steam used to drive its electrical generation turbines. Therefore, for the purposes of this discussion and analysis, GE Aviation will be compared directly to power plants whose primary function is the generation and transmission of electricity by means of the steam cycle.

"Open-cycle" (or "once-through") cooling systems typically produce the highest levels of thermal discharges (and water withdrawals), as compared to closed-cycle or partially closed-cycle systems. In this case, the entire volume of cooling water (and thus waste heat) is discharged to the receiving water. GE Aviation currently operates with an open-cycle cooling system. "Closed-cycle" cooling systems reduce thermal discharges (and cooling water withdrawals). In a closed-cycle system, cooling water is used to condense the steam, but rather than discharge the heated water, a cooling system is used to remove most of the waste heat from the cooling water so that the water can be reused for additional cooling.

Given that GE Aviation is an existing facility that would require retrofitting to achieve technologically-driven improvements, EPA has looked to the existing steam electric facilities that have achieved the greatest reductions in thermal discharges through technological retrofits. As a general matter, the best performing facilities in terms of reducing thermal discharges at existing open-cycle cooling power plants are those facilities that have converted from open-cycle cooling to closed-cycle cooling using some type of "wet" cooling tower technology. Converting to closed-cycle cooling can reduce heat load to the receiving water by 95% or more.[60] EPA's research has identified a number of facilities that have made this type of technological improvement. See *Draft Permit Determinations Document for Brayton Point Station NPDES Permit*, at pp. 7-37 to 7-38; *Responses to Comments for Brayton Point Station NPDES Permit*, at p. IV-115.[61,62]

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[60] Retrofitting all four generating units at Brayton Point Station in Massachusetts will reduce the heat load to Mount Hope Bay (the receiving water) by approximately 96%. USGenNE. Brayton Point Station 316(a) and 316(b) Demonstration. December 2001.

[61] In the Phase I CWA § 316(b) Rule, EPA determined that entrainment and impingement mortality reductions commensurate with the use of closed-cycle cooling reflect the BTA for *new* facilities with CWISs. *See* 40 C.F.R. Part 125, Subpart I (Phase I CWA § 316(b) Rule).

[62] Although the use of "dry" cooling might achieve an even greater marginal reduction in entrainment and impingement, EPA has not identified a single case of a facility retrofitting from open-cycle cooling to dry cooling. Although EPA is unaware of any technical reason that such a conversion would necessarily be impracticable at all facilities—though it seems likely that it would be infeasible at a larger proportion of existing facilities than would a conversion to wet cooling because of factors such as the greater space needed for dry cooling—it would likely achieve only a small marginal additional reduction over the high end of the reduction range for wet cooling towers and would be significantly more expensive. In the absence of examples of such a conversion ever having been implemented, EPA is not prepared to determine that converting to dry cooling is the required BTA for an existing facility like the GE Aviation plant. It should also be noted that in developing the Phase I Rule, EPA similarly declined to mandate dry cooling as the required BTA for new facilities, while recognizing that dry cooling was a *permissible* technology that would satisfy § 316(b) if a facility chose to install it.

EPA has determined that closed-cycle cooling using wet, mechanical draft cooling towers would be the BAT for the reduction of thermal discharges at GE Aviation. As part of its determination of the BTA for GE Aviation's CWISs under CWA § 316(b), EPA evaluated alternative cooling system technologies in light of their feasibility and the various factors listed above (e.g., cost, engineering considerations). *See* Attachment J. EPA relies upon and incorporates by reference that analysis here, aside from the consideration of comparative cost/benefit analysis, which does not apply for setting BAT discharge limits. *See. e.g., In re Dominion Brayton* Point, 12 E.A.D. at 546. At GE Aviation, with a wet cooling tower system, the remaining discharge volume (consisting of cooling tower blowdown) would be small enough that it could be discharged directly to the Lynn Municipal Sewer System, which would eliminate the discharge of cooling water from the Power Plant (Outfall 018) and/or Test Cell (Outfall 014) to the receiving water.

b. Water Quality-Based Requirements

Water quality-based requirements would be based on the Massachusetts WQS's numeric and narrative temperature criteria, designated and existing uses, and antidegradation and mixing zone policies. The State's WQS classify the Saugus River as a Class SB water and, accordingly, prohibit discharges from causing (a) ambient water temperatures to exceed either a daily maximum of 85°F (29.4°C) or a maximum daily mean of 80°F (26.7°C), or (c) a rise in temperature due to a discharge of more than 1.5°F (0.8° C) during the summer months (July through September) or 4° F (2.2° C) during the winter months (October through June). In addition, the WQS would require that thermal discharges be limited so as to allow the designated uses for SB waters, including the provision of good quality fish habitat and a recreational fishing resource, to be attained. At GE Aviation, technology-based thermal limits based on retrofitting either or both the Power Plant and Test Cell operations with closed-cycle cooling would result in more stringent limits (reducing heat load by 95% or more) than would be required by water quality-based thermal limits.

c. CWA § 316(a) Variance-Based Limits

Under 40 CFR Part 125 Subpart H, discussed in Section V.A.3 of this fact sheet, thermal discharge effluent limitations or standards established in permits may be less stringent than those required by otherwise applicable standards "if the discharger demonstrates to the satisfaction of the director that such [otherwise required] effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge is made" (BIP). 40 CFR § 125.73(a). *See also* 33 U.S.C. § 1326(a); 40 C.F.R. § 125.70. If the applicant makes this demonstration to the satisfaction of EPA (or if appropriate, the State), then the permitting authority may issue the permit with less stringent variance-based limitations that are sufficient to assure the protection and propagation of the BIP. Conversely, if the demonstration does not adequately support the requested variance-based thermal discharge limits, then the permitting authority shall deny the requested variance. In that case, the permitting authority may either impose different variance-based limits that it determines are justified by the permit record (i.e., that will assure the protection and propagation of the BIP), or impose limits based on the otherwise applicable technology-based and water quality-based requirements.

In the existing GE permit, issued in 1993, EPA concluded that limits less stringent than required by State WQS or technology-based requirements would assure the protection and propagation of the BIP in the Saugus River. The existing permit allows a maximum daily thermal discharge of 95ºF and an average monthly thermal discharge of 90ºF from Outfalls 018 and 014, based on a CWA § 316(a) variance. In its application to renew this permit, GE did not specifically request a § 316(a) variance for the thermal discharge from outfalls 014 and 018. However, the permittee did not request any alteration of existing permit limits, which EPA interprets to be a request for an renewal of the existing § 316(a) variance. The availability of new information since the last permit decision has prompted EPA to re-evaluate the current § 316(a)-based permit limits to ensure the BIP continues to be protected.

d. Determination under CWA § 316(a)

The draft permit's thermal discharge limits are based on a § 316(a) variance to allow GE to discharge heat to the Saugus River in a manner that will exceed the MA WQS and federal technology-based limits under the BAT standard, but will nonetheless assure the protection and propagation of the BIP. Since the 1993 "tentative decision that thermal discharges satisfy the 316(a) provision" (1993 Fact Sheet, p.10), EPA has received additional monitoring and modeling studies pertaining to GE's thermal discharges.[63] In addition, the status of several resident and anadromous fish species in the Saugus River has changed.[64] This additional information prompted EPA to re-evaluate whether the currently permitted 95˚F maximum discharge limit continues to assure the protection and propagation of the BIP of the Saugus River.

One important consideration is that the existing limits in the 1993 permit were based on a § 316(a) variance that was, at least in part, supported by near-field modeling from 1993. However, this near-field modeling assumed maximum discharge temperatures of 91˚F and 90˚F at Outfalls 018 and 014, respectively, both of which are less than the currently permitted maximum discharge temperature of 95˚F.

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[63] Wheelabrator Saugus (WS), an upstream facility, contracted with Applied Science Associates (ASA) to develop a multi-layer, three-dimensional hydrothermal model to predict the duration and extent of the combined thermal impacts in the Saugus River under varying thermal discharge scenarios from both WS and GE Aviation. Results are provided in ASA's 2004 Report entitled Temperature Mapping and Hydrothermal Model Calibration of the Lower Saugus River Estuary and Environmental Strategic Systems' 2005 Report entitled Narrative Summary: Response to EPA request for additional Modeling Results Presentation. EPA also reviewed the thermal plume survey and far- and near-field modeling that GE Aviation submitted for the last permit issuance (Thermography Study General Electric River Works Facility and Thermal/Biological Impact Analysis – Outfall 014 General Electric River Works Facility).
[64] Both rainbow smelt and river herring have experienced declining populations in recent years. In fact, both rainbow smelt and river herring are listed as Species of Concern by the National Oceanographic and Atmospheric Administration (NOAA), and the Massachusetts Division of Marine Fisheries (MassDMF) provides further protection for river herring through a moratorium on the harvest, possession, and sale of river herring extended through 2011.

Another important consideration is that EPA recently re-issued the NPDES permit for Wheelabrator Saugus (WS), an upstream facility[65] with a year-round maximum effluent temperature limit of 90°F based on a § 316(a) variance. WS's permit application requested an increase in the maximum daily temperature limit from 90°F to 95°F (the current limit at GE). EPA considered monitoring data for thermal effluents in the Saugus River,[66] a predictive model evaluating thermal effluent from both WS and GE,[67] and pertinent life history and thermal tolerance data for several fish species that are commercially important (winter flounder) or recreationally important (striped bass), or that have experienced population declines that have prompted regulators to impose fishing moratoria to safeguard remaining populations (e.g., alewife).[68] EPA denied WS's request for an increase in the maximum temperature limit based on the Agency's conclusion that discharge temperatures in excess of 90°F would not be protective of the BIP. In particular, EPA concluded that winter flounder, alewife, and striped bass juveniles may experience thermally-induced sub-lethal and lethal adverse impacts at temperatures between 86° and 90°F, and that temperatures greater than 90°F would create completely unsuitable habitat. *See* WS fact sheet, p. 17, and WS RTC, Response to General Comment, p.6.

Thermal monitoring in August 2001 demonstrated that river temperatures in the vicinity of GE Outfalls 014 and 018 can exceed 86°F around low slack tide during the hottest months of the year (see Figures 2.11 to 2.15 in ASA 2004 Report). The maximum daily discharge temperature from Outfall 018 during August 2001 was 95°F, which suggests that the thermal discharge, at the currently permitted maximum temperature, may contribute to river temperatures at which several species exhibit sub-lethal and lethal effects. Consistent with the analysis presented in the WS fact sheet and RTC, EPA concludes that a thermal discharge of 95°F would, under certain conditions, raise river temperatures to levels that pose a risk of significant adverse thermal impacts to at least 3 important resident species in the Saugus River (winter flounder, alewife, and striped bass). As a result, EPA has determined that a thermal discharge limit of 95°F would not reasonably assure the protection and propagation of the BIP as required by CWA § 316(a). EPA has reproduced the relevant portions of the analysis from the WS permit record as Attachment K to this fact sheet and incorporates that analysis herein by this reference.

Based on its review of thermal monitoring reflecting the GE Aviation discharge, EPA is granting GE Aviation a CWA § 316(a) variance, but is specifying a more stringent maximum daily temperature limit of 90°F in the draft permit, as compared to the 95°F maximum daily limit in the current permit. As explained above, EPA concludes that a thermal discharge 95°F would not assure the protection and propagation of the BIP because it would pose a risk of adverse thermal impacts to several important species that

[65] Fact Sheet, Wheelabrator Saugus MA
[66] ASA 2004
[67] EES 2005
[68] See Fact Sheet, Wheelabrator Saugus MA, Response to Comments Wheelabrator Saugus MA, and references therein.

are part of the BIP of the Saugus River. A maximum daily temperature limit of 90°F at Outfalls 014 and 018 is more consistent with the near-field modeling that supported the 1993 § 316(a) variance in the current permit. Modeling results from 1993 demonstrate that maximum river temperatures would be expected to be more protective (i.e., less than 86°F) at discharge temperatures of 90° to 91°F.[69] Furthermore, temperatures in the river would not be expected to approach this range except during the half-hour period surrounding slack tide at certain times during the year. However, conditions that may result in potentially harmful temperatures are expected to occur only during the half-hour time frame surrounding low slack tide on the hottest days of the year (e.g., during July and August), and modeling suggests that only a small portion of the river would reach these maximum temperatures. EPA concludes that a 90°F effluent limit poses a threat of only a limited thermal impact to the BIP and, as a result, will assure the BIP's protection and propagation.

It should also be noted that, based on a review of DMR data, the Outfall 018 effluent has not exceeded 90°F since August 2002, and the Outfall 014 effluent has not exceeded 90°F on any occasion (during the time period of October 1998 through July 2008). Therefore, EPA does not anticipate that major operational changes would result from the more stringent thermal limits included in the draft permit.

The Massachusetts WQS specify that variance-based discharge limits set in compliance with CWA § 316(a) are deemed to comply with 314 CMR 4.00. Specifically, 314 CMR 4.05(4)(b)2.c states:

> … alternative effluent limitations established in connection with a variance for a thermal discharge issued under 33 U.S.C. § 1251 (FWPCA, § 316(a)) and 314 CMR 3.00 are in compliance with 314 CMR 4.00. As required by 33 U.S.C. § 1251 (FWPCA, § 316(a)) and 314 CMR 3.00, for permit and variance renewal, the applicant must demonstrate that alternative effluent limitations continue to comply with the variance standard for thermal discharges ….

Because EPA has concluded that the thermal discharge limits in the draft permit comply with CWA § 316(a), the agency also conclude that these limits comply with the Massachusetts WQS at 314 CMR 4.00. EPA will continue to coordinate review of these issues, including with regard to the consideration of public comments. Ultimately, the permit will be subject to certification by the State under CWA § 401(a)(1) that its conditions comply with the WQS.[70]

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[69] According to near-field modeling at permitted discharge flows and an ambient river temperature of 75°F, a maximum river temperatures of 84.5°F would be expected with a maximum discharge temperature of 91°F from Outfall 018, and a maximum river temperature of 84.4°F would be expected at a maximum discharge temperature of 90°F at Outfall 014 (Table 4-4 ENSR 1993a and Table 4-2 ENSR 1993b).

[70] The Massachusetts WQS include antidegradation requirements that protect the existing quality of the State's waters in a variety of ways, including provisions that provide special protections for waters of especially high quality. *See* 314 CMR 4.04. *See also* 40 C.F.R. § 131.12. State antidegradation policy and implementation methods must be "consistent with" CWA § 316(a). 40 C.F.R. § 131.12(a)(4). *See also* 33 U.S.C. § 1313(g) (State water quality standards "relating to heat" must be "consistent with" CWA §

e. Temperature Limits and Anti-Backsliding

The draft permit complies with the the CWA's anti-backsliding requirements, set forth in Section 402(o) of the CWA and 40 C.F.R. §122.44(l). These requirements generally bar the relaxation of prior permit limits, subject to certain exceptions. The draft permit's thermal discharge limits are, however, *more stringent* than the current permit's limits. Second, the anti-backsliding prohibitions apply only to the renewal, reissuance, or modification of technology-based or water quality-based effluent limits. They do not apply to the thermal discharge limits in the existing permit, which were based on a CWA § 316(a) variance.

9. Stormwater Pollution Prevention Plan (SWPPP)

This facility engages in activities which could result in the discharge of pollutants to waters of the United States either directly or indirectly through stormwater runoff. These operations include at least one of the following in an area potentially exposed to precipitation or stormwater: material storage, in-facility material transfer, material processing, and material handling, or loading and unloading. To control the activities/operations, which could contribute pollutants to waters of the United States, potentially violating the State's WQS, the draft permit requires the facility to develop, implement, and maintain a Stormwater Pollution Prevention Plan (SWPPP) containing best management practices (BMPs) appropriate for this specific facility. *See* Sections 304(e) and 402(a)(1) of the CWA and 40 CFR §122.44(k). Specifically, storage areas for aircraft engine parts are an example of material storage operations at this facility that should be included in the SWPPP. The collection of stormwater in secondary containment areas is an example of a material handling operation to be included in the SWPPP.

The goal of the SWPPP is to reduce, or prevent, the discharge of pollutants through the stormwater system. The SWPPP serves to document the selection, design and installation of control measures, including BMPs. Additionally, the SWPPP requirements in the draft permit are intended to provide a systematic approach by which the permittee shall at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of the permit. The SWPPP shall be prepared in

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316(a)). There may, of course, be more than one way that a state could design its thermal standards and antidegradation requirements to be "consistent with" CWA § 316(a). In any event, the draft permit proposes to require a reduced volume of thermal effluent, a lower maximum temperature limit of 90°F, and a reduced volume and velocity of cooling water withdrawals coupled with an improved screening system to reduce entrainment and impingement. These requirements are as stringent as, or more stringent than, the limits in the current permit and should yield substantial environmental improvements. EPA has coordinated with MassDEP on the development of this permit and expects that the MassDEP will find, consistent with EPA's assessment, that the limits proposed in the draft permit will satisfy the State's antidegradation requirements. EPA concludes that the draft permit will not result in any degradation of the water quality in the Saugus River and will, instead, enhance the protection of the river and its aquatic life.

accordance with good engineering practices and identify potential sources of pollutants, which may reasonably be expected to affect the quality of stormwater discharges associated with industrial activity from the facility. The SWPPP, upon implementation, will become a non-numerical effluent limitation or other condition that supports any numerical effluent limitations in the draft permit. Consequently, the SWPPP is equally as enforceable as the numerical limits.

The SWPPP development process involves the following four main steps:

(1) Form a team of qualified facility personnel who will be responsible for developing and updating the SWPPP and assisting the plant manager in its implementation;
(2) Assess the potential stormwater pollution sources;
(3) Select and implement appropriate management practices and controls for these potential pollution sources;
(4) Periodically reevaluate the effectiveness of the SWPPP in preventing stormwater contamination and in complying with the terms and conditions of the draft permit;

Additionally, the permittee shall develop and implement a plan for controlling infiltration of groundwater and inflow of non-allowable non-stormwater flows to the Drainage System. The plan shall be submitted to EPA and MassDEP within six (6) months of the effective date of this permit. The plan shall include an ongoing program to identify and remove sources of infiltration and inflow, and an inflow identification and control program that focuses on the disconnection and redirection of non-allowable non-stormwater flows. A summary report of all actions taken to minimize infiltration and inflow during the previous calendar year shall be submitted to EPA and MassDEP annually, by March 31st. The summary report shall, at a minimum, include: a map and a description of inspection and maintenance activities conducted and corrective actions taken during the previous year; a map with areas identified for infiltration and inflow investigation/action in the coming year; and a calculation of the annual average infiltration and inflow and the maximum monthly infiltration and inflow for the reporting year.

Additionally, the draft permit requires development and implementation of the following site-specific BMPs, at a minimum:

a. The permittee shall eliminate all discharges during dry weather[71] conditions through the Drainage System Outfall vaults (Outfall Serial Numbers 001, 007, 010, 019, 027B, 028, 030, and 031). To achieve this, the permittee shall develop and implement the following BMPs, at a minimum:
   i. The Drainage System Outfall gates shall only open during wet weather[71], after the first flush of pollutants (along with non-allowable non-stormwater flows in the vaults) has been transferred to the CDTS for treatment.

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[71] For the purposes of this permit, at any time weather conditions are considered either "wet weather" conditions or "dry weather" conditions. Wet weather is defined as any time period that begins with an hour that received 0.1 inches or more of rainfall (or equivalent precipitation) and continues until two hours past the last hour that precipitation is recorded. Dry weather is any time which is not wet weather.

   ii. The Drainage System Outfall gates shall remain closed, and without leaks, during all periods of dry weather.

b. The permittee shall eliminate, to the maximum extent practicable, the discharge of non-stormwater flows (other than "allowable non-stormwater flows")[72] either alone or commingled with stormwater directly to the receiving water. To achieve these two objectives, the permittee shall implement all practicable steps including, but not limited to, the following BMPs:
   i. Reconfigure the vault system to ensure that during dry weather all flows in the Drainage System are transferred to the CDTS for treatment prior to discharge.
   ii. Operate the Drainage System vaults, outfalls and pumps so that the first-flush of stormwater flow (first 30 minutes of stormwater flow) commingled with non-stormwater flow (including contaminated groundwater) is not discharged directly to the Saugus River and is, instead, conveyed to the CDTS for treatment. If the permittee determines that this is presently infeasible due to capacity limitations of the system, then the permittee must evaluate what steps would be needed to make it feasible, including increasing pumping capacity, storage capacity and/or the treatment capacity of the CDTS, or reducing sources of infiltration to the system to free up existing capacity. Such evaluation must be submitted to EPA and the MassDEP for review in an annual report, due by March 31st each year.
   iii. Manually operate the transfer pumps in all eight vaults during the days leading up to a significant storm event to reduce the non-stormwater flows to the low level in the vaults and, as a result, to help eliminate, to the maximum extent practicable, the amount of non-allowable non-stormwater flows that are commingled with stormwater flows in the Drainage System vaults and discharged to the Saugus River from the Drainage System Outfalls.
   iv. Evaluate the feasibility of operating the Drainage System Outfall vault gates so that they remain closed when the water reaches the high-high level in the vault, and the pumps continue to transfer the water to the CDTS for treatment, to the maximum extent practicable.
   v. Isolate each source of non-allowable non-stormwater flow, to the maximum extent practicable, and re-pipe it directly to the CDTS for treatment.

c. During wet weather conditions, during periods leading up to forecasted wet weather conditions, and whenever any outfall gate is open, eliminate, to the maximum extent practicable, the generation of non-allowable non-stormwater flows that would be discharged from the Drainage System Outfalls (Outfall Serial Numbers 001, 007, 010, 019, 027B, 028, 030, and 031). To satisfy this requirement, the following discharges are prohibited:
   i. Intermittent discharges during wet weather and during periods leading up to forecasted wet weather conditions. Intermittent discharges consist of: de-aerator storage tanks, building 64-A sump, test cell washdown, stormwater collected in secondary containment dikes and truck loading areas, hydrant testing, sprinkler system testing water, stormwater dye tracing.
   ii. Any discharges from cleaning processes during wet weather, and during periods leading up to forecasted wet weather conditions. Such cleaning processes

[72] "Non-stormwater flows other than 'allowable non-stormwater flows'" are herein referred to as "non-allowable non-stormwater flows."

include, at a minimum, drain cleanouts (including drain system cleaning) and roof mounted air conditioner washing (no detergent).

iii. Any discharge from routine maintenance that generates wastewater discharges during wet weather and during periods leading up to forecasted wet weather conditions, to the maximum extent practicable. Routine maintenance consists of: boiler startup/soot blower drains/boiler draining for maintenance (intermittent), boiler filter backwash, ion exchange regeneration and backwash.

iv. Any discharge from any remaining non-allowable non-stormwater discharge flows during wet weather and during periods leading up to forecasted wet weather conditions, to the maximum extent practicable. These non-allowable non-stormwater flows include, at a minimum, potable water used upon NCCW system failure, steam conduit water, excavation dewatering, contaminated groundwater, cooling water (not including the discharges of NCCW through Outfalls 014 and 018), condensate blowdown, steam conduit blowdown, boiler blowdown, and cooling tower blowdown.

d. In the event of any generation of nonallowable non-stormwater flows during wet weather conditions, or during periods leading up to forecasted wet weather conditions (as identified immediately above in Parts i-v), the permittee shall record the type of flow generated, the corresponding weather conditions, the reason the flow was generated during wet weather conditions, and the fate of the non-stormwater flow in question. The permittee shall submit this information to EPA-NE in an annual report, due by March 31st each year.

e. Eliminate the discharge of contaminated groundwater infiltration to the receiving water at Outfalls 014, 018, and 020. At a minimum, the permittee shall develop and implement the following site-specific BMPs:

i. Inspect outfall pipelines to determine the extent of contaminated groundwater infiltration to all outfalls which discharge directly to the receiving water, and upgrade or replace any leaking pipelines;

ii. Upgrade pipe lining integrity at pipes contributing to outfalls which are expected to discharge contaminated groundwater infiltration directly to the receiving water. The lining of the systems shall include complete internal sand blasting of the pipe, complete sealing of the internal structure with applied liquid sealant, installation of fiberglass type material, and a final layer of liquid finish coating;

iii. Or if pipeline rehabilitation is infeasible, develop and implement a plan for pipeline replacement.

iv. Provide an annual report on the progress of the pipe rehabilitation and replacement until the permittee certifies that no groundwater is discharged through Outfalls 014, 018, or 020. The annual report is due by March 31st each year.

f. Inspect all stormwater collected within the secondary containment areas at the jet fuel farm, around tanks, in the truck unloading ramps, in the Outfall 032 drainage area, and from other areas for evidence of an oil sheen or other contamination prior to such water being routed to the CDTS. In the event that a sheen is observed, the permittee shall eliminate the sheen prior to discharging the water from the containment area or dispose of the water offsite.

g. Perform regular cleaning of the Drainage System pipelines. Dispose of all solids offsite which are accumulated as a result of the cleaning. Minimize the amount of solids left behind in the storm drains and dispose of all collected solids off-site in a manner that complies with federal, State and local laws, regulations and ordinances. Ensure all drainage system cleaning water is disposed of offsite or goes directly to the CDTS for treatment.
h. Ensure the sonic sensor in each outfall vault is operated normally so that the water level in the skimming chamber is never lower than the baffle designed to retain floating material for skimming. The permittee shall report any instances when this is not the case to EPA-NE on an annual basis.
i. Develop and implement a written schedule for inspection and cleaning of all oil/water separators at each Drainage System Outfall vault on a regular basis.
j. Prior to washing roof mounted air conditioner (AC) units, inspect each AC unit for the presence of any visible oil and grease spots or spills. If any such oil and grease is found, manually remove according to normal spill clean-up protocol before any spray washing begins.
k. Containerize any wash water containing detergent and remove offsite for subsequent treatment or disposal.
l. Discharge of any water containing additives (except cooling water authorized for discharge through Outfall 018 or 014) is prohibited. Transfer any discharge containing additives (except cooling water authorized for discharge through Outfall 018 or 014) to the CDTS for treatment.
m. BMPs consistent with the sector specific BMPs included in Sector AB (Transportation equipment, industrial or commercial machinery) and Sector O (Steam Electric Generating Facilities) of the MSGP.

10. Section 316(b) determination

For this permit, EPA is making a 316(b) determination for this facility on a BPJ basis. EPA has considered the design, construction, and capacity of the existing CWISs, improvements proposed by GE Aviation, available technologies, and potential adverse environmental impacts and determined that the following measures represent BTA. This determination is set forth in Attachment J, *Assessment of Cooling Water Intake Structure (CWIS) Technologies and Determination of Best Available Technology (BTA) under Section 316(b)*, to this fact sheet. The draft permit at Part I.C requires the facility to implement changes to the current CWISs to reflect the BTA to minimize the adverse environmental impacts associated with impingement and entrainment.

a. Power Plant CWIS

To minimize impingement mortality, the permittee shall reduce the through-screen velocity at any new or existing screening system to a level no greater than 0.5 fps.

To minimize entrainment, the permittee shall either (a) maintain a year-round monthly average intake flow of 28.7 MGD, commensurate with a 20% reduction in average monthly flow from the current permit; *and* install and operate a fine mesh wedgewire screen with a slot or mesh size no greater than 0.5 mm and a pressurized system to clear debris from the screens; *or* (b) maintain a year-round maximum daily intake flow commensurate with the operation of a closed-cycle cooling system.

b. Test Cell CWIS

To minimize impingement, the permittee shall improve the existing coarse mesh traveling screen with new fiberglass fish lifting buckets, a low pressure spraywash, separate fish and debris return troughs, and a new return trough that avoids high elevation drops and 90-degree turns, and that returns fish to a location that minimizes potential for re-impingement and is submerged at all tidal stages.

To minimize entrainment, the permittee shall operate the CWIS with an average monthly limit of 5 MGD from March 1 to July 31 and an average monthly limit of 27 MGD from August 1 to February 28.

11. Biological Monitoring

The permit's monitoring requirements have been established to yield data representative of the facility's pollutant discharges and CWIS operations under the authority of Sections 308(a) and 402(a)(2) of the CWA and consistent with 40 C.F.R. §§ 122.41 (j), 122.43(a), 122.44(i) and 122.48.

EPA has determined on a site-specific, BPJ basis that the requirements in Part I.C of the draft permit will ensure that the facility's CWISs reflect the BTA for this specific facility and will minimize entrainment and impingement of all life stages of fish. The draft permit at Part I.D requires monitoring impingement and entrainment of aquatic organisms to confirm EPA's evaluation of the likely environmental impact on the aquatic community of the Saugus River resulting from the design and operational changes to the facility's CWISs.

The draft permit at Part I.A. requires effluent monitoring during wet weather events to determine if the potential discharge of contaminated groundwater infiltration could result in the discharge of potentially harmful levels of metals, polychlorinated biphenyls (PCBs), or polycyclic aromatic hydrocarbons (PAHs) from the facility's drainage outfalls. In support of this effluent monitoring, EPA has proposed a limited bioaccumulation survey using the blue mussel (*Mytilus edulis*). Mussels are particularly suited for monitoring water quality because contaminant levels in their tissue respond to changes in ambient environmental levels and accumulate with little metabolic transformation. Since 1986, NOAA's Mussel Watch Program has used the bioaccumulation properties of mussels and other shellfish in a long-term ecosystem monitoring program to assess contamination of the coastal zone on a national scale.[73] EPA's *Technical Support Document for Water Quality-based Toxics Control*

[73] Kimbrough, KL, WE Johnson, GG Lauenstein, JD Christensen, DA Apeti. 2008. An Assessment of Two Decades of Contaminant Monitoring in the Nation's Coastal Zone. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 74. 105 pp.

recommends the use of biological assessments as a method to detect the aggregate effect of impacts upon an aquatic community, including identifying where site-specific criteria modifications may be needed to protect a waterbody, and in evaluating the effectiveness and documenting the biological benefits of pollution controls in the receiving water (Section 1.4.1, p. 18-19). The results from the mussel bioaccumulation study will provide valuable information on the potential biological impacts resulting from the discharge of contaminated groundwater at GE Aviation and will support future evaluations of the effectiveness of the proposed requirements to minimize the discharge of non-allowable, non-stormwater discharges.

The biological monitoring studies proposed in the draft permit are reasonable and appropriate in light of the need to gather data to ensure that the permit, and future renewals of it, will comply with the CWA and the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §§ 1801, et. seq.

## VI. ENDANGERED SPECIES ACT (ESA)

Section 7(a) of the Endangered Species Act of 1973, as amended (ESA), grants authority to and imposes requirements upon Federal agencies regarding the conservation of endangered and threatened species of fish, wildlife, or plants ("listed species"), and the habitat of such species that has been designated as critical ("critical habitat"). The ESA requires Federal agencies, in consultation with and with the assistance of the Secretary of Interior, to insure that any action that they authorize, fund, or carry out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The United States Fish and Wildlife Service (USFWS) typically administers Section 7 consultations for birds and terrestrial and freshwater aquatic species, while the National Marine Fisheries Service (NMFS) typically administers Section 7 consultations for marine species and anadromous fish.

EPA has reviewed the listing of federal endangered or threatened species of fish, wildlife, and plants to see if any such listed species might potentially be impacted by the reissuance of this NPDES permit and has not found any such listed species. Upon review of the current endangered and threatened species in the area, EPA has determined that there are no listed species expected to be present in the vicinity of the outfalls or CWISs of this Facility. Therefore, EPA does not need to consult with NMFS or USFWS under the ESA because EPA's permitting action will not affect listed species.

During the public comment period, EPA has provided a copy of the draft permit and fact sheet to both NMFS and USFWS.

## VII. ESSENTIAL FISH HABITAT (EFH)

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq. (1998)), EPA is required to consult with the National Marine Fisheries Services (NMFS) if EPA's action or proposed actions that it funds, permits, or undertakes, may adversely impact essential fish habitat such as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. § 1802 (10)). Adversely impact means any impact which reduces the quality and/or quantity of EFH (50 C.F.R. § 600.910(a)). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

EFH is only designated for species for which federal fisheries management plans exist (16 U.S.C. § 1855(b) (1) (A)). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999. The following is a list of the EFH species and applicable life stage(s) for Massachusetts Bay, to which the Saugus River discharges:

| Species | Eggs | Larvae | Juveniles | Adults |
|---|---|---|---|---|
| Atlantic cod (*Gadus morhua*) | X | X | X | X |
| haddock (*Melanogrammus aeglefinus*) | X | X | | |
| Pollock (*Pollachius virens*) | X | X | X | X |
| Whiting (*Merluccius bilinearis*) | X | X | X | X |
| Red hake (*Urophycis chuss*) | X | X | X | X |
| white hake (*Urophycis tenuis*) | X | X | X | X |
| Winter flounder (*Pseudopleuronectes americanus*) | X | X | X | X |
| yellowtail flounder (*Pleuronectes ferruginea*) | X | X | X | X |
| windowpane flounder (*Scopthalmus aquosus*) | X | X | X | X |
| American plaice (*Hippoglossoides platessoides*) | X | X | X | X |
| ocean pout (*Macrozoarces americanus*) | X | X | X | X |
| Atlantic halibut (*Hippoglossus hippoglossus*) | X | X | X | X |
| Atlantic sea scallop (*Placopecten magellanicus*) | X | X | X | X |
| Atlantic sea herring (*Clupea harengus*) | | X | X | X |
| Long finned squid (*Loligo pealei*) | n/a | n/a | X | X |
| Short finned squid (*Illex illecebrosus*) | n/a | n/a | X | X |
| Atlantic butterfish (*Peprilus triacanthus*) | X | X | X | X |
| Atlantic mackerel (*Scomber scombrus*) | X | X | X | X |

| | | | | |
|---|---|---|---|---|
| summer flounder (*Paralicthys dentatus*) | | | | X |
| Scup (*Stenotomus chrysops*) | n/a | n/a | X | X |
| black sea bass (*Centropristus striata*) | n/a | | X | X |
| Surf clam (*Spisula solidissima*) | n/a | n/a | X | X |
| bluefin tuna (*Thunnus thynnus*) | | | X | X |

A review of past studies indicates that multiple life stages of several of these species are present in the Saugus River in the vicinity of the discharge. Refer to **Tables 1 through 4**. Therefore, EPA has determined that this facility's operation has the potential to adversely affect EFH species in the Saugus River. These effects may be direct or indirect. For example, entrainment or impingement of an EFH species by the facility would be a direct effect. Harm to species that are not EFH species themselves, but serve as prey species for EFH species, could indirectly harm the EFH species. Here, anadromous fish species such as alewife and American shad enter the Saugus River from Massachusetts Bay and move past the facility to spawn upstream. These fish may be affected by the facility's thermal discharge plumes and/or its the cooling water intake operations. They are not EFH species, but may be selected as prey by EFH species. If facility operations affect these prey species, they may also indirectly affect EFH species through loss of prey.

Based on the available information, EPA has concluded that the limits and conditions contained in this draft permit will minimize adverse effects to EFH species. These conditions are discussed in detail above. They include the following: requirements for reduced intake flow to minimize potential adverse impacts from entrainment and impingement, particularly as it occurs during periods of peak larval density; installation of upgraded screening systems to reduce entrainment and maximize the survival of any organisms impinged on the new screens, including requirements for low through-screen velocity; and improvements to the fish return system to minimize potential adverse impacts from impingement associated with the CWIS. Additionally, the permit's limits on thermal discharges will assure the protection and propagation of the Saugus River's BIP, and the other effluent limits in the permit will satisfy technology-based requirements and Massachusetts WQS.

EPA believes the draft permit adequately protects EFH species, and therefore additional mitigation is not warranted. EPA will consult with NMFS regarding this draft permit and will send NMFS a copy of the draft permit and fact sheet.

## VIII. MONITORING AND REPORTING

The effluent monitoring requirements have been established to yield data representative of the discharge under authority of Section 308 (a) of the CWA in accordance with 40 CFR §§122.41 (j), 122.44 (l), and 122.48.

The draft permit includes new provisions related to Discharge Monitoring Report (DMR) submittals to EPA and the State. The draft permit requires that, no later than one year after the effective date of the permit, the permittee submit all monitoring data and other reports required by the permit to EPA using NetDMR, unless the permittee is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for submitting DMRs and reports ("opt-out request").

In the interim (until one year from the effective date of the permit), the permittee may either submit monitoring data and other reports to EPA in hard copy form, or report electronically using NetDMR.

NetDMR is a national web-based tool for regulated Clean Water Act permittees to submit discharge monitoring reports (DMRs) electronically via a secure Internet application to U.S. EPA through the Environmental Information Exchange Network. NetDMR allows participants to discontinue mailing in hard copy forms under 40 CFR § 122.41 and § 403.12. NetDMR is accessed from the following url: http://www.epa.gov/netdmr. Further information about NetDMR, including contacts for EPA Region 1, is provided on this website.

EPA currently conducts free training on the use of NetDMR, and anticipates that the availability of this training will continue to assist permittees with the transition to use of NetDMR. To participate in upcoming trainings, visit http://www.epa.gov/netdmr for contact information for Massachusetts.

The draft permit requires the permittee to report monitoring results obtained during each calendar month using NetDMR, no later than the 15th day of the month following the completed reporting period. All reports required under the permit shall be submitted to EPA as an electronic attachment to the DMR. Once a permittee begins submitting reports using NetDMR, it will no longer be required to submit hard copies of DMRs or other reports to EPA and will no longer be required to submit hard copies of DMRs to MassDEP. However, permittees must continue to send hard copies of reports other than DMRs to MassDEP until further notice from MassDEP.

The draft permit also includes an "opt-out" request process. Permittees who believe they can not use NetDMR due to technical or administrative infeasibilities, or other logical reasons, must demonstrate the reasonable basis that precludes the use of NetDMR. These permittees must submit the justification, in writing, to EPA at least sixty (60) days prior to the date the facility would otherwise be required to begin using NetDMR. Opt-outs become effective upon the date of written approval by EPA and are valid for twelve (12) months from the date of EPA approval. The opt-outs expire at the end of this twelve (12) month period. Upon expiration, the permittee must submit DMRs and reports to EPA using NetDMR, unless the permittee submits a renewed opt-out request sixty (60) days prior to expiration of its opt-out, and such a request is approved by EPA.

Until electronic reporting using NetDMR begins, or for those permittees that receive written approval from EPA to continue to submit hard copies of DMRs, the draft permit requires that submittal of DMRs and other reports required by the permit continue in hard copy format. Hard copies of DMRs must be postmarked no later than the 15th day of the month following the completed reporting period.

## IX. STATE CERTIFICATION REQUIREMENTS

EPA may not issue a permit unless the State Water Pollution Control Agency with jurisdiction over the receiving waters certifies that the effluent limitations contained in the permit are stringent enough to assure that the discharge will not cause the receiving water to violate State Water Quality Standards. The staff of the Massachusetts Department of Environmental Protection has reviewed the draft permit and advised EPA that the limitations are adequate to protect water quality. EPA has requested permit certification by the State pursuant to 40 CFR 124.53 and expects that the draft permit will be certified.

## X. ADMINISTRATIVE RECORD, PUBLIC COMMENT PERIOD, HEARING REQUESTS, AND PROCEDURES FOR FINAL DECISION

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to Nicole Kowalski, U.S. EPA, Office of Ecosystem Protection, Industrial Permits Branch, 5 Post Office Square, Suite 100 (OEP06-4), Boston, Massachusetts 02109-3912. Any person, prior to such date, may submit a request in writing for a public hearing to consider the draft permit to EPA and the State Agency. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public meeting may be held if the criteria stated in 40 C.F.R. § 124.12 are satisfied. In reaching a decision on the final permit, the EPA will respond to all significant comments and make these responses available to the public on EPA's website and at EPA's Boston office.

Following the close of the comment period, and after any public hearings, if such hearings are held, the EPA will issue a Final Permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days following the notice of the Final Permit decision, any interested person may submit a petition for review of the permit to EPA's Environmental Appeals Board consistent with 40 C.F.R. § 124. 19.

## XI. EPA & MassDEP CONTACTS

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays, from the EPA and MassDEP contacts below:

Nicole Kowalski, EPA New England – Region 1
5 Post Office Square, Suite 100 (OEP06-4)
Boston, Massachusetts 02109-3912
Telephone: (617) 918-1746 FAX: (617) 918-0746
email: kowalski.nicole@epa.gov

Kathleen Keohane, Massachusetts Department of Environmental Protection
Division of Watershed Management, Surface Water Discharge Permit Program
627 Main Street, 2nd Floor
Worcester, Massachusetts 01608
Telephone: (508) 767-2856 FAX: (508) 791-4131
email: kathleen.keohane@state.ma.us

________________
Date

Stephen S. Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency

## XII. ATTACHMENTS

**A. Outfall Flow History and Detail**

**B. Location of GE Lynn River Works Facility (site map)**

**C. River Works NPDES Outfalls/Intakes**

**D. Typical Outfall on the Saugus River (Diagram of Drainage System Outfall Vault)**

**E. Process Flow Diagram - Consolidated Drains Treatment System**

**F. Water Treatment Chemicals Potentially Discharged to the Storm Drain [Drainage System]**

**G. DMR Data Summary**

**H. GE Aviation Stormwater Sampling Results**

**I. GE Aviation Process Water Sampling Results**

**J. Assessment of Cooling Water Intake Structure (CWIS) Technologies and Determination of Best Available Technology (BTA) under Section 316(b)**

**K. Thermal Analysis from Derivation of Permit Limits for Wheelabrator Saugus (NPDES Permit No. MA0028193)**

# Attachment A

Outfall Flow History and Detail
*General Electric Aircraft Engines*
*NPDES Permit Application Amendment*

| Outfall No. | Operation | | Original Permit exp 1993 Feb-90 | Daily Flow Limitation (MGD) | Monitoring Requirements Limits O&G | VOC | pH | Temp | Other | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 001 [1,2,3,4,5] | Dry weather flows are directed to Drain 007 then to CDTS, Outfall 027 | Dry | 3,000 gpd | | | | | | | Pumps To 007; No Dry Limits |
| | Stormwater | Wet | 90,965 gpd | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Quarterly 6.5-8.5 | | | |
| 003 | Emergency Non-Contact Cooling Water (NCCW) | Dry | 300,000 gpd | 0.55 Avg. Mo.1.4 Max. Day | | | Weekly 6.5-8.5 | Weekly/95 Avg. Mo. 105 Max. day | | Emergency Cooling Water Only |
| 005 | Emergency Non-Contact Cooling Water | Dry | 110,000 gpd | 0.55 Avg. Mo.1.4 Max. Day | | | Weekly 6.5-8.5 | Weekly/95 Avg. Mo. 105 Max. day | | Emergency Cooling Water Only |
| 007 [1,2,3,4,5] | Dry weather flows from 001<br>Condensate from steam heating and air conditioning systems (seasonal)<br>Steam conduit water discharge<br>Emergency Non-Contact Cooling Water (NCCW)<br>Dry weather flows are directed to CDTS, Outfall 027<br>Total Dry + NCCW | Dry | 20,000 gpd<br>266,000 gpd<br>286,000 gpd | Emergency 0.3 Avg. Mo. 1.0 Max. Day Other 0.24 Avg. Mo. 0.24 Max. Day | | | Weekly 6.5-8.5 | Emergency Weekly/95 Avg. Mo.: 105 Max. day Other Weekly/90 | | ACO eliminated Dry Weather Flow Limitations and Monitoring requirements; Dry Weather Limits Discontinued; Receives Dry Weather Flows from 001; |
| | Stormwater | Wet | 1.35 mgd | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Quarterly 6.5-8.5 | | | |
| 009 | Non-Contact Cooling Water from heat exchangers & dynamometer instruments in engine test cells.<br>Floor Drains<br>Total Dry Weather | Dry | 150,000 gpd<br>200 gpd<br>150,200 gpd | | | | | | | CLOSED: Re-routed to Outfall 010 Early 90's |
| | Stormwater | Wet | 26,180 gpd | | | | | | | |
| 010 [1,2,3,4,5] | Condensate from steam heating and air conditioning systems (seasonal)<br>Non-Contact Cooling Water from Industrial heat exchangers.<br>Dry weather flows are directed to CDTS, Outfall 027<br>Total Dry Weather | Dry | 0.9 mgd<br>0.9 mgd | 5.36 Avg. Mo. 7.18 Max. Day | | | Weekly 6.5-8.5 | Weekly/85.2 Avg. Mo.: 90 Max. day | | ACO eliminated Dry Weather Flow Limitations and Monitoring requirements; Dry Weather Limits Discontinued |
| | Stormwater | Wet | | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Quarterly 6.5-8.5 | | | |
| 013 | Non-Contact Cooling Water from manufacturing operations.<br>Non-Contact Cooling Water from dynamometer.<br>Steam Condensate.<br>Total Dry Weather | Dry | 36,000 gpd<br>150,000 gpd<br>10,000 gpd<br>196,000 gpd | | | | | | | CLOSED: Re-routed to Outfall 010 Early 90's |
| | Stormwater | Wet | 768,570 gpd | | | | | | | |
| 014 | Non-Contact Cooling Water from aircraft engine test facility heat exchangers<br>Condensate Blowdown<br>Engine & Compressor Test Facility NCCW<br>Total Dry Weather | Dry | 22.3 mgd<br>300,000 gpd<br>22.6 mgd | 27 Avg. Mo. 45 Max. Day | | | Weekly 6.5-8.5 | Weekly/90 Avg. Mo.: 95 Max. day | | TEST CELL RIVER CWS; City water substituted for cooling (EPA Letter 10/27/97 0 Anti-foam agent added (14A) |
| 015 | Non-Contact Cooling Water from Industrial heat exchangers.<br>Steam Condensate<br>Floor Drains<br>Total Dry Weather | Dry | 15,000 gpd<br>250 gpd<br>250 gpd<br>15,500 gpd | | | | | | | CLOSED: Re-routed to Outfall 019 Early 90's |
| | Stormwater | Wet | 21,505 gpd | | | | | | | |
| 017 | Contact Cooling Water.<br>Total Dry Weather | Dry | 5,000 gpd<br>5,000 gpd | | | | | | | CLOSED: Re-routed to Outfall 019 Early 90's |
| | Stormwater | Wet | 50,490 gpd | | | | | | | |
| 018 | Non-contact cooling water (river water) from power plant generating equipment<br>Turbine condensate (intermittent)<br>Boiler startup/soot blower drains/boiler draining for maintenance (intermittent)<br>Boiler Filter Backwash & Ion Exchange Regeneration & Backwash<br>De-aerator storage tanks (intermittent)<br>Steam condensate return from steam users (seasonal)<br>Boiler blowdown<br>Total Dry Weather | Dry | 33.0 mgd<br>10,000 gpd<br>19,000 gpd<br>200 gpd<br>33.3 mgd | 35.6 Avg. Mo. 35.6 Max. Day | | | Weelky 6.5-8.5 | Weekly/90 Avg. Mo.:95 Max. day | | POWER PLANT CWS:<br>Anti-foamAgent added (18A) |
| | Stormwater | Wet | 129,030 gpd | | | | | | | |

| Outfall No. | Operation | | Original Permit exp 1993 Feb-90 | Daily Flow Limitation (MGD) | Monitoring Requirements Limits O&G | VOC | pH | Temp | Other | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 019 [1,2,3,4,5] | Steam condensate return from steam users (intermittent)<br>Emergency steam condensate from small engine component testing<br>Boiler filter backwash, ion exchange regeneration & backwash (intermittent)<br>Condensate from steam heating and air conditioning systems (seasonal)<br>Dry weather flows are directed to CDTS, Outfall 027 | | | 0.083 Avg. Mo. | | | Weekly 6.5-8.5 | Weekly/88.4 Avg. Mo.: 90 Max. day | Momthly Report on Silver and Mercury | Silver and Mercury monitoring no longer requ's (EPA Letter 1/15/98) ACO eliminated Dry Weather Flow Limitations and Monitoring requirements |
| | Stormwater | Wet | 18,700 gpd | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Quarterly 6.5-8.5 | | | |
| 020 | Unused NCCW from power generation equipment (river water bypass)<br>Steam Condensate<br>Total Dry Weather | Dry | 16.9 mgd<br>25,000 gpd<br>16.93 mgd | 16.90Avg. Mo. | | | Weekly 6.5-8.5 | | | NOT AN OUTFALL - BYPASS ONLY; Dry and wet weather flow discontinued June 2000, only unused river water discharges - no monitoring required (EPA LETTER 6/21/04) |
| | Stormwater | Wet | 12,155 gpd | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Quarterly 6.5-8.5 | | | **Storm water rerouted to Outfall 027 (EPA Letter 4/25/2000) Dry and wet weathewr flow discontinued June 2000, only unused river water discharges - no monitoring required (EPAletter 6/21/04** |
| 021 | NCCW from power generation equipment<br>Cellar drainange from steam turbine balancing operation<br>Total Dry Weather | Dry | 7.2 mgd<br>500 gpd<br>7.2 mgd | | | | | | | CLOSED: Outfall Eliminated |
| | Stormwater | Wet | 4,675 gpd | | | | | | | |
| 027 [2,3,4,5,6] | Dry weather flows from 001 and 007<br>Dry weather flows from 010<br>Dry weather flows from 019<br>Dry weather flows from 028 and 030<br>Dry weather flows from 031<br>Bldg 64-A sump (intermittent)<br>Steam condensate return from steam users (intermittent)<br>Oil Cooler Cooling Water (intermittent)<br>Air Vacuum Cooling Water (intermittent)<br>Steam Conduit Water<br>Cooling tower blowdown<br>Rain water collected in secondary containment dikes and truck loading areas<br>Dry weather flows are directed to CDTS and treated before discharge<br>Total Dry Weather | Dry | 8,000 gpd<br>8,000 gpd | 0.3 Avg. Mo.<br>0.83 Max. Day | Weekly 10mg/l Avg. Mo. 15mg/l Max Day | | Weekly 6.50-8.5 | Weekly/85 Avg. Mo.:90 Max. Day | Monthly Benzene 5 ug/l BTEX 100 ug/l PCB's BDL | ACO permits 0.05 mgd Avg. Mo. & 1.0 MGD Max. Day Building 64 treatment system rerouted to City Sewer |
| | Stormwater | Wet | 1.35+0.046 mgd | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Weekly 6.50-8.5 | | | **Wet weather at 027 includes redirected Wet Weather from Outfall 020.** |
| 028 [1,2,3,4,6] | Steam Condensate (seasonal)<br>Emergency Non-Contact Cooling Water (NCCW) from Nitriding/Carburizing process<br>Dry weather flows are directed to 030 then to CDTS, Outfall 027<br>Total Dry Weather | Dry | 5,000 gpd<br>5,000 gpd | 0.0036 Avg. Mo.<br>0.0048 Max. Day | | Monthly Report | Weekly 6.50-8.5 | Weekly/85 Avg. Mo.:90 Max. Day | | PUMPS TO 030; Dry Weather Limits Discontinued; ACO eliminated Dry Flow Limitations and Momitoring requirements |
| | Stormwater | Wet | 632,060 gpd | None | Quarterly wet Weather/10 mg/l Avg. Mo | | Quarterly 6.5-8.5 | | | |
| 029 | NCCW (river water) and steam condensate from production test equipment. | Dry | 42.0 mgd | 28.8 Avg. Mo.<br>54.7 Max. Day | | | Weekly 6.5-8.5 | Weekly/90 Avg. Mo.:95 Max. Day | Monthly Report on Cadmium & Chromium | GEAR PLANT CWIS; OUT OF SERVICE; Condensate rerouted to 028 (EPA letter 4/25/2000) Cadmium and Chromium monitoring no longer req's (EPA Letter 1/5/98) |

| Outfall No. | Operation | | Original Permit exp 1993 Feb-90 | Daily Flow Limitation (MGD) | Monitoring Requirements Limits O&G | VOC | pH | Temp | Other | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 030 [1,2,3,4,5] | 028 dry weather flows<br>Non-Contact cooling water from heat exchangers.<br>Dry weather flows are directed to CDTS<br>Total Dry Weather | Dry | 50,000 gpd<br>**50,000 gpd** | | | | | | | Dry Weather Limits Discontinued<br>Receives Dry Weather from 028 |
| | **Stormwater** | Wet | **529,210 gpd** | **None** | **Quarterly wet Weather/10 mg/l Avg. Mo** | | **Quarterly 6.5-8.5** | | | |
| 031 [1,2,3,4,5] | Steam conduit discharge<br>Cooling tower blowdown<br>Test cell washdown water (intermittent)<br>Condensate from air receivers<br>Dry weather flows aredirected to CDTS<br>Total Dry Weather | Dry | 8,000 gpd<br>350,000 gpd<br>700 gpd<br>**358,700 gpd** | **0.762 Avg. Mo.<br>2.2 Max Day** | | **Monthly Report** | **Weekly 6.5-8.5** | **Weekly/90 Avg. Mo.:90 Max. day** | | ACO eliminated Dry Weather Flow Limitations and Monitoring requirements |
| | Stormwater | Wet | **2.7 mgd** | **None** | **Quarterly wet Weather/10 mg/l Avg. Mo.** | | **Quarterly 6.5-8.5** | | | |
| 032 | Stormwater Collection in Fuel Farm Containment Dikes | Wet | **33,335 gpd** | **None** | | | **Weekly 6.5-8.5** | | | Corrected to quarterly pH (EPA Letter 4/14/97) Discharge from outfall eliminated 2/8/02: storm water now pumped for treatment and discharge through 027 |

[1] Discharge to outfall only when drain flow exceeds pumping capacity during storm events and/or maintenance activities and power failures.

[2] This drain is subject to groundwater infiltration. Also, when catch basins and manholes are cleaned out and sediment is removed, water is poured back into drain system.

[3] Hydrant testing: Approximately 1,000 gallons per hydrant; 90 hydrants facility-wide.

[4] Sprinkler (fire protection) system testing for each building results in city water discharge; volume depends upon size of system.

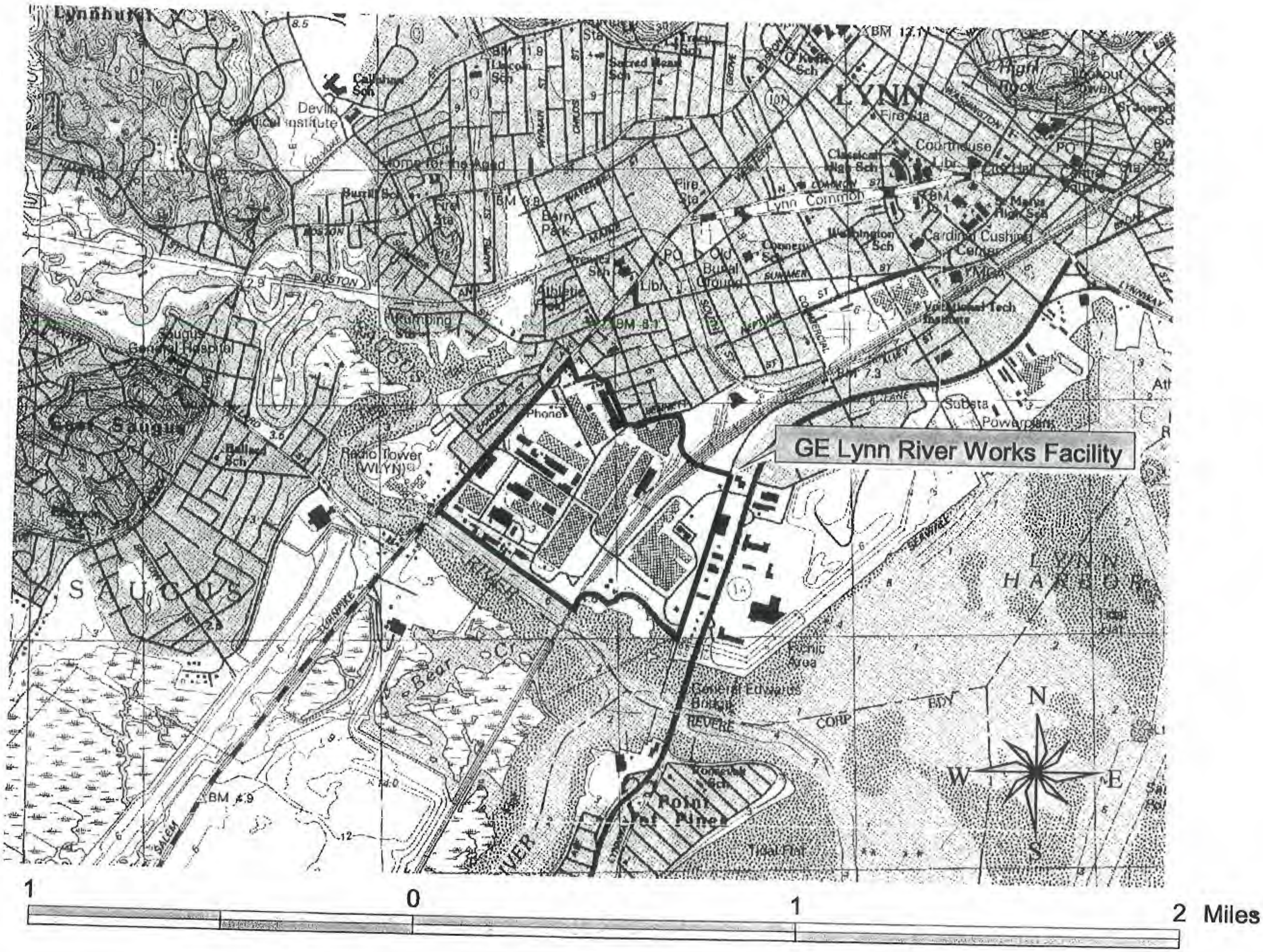
[5] When non-contact cooling water systems fail, city water is used during repairs to continue operations; discharge is intermittent, infrequent, emergency only.

[6] Once the consolidated drains treatment system is on line, Outfalls 001, 007, 010, 019, 028, 030, and 031 will have slide gates closed, and dry weather flow from these drains (with the exception of leakage around the gate seals) will be pumped to the treatment system . The design average discharge through Outfall 027 is 300 gpm, and the max flow of 500 gpm is based on the EQ tank pump rating (assuming that is the only treatment).

Shaded areas indicate drain systems that are pumped to the CDTS.

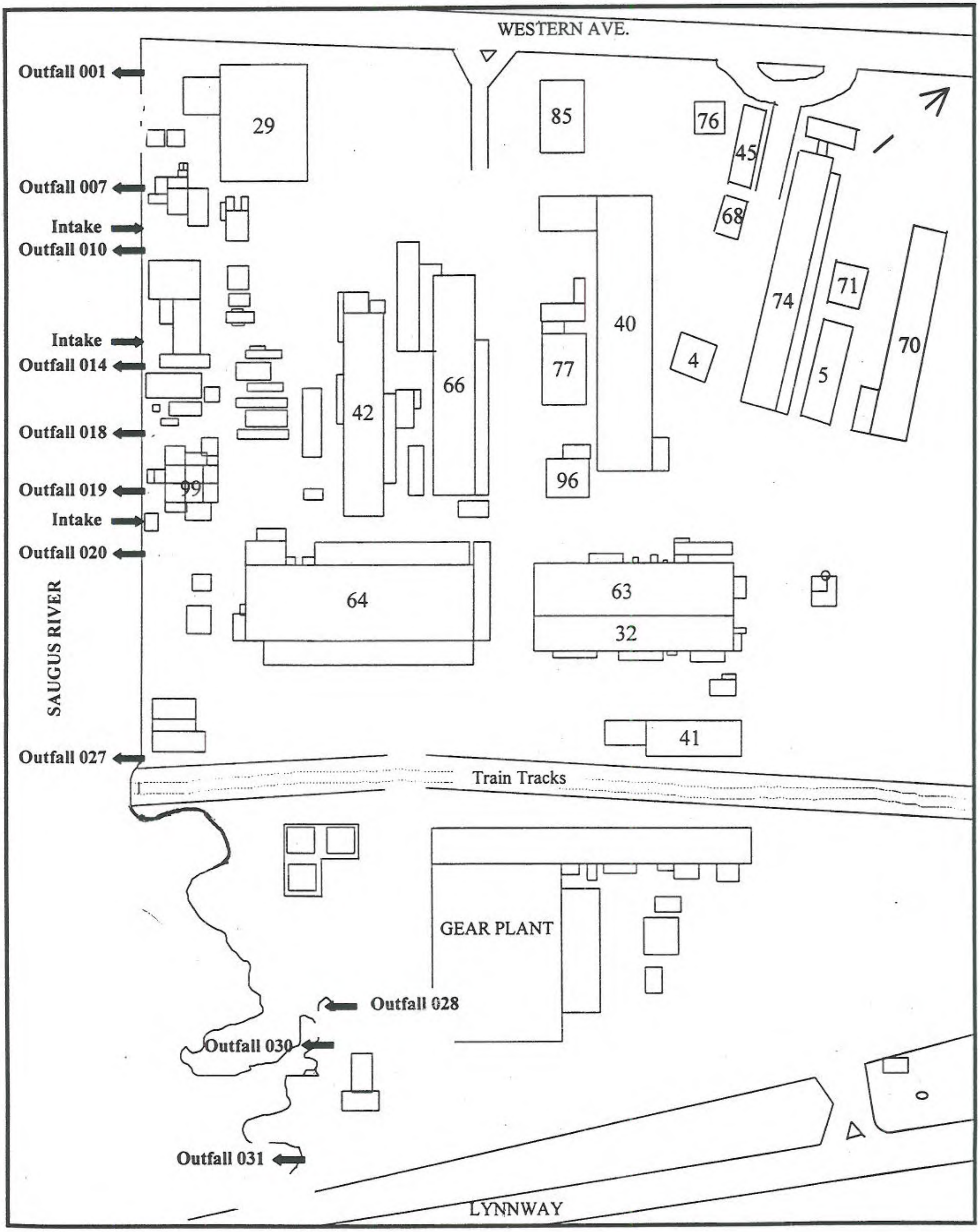
Attachment B

# Location of GE Lynn River Works Facility



Attachment C

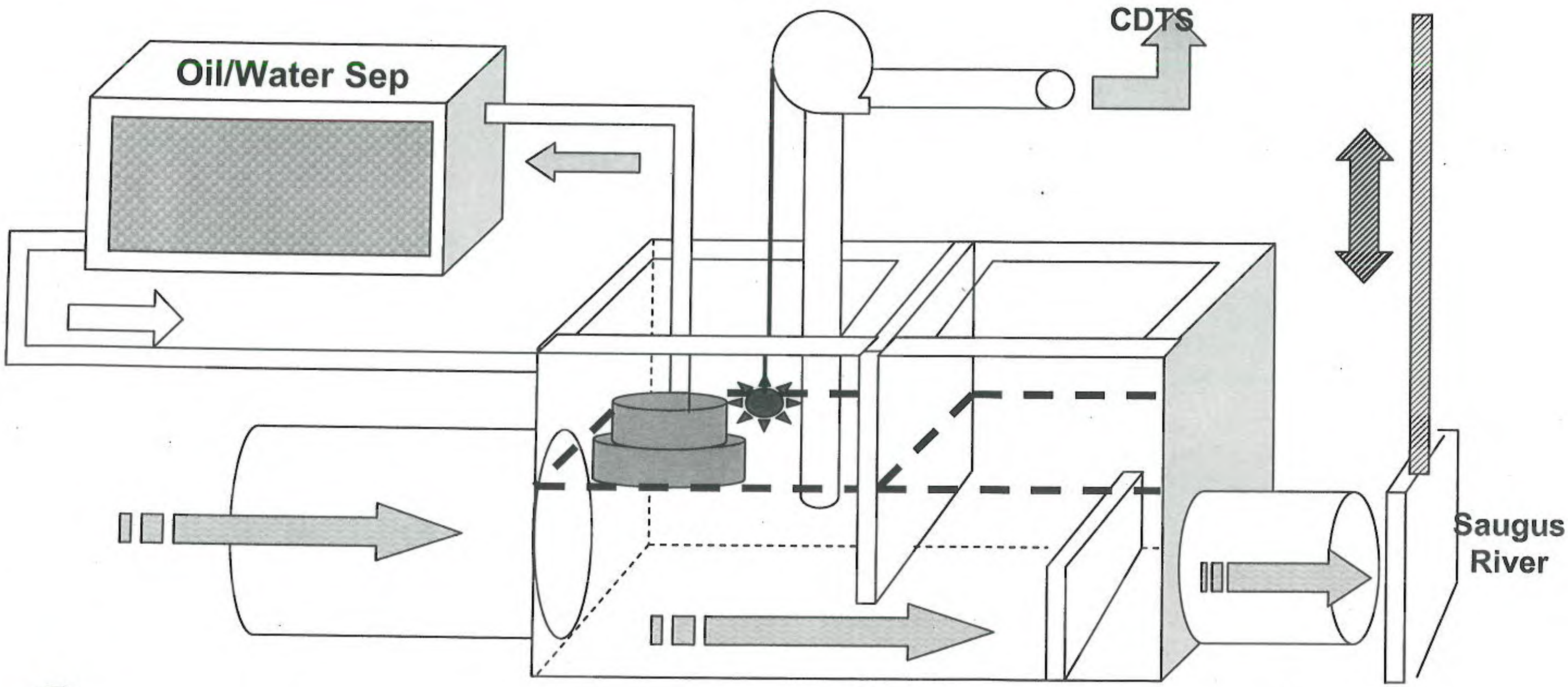
## River Works NPDES Outfalls/Intakes Map



Attachment D

# GE Aviation Lynn, Massachusetts
## Typical Outfall on the Saugus River

**This Sketch assumes the Outfall handles both Storm and Dry Weather Flows Typical Dry Weather Flows consist of Non-Contact Cooling (City) Water; Groundwater Infiltration; Steam Condensate. Dry Weather flows are treated at the Consolidated Drains Treatment System [CDTS]. Storm water is not treated.**




GE imagination at work

# Process Flow Diagram
## GEAE River Works Facility - Lynn
## Consolidated Drains Treatment System

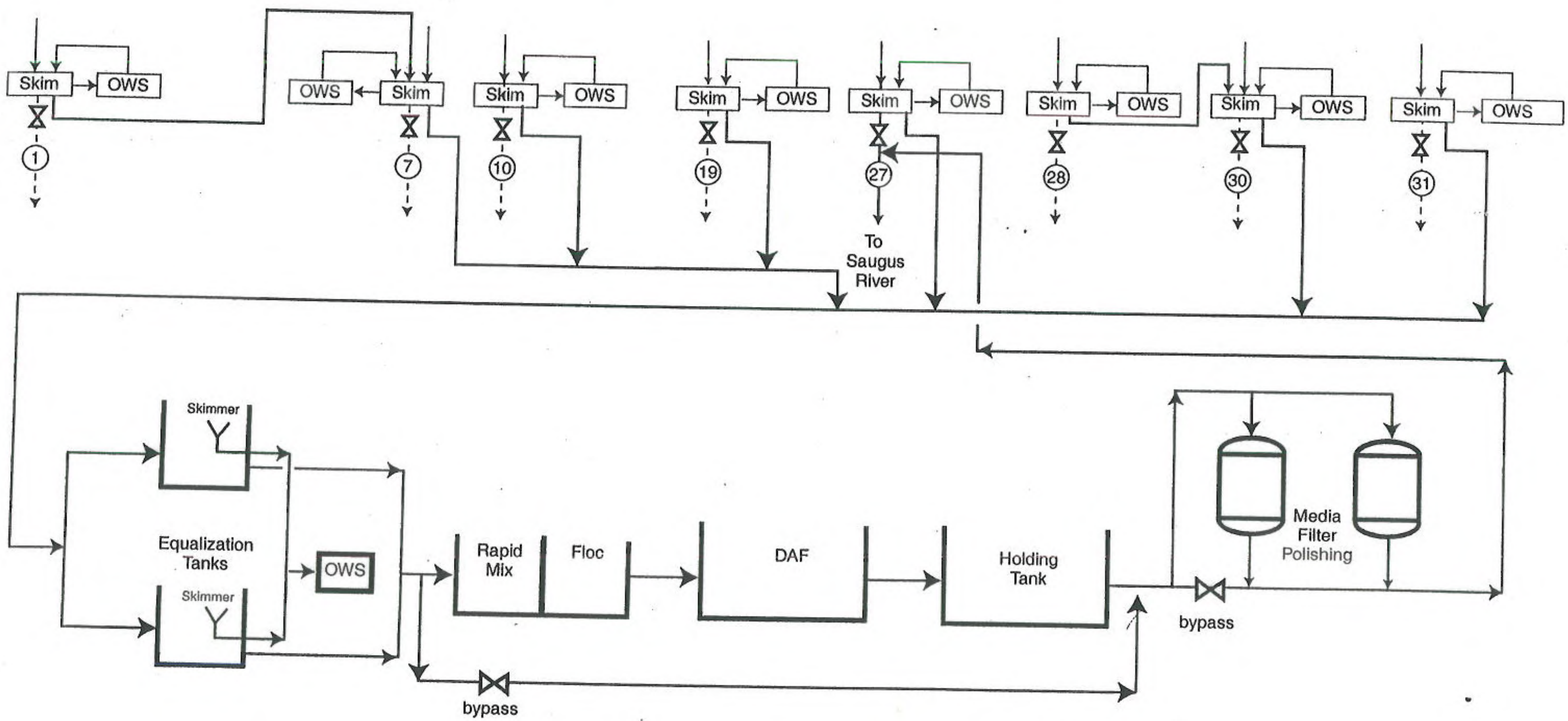


**EXHIBIT 2-2**
Water Treatment Chemicals Potentially Discharged to Storm Drains
*General Electric Aircraft Engines*
*NPDES Permit Application Amendment*

| Application | G E BetzProduct | G E Betz Product Information | Dosing As Applied | Alternatives Products | Alternative Product Information |
|---|---|---|---|---|---|
| Sulfite Oxygen Scavenger | IS3000 | Sodium Sulfite 33% Active | 20 – 80 ppm as $SO_3$ | 1720<br>Pretec 32 | Sodium Sulfite 25% Active |
| Caustic<br>pH Adjustment | ADJ560 | 44% Active Potassium Hydroxide, Sodium Hydroxide | 200 – 400 p-Alkalinity; Target Boiler Water pH of 11.0 to 12.0 | 8735<br>BL409LF | 44% Potassium Hydroxide, Sodium Hydroxide |
| Polymer | APO500 | 30% Active Polymerthacyrate Polymer | 30 – 100 ppm as Active | Transport Plus 7204 | 22% Active PA |
| Steam Treatment | NAO540 | 40.5 % Active Cyclohexylamine, Morpholine Blend | 5 to 10 ppm as Active in Boiler Blowdown | Ultramine 130 | 41% Active Cyclohexylamine, Morpholine Blend |
| Boiler Antifoam | ADJ575 | 30% Active (Double Strength) | 3 to 13 ppm as Active in Boiler Blowdown | 750<br>Antifoam (C-1) | 15% Active Antifoam |
| River Antifoam | AF3351 | Fatty Alcohol | 1 to 15 ppm active | 7465 | Fatty alcohol |
| River Antifoam | AF2290 | Silicone Based Defoamer | 1 to 15 ppm active | | |
| Polymer | Optisperse AP302 | 29.5% Polymethacrylate with 0.5% Sodium Molybdate | 30 – 100 ppm Active Polymethacrylate, 0.5 to 2.0 ppm as $MoO_4$ | Transport Plus 7205 | Polyacyrate dispersing polymer |
| Prevents Scaling (Keeps Ca, Mg, Fe in solution) | Optisperse CL360 | 32.0% Active EDTA, NTA chelant | 3 to 6 ppm as Active in Boiler Blowdown | BoilerGUARD ST<br>BoilerGUARD 4520 | EDTA chelant |
| Coagulants and Flocculants Chemical treat at B35 CDTS | Klaraid IC1172<br>Polyfloc AE1138<br>Polyfloc AP1138 | Sodium Sulfite 33% Active | 20 – 80 ppm as $SO_3$ | 1720<br>Pretec 32 | Sodium Sulfite 25% Active |
| Corrosion Inhibitor | Dianodic DN310 | Phosphate, HRAzole blend | 12 to 120 ppm as Active | XLP170<br>LCS 59 | Phosphate based corrosion inhibitor |
| Corrosion Inhibitor | Continuum AT201 | Phosphonate, polymer with molybdate tracer | 12 to 120 ppm as active<br>0.5 to 2 ppm as $MoO_4$ | XLT 170 | Phosphonate based inhibitor |
| Bromine-based Bactericide | Stabrom 909 | 6.7% active bromine | 2 to 8 ppm as active | XLP170<br>LCS 59 | Phosphate based corrosion inhibitor |
| Oxidizing Biocide | Spectrus OX107, OX108 | Bromine- chlorine pucks and powder | 1 to 5 ppm as free $CL_2$ active | | Phosphonate based inhibitor |
| Non oxidizing biocide | Spectrus NX114 | iso-bronopol blend | 10 to 20 ppm as active | Stabrex ST-10<br>Stabrex ST-20 | 6.2% active bromine |
| Non ox biocide | Spectrus NX112 | Gluteraldehyde biocide | 40 to 100 ppm as active | Calgon H-640<br>H-900 | Bromine- chlorine pucks and powder |
| Closed water loop | Inhibitor AZ660 | Azole copper corrosion agent | 5 to 20 ppm as active | Not available | |
| Closed water loop | Corrshield NT402 | Nitrite blended inhibitor | 20 to1,000 ppm active | Nalco 2839 | 15%gluteraldehyde |
| Closed water loop | Corrshield MD405 | molybdenum blend | 20 to 300 ppm active | Not available | |
| Corrosion Inhibitor For B-35 tower | Continuum AT901 | Phosphonate, phosphate polymer with molybdate tracer in unique dry solid | 3 to 12 ppm as active<br>0.5 to 2 ppm as $MoO_4$ | none | |
| Non ox idizing biocide for B-35 | Spectrus OX903 | DBNPA in unique solid form | 1 to 10 ppm as active | Not available | |

# Attachment G

## General Electric, Lynn - DMR Data Summary 1/09

**001W**

| MP Date | Rec'd Date | O&G<br>10 mg/L<br>MO AVG | pH<br>6.5 SU<br>MINIMUM | pH<br>8.5 SU<br>MAXIMUM |
|---|---|---|---|---|
| 10/31/1998 | 11/16/1998 | 5 | 7.68 | 7.68 |
| 1/31/1999 | 2/16/1999 | 5 | 7.9 | 7.9 |
| 4/30/1999 | 5/13/1999 | 5 | 7.2 | 7.2 |
| 7/31/1999 | 8/16/1999 | 5 | 7 | 7 |
| 10/31/1999 | 11/15/1999 | 5 | 7.5 | 7.7 |
| 1/31/2000 | 2/15/2000 | 5 | 7.4 | 7.4 |
| 4/30/2000 | 5/15/2000 | 5 | 6.6 | 6.6 |
| 7/31/2000 | 8/14/2000 | 5 | 7.2 | 7.2 |
| 10/31/2000 | 11/13/2000 | 5 | 7.4 | 7.4 |
| 1/31/2001 | 2/14/2001 | 5 | 5.3 | 5.3 |
| 4/30/2001 | 5/9/2001 | 5 | 5.3 | 5.3 |
| 7/31/2001 | 8/9/2001 | 5 | 7.1 | 7.1 |
| 10/31/2001 | 11/14/2001 | 5 | 6.9 | 6.9 |
| 1/31/2002 | 2/14/2002 | 5 | 7.6 | 7.6 |
| 4/30/2002 | 5/14/2002 | 5 | 5.8 | 5.8 |
| 7/31/2002 | 8/14/2002 | 5 | 6.6 | 6.6 |
| 10/31/2002 | 11/14/2002 | 5 | 6.9 | 6.9 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7.3 | 7.3 |
| 4/30/2003 | 5/13/2003 | 5 | 7.4 | 7.4 |
| 7/31/2003 | 8/14/2003 | 5 | 7.2 | 7.2 |
| 10/31/2003 | 11/12/2003 | 5 | 7.6 | 7.6 |
| 1/31/2004 | 2/13/2004 | 5 | 7.52 | 7.52 |
| 4/30/2004 | 5/17/2004 | 5 | 7.84 | 7.84 |
| 7/31/2004 | 8/10/2004 | 5 | 7.9 | 7.9 |
| 10/31/2004 | 11/15/2004 | 5 | 7.59 | 7.59 |
| 1/31/2005 | 2/14/2005 | 5 | 7.13 | 7.13 |
| 4/30/2005 | 5/18/2005 | 5 | 6.23 | 6.23 |
| 7/31/2005 | 8/19/2005 | 5 | 7.71 | 7.71 |
| 10/31/2005 | 11/15/2005 | 5 | 7.52 | 7.52 |
| 1/31/2006 | 2/14/2006 | 5 | 6.98 | 6.98 |
| 4/30/2006 | 5/15/2006 | 5 | 7.27 | 7.27 |
| 7/31/2006 | 8/7/2006 | 5 | 6.71 | 6.71 |
| 10/31/2006 | 11/15/2006 | 5 | 6.77 | 6.77 |
| 1/31/2007 | 2/14/2007 | 5 | 5.9 | 5.9 |
| 4/30/2007 | 5/16/2007 | 5 | 6.9 | 6.9 |
| 7/31/2007 | 7/13/2007 | 5 | 6.79 | 6.79 |
| 10/31/2007 | 11/14/2007 | 5 | 7.47 | 7.47 |
| 1/31/2008 | 2/15/2008 | 9 | 6.95 | 6.95 |
| 4/30/2008 | 5/7/2008 | 5 | 7.08 | 7.08 |
| 7/31/2008 | 8/11/2008 | 5 | 7.01 | 7.01 |
| 10/31/2008 | 11/12/2008 | 5 | 7.11 | 7.11 |

**001W**

| | | O&G<br>10 mg/L<br>MO AVG | pH<br>6.5 SU<br>MINIMUM | pH<br>8.5 SU<br>MAXIMUM |
|---|---|---|---|---|
| | Ave | 5.1 | 7.1 | 7.1 |
| | max | 9 | 7.9 | 7.9 |
| | min | 5 | 5.3 | 5.3 |
| | exceedence | 0 | 5 | 0 |

**007D**

| | | Flow | | pH | | Temperature | |
|---|---|---|---|---|---|---|---|
| | | .024 Mgal/d | .024 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 90 deg F |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| 10/31/1998 | 11/16/1998 | 0.024 | 0.024 | | | 58 | 62.4 |
| 11/30/1998 | 12/16/1998 | 0.024 | 0.024 | | | 51 | 52 |
| 12/31/1998 | 1/19/1999 | 0.024 | 0.024 | | | 50.3 | 55 |
| 1/31/1999 | 2/16/1999 | 0.024 | 0.024 | 6.9 | 7.9 | 44.7 | 47 |
| 2/28/1999 | 3/16/1999 | 0.024 | 0.024 | 6.7 | 7.8 | 46.1 | 50 |
| 3/31/1999 | 4/16/1999 | 0.024 | 0.024 | 7.4 | 7.8 | 44.7 | 46.8 |
| 4/30/1999 | 5/13/1999 | 0.024 | 0.024 | 7.2 | 7.3 | 51.4 | 53 |
| 5/31/1999 | 6/16/1999 | 0.024 | 0.024 | 7.1 | 7.8 | 58 | 63 |
| 6/30/1999 | 7/14/1999 | 0.024 | 0.024 | 7.1 | 7.2 | 66.3 | 68.6 |
| 7/31/1999 | 8/16/1999 | 0.024 | 0.024 | 7 | 7.2 | 72.5 | 73.8 |
| 8/31/1999 | 9/17/1999 | 0.024 | 0.024 | 7.2 | 7.2 | 72.5 | 74.3 |
| 9/30/1999 | 10/18/1999 | 0.024 | 0.024 | 7 | 7.2 | 71.8 | 77 |
| 10/31/1999 | 11/15/1999 | 0.024 | 0.024 | 6.9 | 7.9 | 63 | 64 |
| 11/30/1999 | 12/15/1999 | 0.024 | 0.024 | 6.8 | 7.5 | 57 | 63 |
| 12/31/1999 | 1/14/2000 | 0.024 | 0.024 | 6.8 | 7.8 | 50 | 54 |
| 1/31/2000 | 2/15/2000 | 0.024 | 0.024 | 6.6 | 7.4 | 45 | 49 |
| 2/29/2000 | 3/15/2000 | 0.024 | 0.024 | 7 | 7.1 | 45 | 47 |
| 3/31/2000 | 4/12/2000 | 0.024 | 0.024 | 6.9 | 7.1 | 48 | 51 |
| 4/30/2000 | 5/15/2000 | 0.024 | 0.024 | 6.7 | 7.1 | 51 | 52 |
| 5/31/2000 | 6/13/2000 | 0.024 | 0.024 | 6.6 | 7.2 | 57 | 60 |
| 6/30/2000 | 7/14/2000 | 0.024 | 0.024 | 6.8 | 7.4 | 65 | 68 |
| 7/31/2000 | 8/14/2000 | 0.005 | 0.024 | 7 | 7 | 69 | 69 |
| 8/31/2000 | 9/13/2000 | C | C | C | C | C | C |
| 9/30/2000 | 10/12/2000 | C | C | C | C | C | C |
| 10/31/2000 | 11/13/2000 | C | C | C | C | C | C |
| 11/30/2000 | 12/11/2000 | C | C | C | C | C | C |
| 12/31/2000 | 1/10/2001 | C | C | C | C | C | C |
| 1/31/2001 | 2/14/2001 | C | C | C | C | C | C |
| 2/28/2001 | 3/15/2001 | C | C | C | C | C | C |
| 3/31/2001 | 4/12/2001 | C | C | C | C | C | C |
| 4/30/2001 | 5/9/2001 | C | C | C | C | C | C |
| 5/31/2001 | 6/11/2001 | C | C | C | C | C | C |
| 6/30/2001 | 7/12/2001 | C | C | C | C | C | C |
| 7/31/2001 | 8/9/2001 | C | C | C | C | C | C |
| 8/31/2001 | 9/14/2001 | C | C | C | C | C | C |
| 9/30/2001 | 10/10/2001 | C | C | C | C | C | C |
| 10/31/2001 | 11/14/2001 | C | C | C | C | C | C |
| 11/30/2001 | 12/12/2001 | C | C | C | C | C | C |
| 12/31/2001 | 1/14/2002 | C | C | C | C | C | C |
| 1/31/2002 | 2/14/2002 | C | C | C | C | C | C |
| 2/28/2002 | 3/12/2002 | C | C | C | C | C | C |
| 3/31/2002 | 4/15/2002 | C | C | C | C | C | C |
| 4/30/2002 | 5/14/2002 | C | C | C | C | C | C |
| 5/31/2002 | 6/13/2002 | C | C | C | C | C | C |
| 6/30/2002 | 7/10/2002 | C | C | C | C | C | C |
| 7/31/2002 | 8/14/2002 | C | C | C | C | C | C |
| 8/31/2002 | 9/16/2002 | C | C | C | C | C | C |
| 9/30/2002 | 10/11/2002 | C | C | C | C | C | C |
| 10/31/2002 | 11/14/2002 | C | C | C | C | C | C |
| 11/30/2002 | 12/13/2002 | C | C | C | C | C | C |
| 12/31/2002 | 1/15/2003 | C | C | C | C | C | C |
| 1/31/2003 | 2/12/2003 | C | C | C | C | C | C |
| 2/28/2003 | 3/31/2003 | C | C | C | C | C | C |
| 3/31/2003 | 4/10/2003 | C | C | C | C | C | C |
| 4/30/2003 | 5/13/2003 | C | C | C | C | C | C |
| 5/31/2003 | 6/12/2003 | C | C | C | C | C | C |
| 6/30/2003 | 7/11/2003 | C | C | C | C | C | C |
| 7/31/2003 | 8/14/2003 | C | C | C | C | C | C |
| 8/31/2003 | 9/12/2003 | C | C | C | C | C | C |
| 9/30/2003 | 10/14/2003 | C | C | C | C | C | C |
| 10/31/2003 | 11/12/2003 | C | C | C | C | C | C |
| 11/30/2003 | 12/10/2003 | C | C | C | C | C | C |
| 12/31/2003 | 1/13/2004 | C | C | C | C | C | C |
| 1/31/2004 | 2/13/2004 | C | C | C | C | C | C |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2/29/2004 | 3/15/2004 | C | C | C | C | C | C |
| 3/31/2004 | 4/18/2004 | C | C | C | C | C | C |
| 4/30/2004 | 5/17/2004 | C | C | C | C | C | C |
| 5/31/2004 | 6/14/2004 | C | C | C | C | C | C |
| 6/30/2004 | 7/12/2004 | C | C | C | C | C | C |
| 7/31/2004 | 8/10/2004 | C | C | C | C | C | C |
| 8/31/2004 | 9/13/2004 | C | C | C | C | C | C |
| 9/30/2004 | 10/15/2004 | C | C | C | C | C | C |
| 10/31/2004 | 11/15/2004 | C | C | C | C | C | C |
| 11/30/2004 | 12/9/2004 | C | C | C | C | C | C |
| 12/31/2004 | 1/13/2005 | C | C | C | C | C | C |
| 1/31/2005 | 2/14/2005 | C | C | C | C | C | C |
| 2/28/2005 | 3/14/2005 | C | C | C | C | C | C |
| 3/31/2005 | 4/15/2005 | C | C | C | C | C | C |
| 4/30/2005 | 5/18/2005 | C | C | C | C | C | C |
| 5/31/2005 | 6/13/2005 | C | C | C | C | C | C |
| 6/30/2005 | 7/14/2005 | C | C | C | C | C | C |
| 7/31/2005 | 8/17/2005 | C | C | C | C | C | C |
| 8/31/2005 | 9/12/2005 | C | C | C | C | C | C |
| 9/30/2005 | 10/17/2005 | C | C | C | C | C | C |
| 10/31/2005 | 11/15/2005 | C | C | C | C | C | C |
| 11/30/2005 | 12/13/2005 | C | C | C | C | C | C |
| 12/31/2005 | 1/13/2006 | C | C | C | C | C | C |
| 1/31/2006 | 2/14/2006 | C | C | C | C | C | C |
| 2/28/2006 | 3/13/2006 | C | C | C | C | C | C |
| 3/31/2006 | 4/14/2006 | C | C | C | C | C | C |
| 4/30/2006 | 5/15/2006 | C | C | C | C | C | C |
| 5/31/2006 | 6/14/2006 | C | C | C | C | C | C |
| 6/30/2006 | 7/13/2006 | C | C | C | C | C | C |
| 7/31/2006 | 8/7/2006 | C | C | C | C | C | C |
| 8/31/2006 | 9/18/2006 | C | C | C | C | C | C |
| 9/30/2006 | 10/16/2006 | C | C | C | C | C | C |
| 10/31/2006 | 11/15/2006 | C | C | C | C | C | C |
| 11/30/2006 | 12/15/2006 | C | C | C | C | C | C |
| 12/31/2006 | 1/11/2007 | C | C | C | C | C | C |
| 1/31/2007 | 2/14/2007 | C | C | C | C | C | C |
| 2/28/2007 | 3/14/2007 | C | C | C | C | C | C |
| 3/31/2007 | 4/16/2007 | C | C | C | C | C | C |
| 4/30/2007 | 5/16/2007 | C | C | C | C | C | C |
| 5/31/2007 | 6/14/2007 | C | C | C | C | C | C |
| 6/30/2007 | 7/13/2007 | C | C | C | C | C | C |
| 7/31/2007 | 8/15/2007 | C | C | C | C | C | C |
| 8/31/2007 | 9/13/2007 | C | C | C | C | C | C |
| 9/30/2007 | 10/12/2007 | C | C | C | C | C | C |
| 10/31/2007 | 11/14/2007 | C | C | C | C | C | C |
| 11/30/2007 | 12/12/2007 | C | C | C | C | C | C |
| 12/31/2007 | 1/14/2008 | C | C | C | C | C | C |
| 1/31/2008 | 2/15/2008 | C | C | C | C | C | C |
| 2/29/2008 | 3/14/2008 | C | C | C | C | C | C |
| 3/31/2008 | 4/11/2008 | C | C | C | C | C | C |
| 4/30/2008 | 5/7/2008 | C | C | C | C | C | C |
| 5/31/2008 | 6/13/2008 | C | C | C | C | C | C |
| 6/30/2008 | 7/11/2008 | C | C | C | C | C | C |
| 7/31/2008 | 8/11/2008 | C | C | C | C | C | C |
| 8/31/2008 | 9/10/2008 | C | C | C | C | C | C |
| 9/30/2008 | 10/10/2008 | C | C | C | C | C | C |
| 10/31/2008 | 11/12/2008 | C | C | C | C | C | C |
| 11/30/2008 | | | | | | | |
| 12/31/2008 | | | | | | | |
| **007D** | | Flow | | pH | | Temperature | |
| | | .024 Mgal/d | .024 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 90 deg F |
| | | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| | Ave | 0.023 | 0.024 | 6.9 | 7.4 | 56.2 | 59.1 |
| | max | 0.024 | 0.024 | 7.4 | 7.9 | 72.5 | 77 |
| | min | 0.005 | 0.024 | 6.6 | 7 | 44.7 | 46.8 |
| | exceedence | 0 | 0 | 0 | 0 | 0 | 0 |

*C: NODI code which refers to "no discharge"

**007W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 5 | 7.9 | 7.9 |
| 1/31/1999 | 2/16/1999 | 5 | 7.4 | 7.4 |
| 4/30/1999 | 5/13/1999 | 5 | 7.2 | 7.2 |
| 7/31/1999 | 8/16/1999 | 5 | 6.9 | 6.9 |
| 10/31/1999 | 11/15/1999 | 5 | 7.2 | 7.3 |
| 1/31/2000 | 2/15/2000 | 5 | 7.4 | 7.4 |
| 4/30/2000 | 5/15/2000 | 5 | 6.6 | 6.6 |
| 7/31/2000 | 8/14/2000 | 5 | 7.1 | 7.1 |
| 10/31/2000 | 11/13/2000 | | | |
| 1/31/2001 | 2/14/2001 | 5 | 6.6 | 6.6 |
| 4/30/2001 | 5/9/2001 | 5 | 5.7 | 5.7 |
| 7/31/2001 | 8/9/2001 | 5 | 6.7 | 6.7 |
| 10/31/2001 | 11/14/2001 | 5 | 6.8 | 6.8 |
| 1/31/2002 | 2/14/2002 | 5 | 6.8 | 6.8 |
| 4/30/2002 | 5/14/2002 | 5 | 6.2 | 6.2 |
| 7/31/2002 | 8/14/2002 | 5 | 6.3 | 6.3 |
| 10/31/2002 | 11/14/2002 | 5 | 6.8 | 6.8 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7.5 | 7.5 |
| 4/30/2003 | 5/13/2003 | 5 | 7.4 | 7.4 |
| 7/31/2003 | 8/14/2003 | 5 | 6.6 | 6.6 |
| 10/31/2003 | 11/12/2003 | 5 | 7.58 | 7.58 |
| 1/31/2004 | 2/13/2004 | 5 | 7.63 | 7.63 |
| 4/30/2004 | 5/17/2004 | 5 | 6.96 | 6.96 |
| 7/31/2004 | 8/10/2004 | 5 | 7.81 | 7.81 |
| 10/31/2004 | 11/15/2004 | 5 | 7.21 | 7.21 |
| 1/31/2005 | 2/14/2005 | 5 | 7.21 | 7.21 |
| 4/30/2005 | 5/18/2005 | 5 | 6.87 | 6.87 |
| 7/31/2005 | 8/17/2005 | 5 | 7.92 | 7.92 |
| 10/31/2005 | 11/15/2005 | 5 | 7.58 | 7.58 |
| 1/31/2006 | 2/14/2006 | 5 | 7.27 | 7.27 |
| 4/30/2006 | 5/15/2006 | 5 | 7.11 | 7.11 |
| 7/31/2006 | 8/7/2006 | 5 | 6.9 | 6.9 |
| 10/31/2006 | 11/15/2006 | 5 | 6.91 | 6.91 |
| 1/31/2007 | 2/14/2007 | 5 | 6.2 | 6.2 |
| 4/30/2007 | 5/16/2007 | 5 | 7.05 | 7.02 |
| 7/31/2007 | 7/13/2007 | 5 | 7.02 | 7.02 |
| 10/31/2007 | 11/14/2007 | 5 | 7.21 | 7.21 |
| 1/31/2008 | 2/15/2008 | 8.4 | 7.22 | 7.22 |
| 4/30/2008 | 5/7/2008 | 5 | 6.92 | 6.92 |
| 7/31/2008 | 8/11/2008 | 5 | 6.95 | 6.95 |
| 10/31/2008 | 11/12/2008 | 5 | 6.95 | 6.95 |

**007W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave: | 5.1 | 7.04 | 7.04 |
| | max | 8.4 | 7.92 | 7.92 |
| | min | 5 | 5.7 | 5.7 |
| | exceedence | 0 | 4 | 0 |

**010D**

| | | Flow | | Mercury | pH | | Silver | Temperature | |
|---|---|---|---|---|---|---|---|---|---|
| | | 5.36 Mgal/d | 7.18 Mgal/d | Req. Mon. mg/L | 6.5 SU | 8.5 SU | Req. Mon. mg/L | 85.2 deg F | 90 deg F |
| MP Date | Rec'd Date | MO AVG | DAILY MX | DAILY MX | MINIMUM | MAXIMUM | DAILY MX | MO AVG | DAILY MX |
| 10/31/1998 | 11/16/1998 | 5.36 | 7.18 | | | | | 58.3 | 60.8 |
| 11/30/1998 | 12/16/1998 | 5.36 | 7.18 | | | | | 50 | 52 |
| 12/31/1998 | 1/19/1999 | 5.36 | 7.18 | | | | | 50.2 | 58 |
| 1/31/1999 | 2/16/1999 | 5.36 | 7.18 | | 6.9 | 7.7 | | 44.6 | 47 |
| 2/28/1999 | 3/16/1999 | 5.36 | 7.18 | | 6.7 | 7.2 | | 47.2 | 50 |
| 3/31/1999 | 4/16/1999 | 5.36 | 7.18 | | 6.7 | 7.8 | | 45.5 | 46.6 |
| 4/30/1999 | 5/13/1999 | 5.36 | 7.18 | | 7.1 | 7.3 | | 50.2 | 51.5 |
| 5/31/1999 | 6/16/1999 | 5.36 | 7.18 | | 7.1 | 7.6 | | 57.6 | 63 |
| 6/30/1999 | 7/14/1999 | 5.36 | 7.18 | | 7.1 | 7.8 | | 65.6 | 69.4 |
| 7/31/1999 | 8/16/1999 | 5.36 | 7.18 | | 7.1 | 7.2 | | 69.8 | 71.8 |
| 8/31/1999 | 9/17/1999 | 5.36 | 7.18 | | 7.1 | 7.5 | | 71.5 | 73.4 |
| 9/30/1999 | 10/18/1999 | 5.36 | 7.28 | | 7 | 7.3 | | 69.8 | 74 |
| 10/31/1999 | 11/15/1999 | 5.36 | 7.18 | | 6.9 | 7.5 | | 61.4 | 63 |
| 11/30/1999 | 12/15/1999 | 5.36 | 7.18 | | 6.8 | 7.6 | | 55 | 61 |
| 12/31/1999 | 1/14/2000 | 5.36 | 7.18 | | 6.8 | 7.5 | | 49 | 52 |
| 1/31/2000 | 2/15/2000 | 5.36 | 7.18 | | 6.9 | 7.4 | | 43 | 47 |
| 2/29/2000 | 3/15/2000 | 5.36 | 7.18 | | 6.8 | 7.3 | | 42 | 47 |
| 3/31/2000 | 4/12/2000 | 5.36 | 7.18 | | 6.9 | 7.1 | | 47 | 49 |
| 4/30/2000 | 5/15/2000 | 5.36 | 7.18 | | 7.2 | 7.3 | | 51 | 52 |
| 5/31/2000 | 6/13/2000 | 5.36 | 7.18 | | 6.7 | 7.3 | | 57 | 60 |
| 6/30/2000 | 7/14/2000 | 5.36 | 7.18 | | 6.9 | 7.4 | | 64 | 67 |
| 7/31/2000 | 8/14/2000 | 1.07 | 7.18 | | 7.2 | 7.2 | | 65 | 65 |
| 8/31/2000 | 9/18/2000 | C | C | | C | C | | C | C |
| 9/30/2000 | 10/12/2000 | C | C | | C | C | | C | C |
| 10/31/2000 | 11/13/2000 | C | C | | C | C | | C | C |
| 11/30/2000 | 12/11/2000 | C | C | | C | C | | C | C |
| 12/31/2000 | 1/10/2001 | C | C | | C | C | | C | C |
| 1/31/2001 | 2/14/2001 | C | C | | C | C | | C | C |
| 2/28/2001 | 3/15/2001 | C | C | | C | C | | C | C |
| 3/31/2001 | 4/12/2001 | C | C | | C | C | | C | C |
| 4/30/2001 | 5/9/2001 | C | C | | C | C | | C | C |
| 5/31/2001 | 6/11/2001 | C | C | | C | C | | C | C |
| 6/30/2001 | 7/12/2001 | C | C | | C | C | | C | C |
| 7/31/2001 | 8/9/2001 | C | C | | C | C | | C | C |
| 8/31/2001 | 9/14/2001 | C | C | | C | C | | C | C |
| 9/30/2001 | 10/10/2001 | C | C | | C | C | | C | C |
| 10/31/2001 | 11/14/2001 | C | C | | C | C | | C | C |
| 11/30/2001 | 12/12/2001 | C | C | | C | C | | C | C |
| 12/31/2001 | 1/14/2002 | C | C | | C | C | | C | C |
| 1/31/2002 | 2/14/2002 | C | C | | C | C | | C | C |
| 2/28/2002 | 3/12/2002 | C | C | | C | C | | C | C |
| 3/31/2002 | 4/15/2002 | C | C | | C | C | | C | C |
| 4/30/2002 | 5/14/2002 | C | C | | C | C | | C | C |
| 5/31/2002 | 6/13/2002 | C | C | | C | C | | C | C |
| 6/30/2002 | 7/10/2002 | C | C | | C | C | | C | C |
| 7/31/2002 | 8/14/2002 | C | C | | C | C | | C | C |
| 8/31/2002 | 9/16/2002 | C | C | | C | C | | C | C |
| 9/30/2002 | 10/11/2002 | C | C | | C | C | | C | C |
| 10/31/2002 | 11/14/2002 | C | C | | C | C | | C | C |
| 11/30/2002 | 12/13/2002 | C | C | | C | C | | C | C |
| 12/31/2002 | 1/15/2003 | C | C | | C | C | | C | C |
| 1/31/2003 | 2/12/2003 | C | C | | C | C | | C | C |
| 2/28/2003 | 3/31/2003 | C | C | | C | C | | C | C |
| 3/31/2003 | 4/10/2003 | C | C | | C | C | | C | C |
| 4/30/2003 | 5/13/2003 | C | C | | C | C | | C | C |
| 5/31/2003 | 6/12/2003 | C | C | | C | C | | C | C |
| 6/30/2003 | 7/11/2003 | C | C | | C | C | | C | C |
| 7/31/2003 | 8/14/2003 | C | C | | C | C | | C | C |
| 8/31/2003 | 9/12/2003 | C | C | | C | C | | C | C |
| 9/30/2003 | 10/14/2003 | C | C | | C | C | | C | C |
| 10/31/2003 | 11/12/2003 | C | C | | C | C | | C | C |
| 11/30/2003 | 12/10/2003 | C | C | | C | C | | C | C |
| 12/31/2003 | 1/13/2004 | C | C | | C | C | | C | C |
| 1/31/2004 | 2/13/2004 | C | C | | C | C | | C | C |
| 2/29/2004 | 3/15/2004 | C | C | | C | C | | C | C |
| 3/31/2004 | 4/18/2004 | C | C | | C | C | | C | C |
| 4/30/2004 | 5/17/2004 | C | C | | C | C | | C | C |
| 5/31/2004 | 6/14/2004 | C | C | | C | C | | C | C |
| 6/30/2004 | 7/12/2004 | C | C | | C | C | | C | C |
| 7/31/2004 | 8/10/2004 | C | C | | C | C | | C | C |
| 8/31/2004 | 9/13/2004 | C | C | | C | C | | C | C |
| 9/30/2004 | 10/15/2004 | C | C | | C | C | | C | C |
| 10/31/2004 | 11/15/2004 | C | C | | C | C | | C | C |
| 11/30/2004 | 12/9/2004 | C | C | | C | C | | C | C |
| 12/31/2004 | 1/13/2005 | C | C | | C | C | | C | C |
| 1/31/2005 | 2/14/2005 | C | C | | C | C | | C | C |
| 2/28/2005 | 3/14/2005 | C | C | | C | C | | C | C |
| 3/31/2005 | 4/15/2005 | C | C | | C | C | | C | C |
| 4/30/2005 | 5/18/2005 | C | C | | C | C | | C | C |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5/31/2005 | 6/13/2005 | C | C | | C | C | | C | C |
| 6/30/2005 | 7/14/2005 | C | C | | C | C | | C | C |
| 7/31/2005 | 8/17/2005 | C | C | | C | C | | C | C |
| 8/31/2005 | 9/12/2005 | C | C | | C | C | | C | C |
| 9/30/2005 | 10/17/2005 | C | C | | C | C | | C | C |
| 10/31/2005 | 11/15/2005 | C | C | | C | C | | C | C |
| 11/30/2005 | 12/13/2005 | C | C | | C | C | | C | C |
| 12/31/2005 | 1/13/2006 | C | C | | C | C | | C | C |
| 1/31/2006 | 2/14/2006 | C | C | | C | C | | C | C |
| 2/28/2006 | 3/13/2006 | C | C | | C | C | | C | C |
| 3/31/2006 | 4/14/2006 | C | C | | C | C | | C | C |
| 4/30/2006 | 5/15/2006 | C | C | | C | C | | C | C |
| 5/31/2006 | 6/14/2006 | C | C | | C | C | | C | C |
| 6/30/2006 | 7/13/2006 | C | C | | C | C | | C | C |
| 7/31/2006 | 8/7/2006 | C | C | | C | C | | C | C |
| 8/31/2006 | 9/19/2006 | C | C | | C | C | | C | C |
| 9/30/2006 | 10/16/2006 | C | C | | C | C | | C | C |
| 10/31/2006 | 11/15/2006 | C | C | | C | C | | C | C |
| 11/30/2006 | 12/15/2006 | C | C | | C | C | | C | C |
| 12/31/2006 | 1/11/2007 | C | C | | C | C | | C | C |
| 1/31/2007 | 2/14/2007 | C | C | | C | C | | C | C |
| 2/28/2007 | 3/14/2007 | C | C | | C | C | | C | C |
| 3/31/2007 | 4/16/2007 | C | C | | C | C | | C | C |
| 4/30/2007 | 5/16/2007 | C | C | | C | C | | C | C |
| 5/31/2007 | 6/14/2007 | C | C | | C | C | | C | C |
| 6/30/2007 | 7/13/2007 | C | C | | C | C | | C | C |
| 7/31/2007 | 8/15/2007 | C | C | | C | C | | C | C |
| 8/31/2007 | 9/13/2007 | C | C | | C | C | | C | C |
| 9/30/2007 | 10/12/2007 | C | C | | C | C | | C | C |
| 10/31/2007 | 11/14/2007 | C | C | | C | C | | C | C |
| 11/30/2007 | 12/12/2007 | C | C | | C | C | | C | C |
| 12/31/2007 | 1/14/2008 | C | C | | C | C | | C | C |
| 1/31/2008 | 2/15/2008 | C | C | | C | C | | C | C |
| 2/29/2008 | 3/14/2008 | C | C | | C | C | | C | C |
| 3/31/2008 | 4/11/2008 | C | C | | C | C | | C | C |
| 4/30/2008 | 5/7/2008 | C | C | | C | C | | C | C |
| 5/31/2008 | 6/13/2008 | C | C | | C | C | | C | C |
| 6/30/2008 | 7/11/2008 | C | C | | C | C | | C | C |
| 7/31/2008 | 8/11/2008 | C | C | | C | C | | C | C |
| 8/31/2008 | 9/10/2008 | C | C | | C | C | | C | C |
| 9/30/2008 | 10/10/2008 | C | C | | C | C | | C | C |
| 10/31/2008 | 11/12/2008 | C | C | | C | C | | C | C |
| 11/30/2008 | | | | | | | | | |
| 12/31/2008 | | | | | | | | | |
| **010D** | | Flow | | Mercury | pH | | Silver | Temperature | |
| | | 5.36 Mgal/d | 7.18 Mgal/d | Req. Mon. mg/L | 6.5 SU | 8.5 SU | Req. Mon. mg/L | 85.2 deg F | 90 deg F |
| | | MO AVG | DAILY MX | DAILY MX | MINIMUM | MAXIMUM | DAILY MX | MO AVG | DAILY MX |
| | Ave | 5.17 | 7.18 | 0 | 6.9 | 7.4 | 0 | 55.2 | 58.2 |
| | max | 5.36 | 7.28 | 0 | 7.2 | 7.8 | 0 | 71.5 | 74 |
| | min | 1.07 | 7.18 | 0 | 6.7 | 7.1 | 0 | 42 | 46.6 |
| | exceedence | 0 | 1 | NA | 0 | 0 | NA | 0 | 0 |

*C: NODI code which refers to "no discharge"

**010W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 5 | 7.6 | 7.6 |
| 1/31/1999 | 2/16/1999 | 5 | 7.4 | 7.4 |
| 4/30/1999 | 5/13/1999 | 5 | 7.1 | 7.1 |
| 7/31/1999 | 8/16/1999 | 5 | 6.9 | 6.9 |
| 10/31/1999 | 11/15/1999 | 5 | 7.1 | 7.1 |
| 1/31/2000 | 2/15/2000 | 5 | 7.5 | 7.5 |
| 4/30/2000 | 5/15/2000 | 5 | 6.3 | 6.3 |
| 7/31/2000 | 8/14/2000 | 5 | 6.5 | 6.5 |
| 10/31/2000 | 11/13/2000 | 5 | 6.8 | 6.8 |
| 1/31/2001 | 2/14/2001 | 5 | 5.9 | 5.9 |
| 4/30/2001 | 5/9/2001 | 5 | 7.6 | 7.6 |
| 7/31/2001 | 8/9/2001 | 5 | 6.5 | 6.5 |
| 10/31/2001 | 11/14/2001 | 5 | 6.8 | 6.8 |
| 1/31/2002 | 2/14/2002 | 5 | 7.6 | 7.6 |
| 4/30/2002 | 5/14/2002 | 5 | 6.8 | 6.8 |
| 7/31/2002 | 8/14/2002 | 5 | 6.2 | 6.2 |
| 10/31/2002 | 11/14/2002 | 5 | 7.2 | 7.2 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7 | 7 |
| 4/30/2003 | 5/13/2003 | 8.1 | 7.5 | 7.5 |
| 7/31/2003 | 8/14/2003 | 5 | 7.9 | 7.9 |
| 10/31/2003 | 11/12/2003 | 5 | 7.63 | 7.63 |
| 1/31/2004 | 2/13/2004 | 5 | 7.68 | 7.68 |
| 4/30/2004 | 5/17/2004 | 5 | 6.81 | 6.81 |
| 7/31/2004 | 8/10/2004 | 5 | 7.76 | 7.76 |
| 10/31/2004 | 11/15/2004 | 5 | 7.45 | 7.45 |
| 1/31/2005 | 2/14/2005 | 5 | 7.13 | 7.13 |
| 4/30/2005 | 5/18/2005 | 5 | 6.52 | 6.52 |
| 7/31/2005 | 8/17/2005 | 5 | 7.4 | 7.4 |
| 10/31/2005 | 11/15/2005 | 5 | 7.42 | 7.42 |
| 1/31/2006 | 2/14/2006 | 5 | 7.11 | 7.11 |
| 4/30/2006 | 5/15/2006 | 5 | 7.13 | 7.13 |
| 7/31/2006 | 8/7/2006 | 5 | 6.86 | 6.86 |
| 10/31/2006 | 11/15/2006 | 5 | 6.87 | 6.87 |
| 1/31/2007 | 2/14/2007 | 5 | 5.9 | 5.9 |
| 4/30/2007 | 5/16/2007 | 5 | 6.91 | 6.91 |
| 7/31/2007 | 7/13/2007 | 5 | 6.87 | 6.87 |
| 10/31/2007 | 11/14/2007 | 5 | 7.18 | 7.18 |
| 1/31/2008 | 2/15/2008 | 5 | 7.93 | 7.93 |
| 4/30/2008 | 5/7/2008 | 5 | 6.88 | 6.88 |
| 7/31/2008 | 8/11/2008 | 5 | 6.79 | 6.79 |
| 10/31/2008 | 11/12/2008 | 5 | 6.9 | 6.9 |

**010W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave | 5.08 | 7.06 | 7.06 |
| | max | 8.1 | 7.93 | 7.93 |
| | min | 5 | 5.9 | 5.9 |
| | exceedence | 0 | 4 | 0 |

**014A**

| | | Flow | | pH | | Temperature | |
|---|---|---|---|---|---|---|---|
| | | 27 Mgal/d | 45 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 95 deg F |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| 10/31/1998 | 11/16/1998 | 1.19 | 34 | 7.9 | 8.1 | 60.3 | 69.8 |
| 11/30/1998 | 12/16/1998 | 1.26 | 34 | 7.7 | 8.1 | 50 | 53 |
| 12/31/1998 | 1/19/1999 | | | | | | |
| 1/31/1999 | 2/16/1999 | 0.89 | 34 | 7.1 | 7.6 | 40.2 | 42 |
| 2/28/1999 | 3/16/1999 | 0.00014 | 34 | 7.2 | 7.5 | 41.8 | 46 |
| 3/31/1999 | 4/16/1999 | 0.000024 | 0.000748 | 7.7 | 8.1 | 40.6 | 43.2 |
| 4/30/1999 | 5/13/1999 | 0.026 | 0.79 | 8.1 | 8.2 | 48.5 | 49.6 |
| 5/31/1999 | 6/16/1999 | 0.136 | 4.1 | 8 | 8.1 | 57.3 | 63 |
| 6/30/1999 | 7/14/1999 | 1.16 | 34 | 7.1 | 8.2 | 65.7 | 70.2 |
| 7/31/1999 | 8/16/1999 | 6.5 | 34 | 7.7 | 7.9 | 69.8 | 73.4 |
| 8/31/1999 | 9/17/1999 | 3.8 | 34 | 7.2 | 8.1 | 72.4 | 76 |
| 9/30/1999 | 10/18/1999 | 0.987 | 29 | 7.5 | 7.5 | 70 | 70 |
| 10/31/1999 | 11/15/1999 | 0.0008 | 0.026 | | | | |
| 11/30/1999 | 12/15/1999 | 4.45 | 34 | 8 | 8.1 | 50 | 52 |
| 12/31/1999 | 1/14/2000 | 0.0002 | 0.007 | | | | |
| 1/31/2000 | 2/15/2000 | 3 | 34 | 7.2 | 7.4 | 48 | 51 |
| 2/29/2000 | 3/15/2000 | 0.024 | 0.712 | 7.6 | 7.6 | 35 | 35 |
| 3/31/2000 | 4/12/2000 | 3.05 | 40 | 7.6 | 8.2 | 51 | 55 |
| 4/30/2000 | 5/15/2000 | 0.066 | 1.99 | 6.5 | 8.4 | 48 | 55 |
| 5/31/2000 | 6/13/2000 | 2.83 | 40 | 7.6 | 8.1 | 62 | 70 |
| 6/30/2000 | 7/14/2000 | 0.23 | 6.9 | 7.6 | 7.6 | 71 | 71 |
| 7/31/2000 | 8/14/2000 | 6.7 | 40 | 7.7 | 7.8 | 84 | 86 |
| 8/31/2000 | 9/13/2000 | 2.3 | 40 | 7.8 | 7.8 | 70 | 70 |
| 9/30/2000 | 10/12/2000 | 2.7 | 40 | 7.5 | 7.9 | 67 | 82 |
| 10/31/2000 | 11/13/2000 | 1.7 | 40 | 7.4 | 7.7 | 62 | 63 |
| 11/30/2000 | 12/11/2000 | 0.5 | 16 | 7.8 | 8 | 58 | 60 |
| 12/31/2000 | 1/10/2001 | 0.7 | 20.3 | 7.7 | 7.7 | 51 | 53 |
| 1/31/2001 | 2/14/2001 | | | | | | |
| 2/28/2001 | 3/15/2001 | 0.01 | 0.18 | | | | |
| 3/31/2001 | 4/12/2001 | 0.25 | 7.35 | 7.9 | 7.9 | 38 | 38 |
| 4/30/2001 | 5/9/2001 | 9.3 | 40 | 8 | 8.1 | 54 | 55 |
| 5/31/2001 | 6/11/2001 | 0.24 | 7.4 | 7.9 | 7.9 | 61 | 61 |
| 6/30/2001 | 7/12/2001 | 0.09 | 2.8 | 8.1 | 8.1 | 74 | 74 |
| 7/31/2001 | 8/9/2001 | 0.14 | 4.1 | 7.9 | 7.9 | 76 | 76 |
| 8/31/2001 | 9/14/2001 | 0.03 | 0.83 | 8 | 8 | 76 | 76 |
| 9/30/2001 | 10/10/2001 | 0.21 | 6.4 | 8.2 | 8.2 | 68 | 68 |
| 10/31/2001 | 11/14/2001 | 5.51 | 40 | 8 | 8.1 | 66 | 67 |
| 11/30/2001 | 12/12/2001 | 3.6 | 40 | 7.9 | 8.2 | 61 | 63 |
| 12/31/2001 | 1/14/2002 | 0.45 | 40 | 7.8 | 7.8 | 55 | 55 |
| 1/31/2002 | 2/14/2002 | 0.11 | 0.11 | | | | |
| 2/28/2002 | 3/12/2002 | 0.52 | 40 | 7.9 | 7.9 | 50 | 59 |
| 3/31/2002 | 4/15/2002 | | | | | | |
| 4/30/2002 | 5/14/2002 | 8.96 | 40 | 8 | 8.1 | 54 | 59 |
| 5/31/2002 | 6/13/2002 | 0.23 | 40 | | | | |
| 6/30/2002 | 7/10/2002 | | | | | | |
| 7/31/2002 | 8/14/2002 | | | | | | |
| 8/31/2002 | 9/16/2002 | | | | | | |
| 9/30/2002 | 10/11/2002 | | | | | | |
| 10/31/2002 | 11/14/2002 | 0.27 | 40 | 7.7 | 8 | 56 | 58 |
| 11/30/2002 | 12/13/2002 | 1.01 | 40 | 7.8 | 8.2 | 50 | 52 |
| 12/31/2002 | 1/15/2003 | 0.0004 | 40 | 8.3 | 8.3 | 37 | 37 |
| 1/31/2003 | 2/12/2003 | 3 | 40 | 8 | 8.1 | 40 | 40 |
| 2/28/2003 | 3/31/2003 | 2.64 | 40 | 8.14 | 8.14 | 41.78 | 41.78 |
| 3/31/2003 | 4/10/2003 | 2.4 | 40 | 8.1 | 8.3 | 48.2 | 61 |
| 4/30/2003 | 5/13/2003 | 0.65 | 19.4 | 8 | 8 | 45 | 45 |
| 5/31/2003 | 6/12/2003 | 0.46 | 14.4 | 8.2 | 8.2 | 64.1 | 64.1 |
| 6/30/2003 | 7/11/2003 | 0.006 | 0.19 | | | | |
| 7/31/2003 | 8/14/2003 | 0.005 | 0.16 | | | | |
| 8/31/2003 | 9/12/2003 | 0.008 | 0.24 | | | | |
| 9/30/2003 | 10/14/2003 | 3.04 | 40 | 8.26 | 8.26 | 75.6 | 75.6 |
| 10/31/2003 | 11/12/2003 | 3.53 | 40 | 8.12 | 8.12 | 66.76 | 66.76 |
| 11/30/2003 | 12/10/2003 | 0.02 | 0.58 | 8.08 | 8.08 | 48.01 | 48.01 |
| 12/31/2003 | 1/13/2004 | 1.61 | 40 | 8.13 | 8.44 | 44.35 | 48.14 |
| 1/31/2004 | 2/13/2004 | 0.01 | 0.31 | 8.11 | 8.15 | 37.5 | 42.25 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2/29/2004 | 3/15/2004 | 2.67 | 40 | 8.22 | 8.24 | 39.8 | 41.4 |
| 3/31/2004 | 4/18/2004 | 0.009 | 0.286 | | | | |
| 4/30/2004 | 5/17/2004 | 0.22 | 6.56 | 8.26 | 8.26 | 46.5 | 46.5 |
| 5/31/2004 | 6/14/2004 | 8 | 40 | 8.29 | 8.42 | 62.2 | 68.6 |
| 6/30/2004 | 7/12/2004 | 0.0009 | 0.028 | 8.24 | 8.46 | 62.6 | 65.3 |
| 7/31/2004 | 8/10/2004 | 0.006 | 0.0002 | 8.37 | 8.37 | 61.31 | 61.31 |
| 8/31/2004 | 9/13/2004 | 0.41 | 12.8 | 8.33 | 8.4 | 69.43 | 72.82 |
| 9/30/2004 | 10/15/2004 | 0.002 | 0.049 | | | | |
| 10/31/2004 | 11/15/2004 | 9.06 | 40 | 8.03 | 8.46 | 65.14 | 70.75 |
| 11/30/2004 | 12/9/2004 | | | | | | |
| 12/31/2004 | 1/13/2005 | 0.021 | 0.66 | 8.31 | 8.31 | 37.16 | 37.16 |
| 1/31/2005 | 2/14/2005 | | | | | | |
| 2/28/2005 | 3/14/2005 | | | | | | |
| 3/31/2005 | 4/15/2005 | 0.006 | 0.18 | 8.39 | 8.39 | 41.42 | 41.42 |
| 4/30/2005 | 5/18/2005 | 0.19 | 5.7 | 8.48 | 8.57 | 52.52 | 53.15 |
| 5/31/2005 | 6/13/2005 | 0.09 | 0.92 | 8.54 | 8.54 | 55.5 | 55.5 |
| 6/30/2005 | 7/14/2005 | | | | | | |
| 7/31/2005 | 8/17/2005 | 0.1 | 2.77 | 8.58 | 8.58 | 66.35 | 66.35 |
| 8/31/2005 | 9/12/2005 | | | | | | |
| 9/30/2005 | 10/17/2005 | 7.02 | 40.3 | 7.99 | 8.18 | 69.7 | 76.8 |
| 10/31/2005 | 11/15/2005 | 2.33 | 22.94 | 7.84 | 8.35 | 66.6 | 71 |
| 11/30/2005 | 12/13/2005 | 0.0006 | 0.0008 | | | | |
| 12/31/2005 | 1/13/2006 | 0.001 | 0.01 | | | | |
| 1/31/2006 | 2/14/2006 | 0.17 | 1.43 | 8.27 | 8.56 | 45.5 | 48.6 |
| 2/28/2006 | 3/13/2006 | 0.05 | 0.25 | 8.23 | 8.35 | 41.3 | 44.1 |
| 3/31/2006 | 4/14/2006 | 1.98 | 36.21 | 8.33 | 8.33 | 35.2 | 35.2 |
| 4/30/2006 | 5/15/2006 | 0.0005 | 0.0006 | | | | |
| 5/31/2006 | 6/14/2006 | 0.0005 | 0.006 | 8.21 | 8.21 | 50.2 | 50.2 |
| 6/30/2006 | 7/13/2006 | 0.28 | 8.31 | 8.09 | 8.09 | 68.34 | 68.34 |
| 7/31/2006 | 8/7/2006 | 0.0004 | 0.001 | | | | |
| 8/31/2006 | 9/19/2006 | 0.65 | 12.39 | 7.99 | 8.28 | 71.14 | 76.42 |
| 9/30/2006 | 10/16/2006 | 2.23 | 30.6 | | | | |
| 10/31/2006 | 11/15/2006 | 0.3 | 9.34 | 8.01 | 8.37 | 65.3 | 74.2 |
| 11/30/2006 | 12/15/2006 | 0.002 | 0.04 | 8.07 | 8.07 | 46.4 | 46.4 |
| 12/31/2006 | 1/11/2007 | 0.0003 | 0.002 | | | | |
| 1/31/2007 | 2/14/2007 | | | | | | |
| 2/28/2007 | 3/14/2007 | 0.47 | 13.13 | 8.08 | 8.18 | 32.1 | 35 |
| 3/31/2007 | 4/16/2007 | | | | | | |
| 4/30/2007 | 5/16/2007 | | | | | | |
| 5/31/2007 | 6/14/2007 | | | | | | |
| 6/30/2007 | 7/13/2007 | 0.12 | 3.63 | 7.9 | 7.9 | 68.1 | 68.1 |
| 7/31/2007 | 8/13/2007 | | | | | | |
| 8/31/2007 | 9/13/2007 | 0.89 | 13.16 | 7.85 | 8.03 | 79.4 | 80.6 |
| 9/30/2007 | 10/12/2007 | 2.41 | 29.31 | 7.66 | 7.9 | 70.4 | 71.9 |
| 10/31/2007 | 11/14/2007 | 0.02 | 0.49 | 7.87 | 7.87 | 57.3 | 57.3 |
| 11/30/2007 | 12/12/2007 | 0.16 | 0.66 | 7.87 | 7.95 | 51.4 | 53.6 |
| 12/31/2007 | 1/14/2008 | 0.1 | 1.29 | 7.89 | 8.14 | 41.1 | 41.1 |
| 1/31/2008 | 2/15/2008 | 0.08 | 0.65 | 7.98 | 8.08 | 45.13 | 48.4 |
| 2/29/2008 | 3/14/2008 | | | | | | |
| 3/31/2008 | 4/11/2008 | | | | | | |
| 4/30/2008 | 5/7/2008 | 9.09 | 35.28 | 7.78 | 8.02 | 58.9 | 62.4 |
| 5/31/2008 | 6/13/2008 | 1.61 | 25.78 | 7.8 | 7.93 | 62.7 | 63.8 |
| 6/30/2008 | 7/11/2008 | 5.92 | 26.84 | 7.69 | 7.91 | 72.1 | 80.7 |
| 7/31/2008 | 8/11/2008 | 0.0003 | 0.0081 | 7.72 | 7.72 | 74.4 | 74.4 |
| 8/31/2008 | 9/10/2008 | | | | | | |
| 9/30/2008 | 10/10/2008 | | | | | | |
| 10/31/2008 | | | | | | | |
| 11/30/2008 | | | | | | | |
| 12/31/2008 | | | | | | | |
| **014A** | | Flow | | pH | | Temperature | |
| | | 27 Mgal/d | 45 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 95 deg F |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| | Ave: | 1.51 | 18.10 | 7.91 | 8.09 | 56.55 | 59.02 |
| | max | 9.3 | 40.3 | 8.58 | 8.58 | 84 | 86 |
| | min | 0.000024 | 0.0002 | 6.5 | 7.4 | 32.1 | 35 |
| | exceedence | 0 | 0 | 0 | 4 | 0 | 0 |

**018A**

| | | Flow | | ph | | Temperature | |
|---|---|---|---|---|---|---|---|
| | | 35.6 Mgal/d | 35.6 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 95 deg F |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| 10/31/1998 | 11/16/1998 | 29.6 | 34.9 | 7.6 | 8.2 | 67.2 | 70.1 |
| 11/30/1998 | 12/16/1998 | 30.7 | 34.9 | 7.6 | 7.9 | 59 | 61 |
| 12/31/1998 | 1/19/1999 | 29.7 | 34.9 | 7.6 | 8.2 | 56.4 | 59 |
| 1/31/1999 | 2/16/1999 | 29.3 | 34.9 | 7.5 | 7.6 | 48.2 | 51.8 |
| 2/28/1999 | 3/16/1999 | 28.1 | 34.9 | 7.4 | 8.1 | 49.3 | 56 |
| 3/31/1999 | 4/16/1999 | 28.6 | 34.9 | 7.7 | 8.1 | 55.7 | 71 |
| 4/30/1999 | 5/13/1999 | 27.7 | 34.9 | 7.9 | 8.1 | 64.8 | 77 |
| 5/31/1999 | 6/16/1999 | 28.8 | 34.9 | 7.9 | 8 | 76 | 91 |
| 6/30/1999 | 7/14/1999 | 28.8 | 28.8 | 7.7 | 8.1 | 84 | 95 |
| 7/31/1999 | 8/16/1999 | 30.7 | 34.9 | 7.6 | 7.7 | 85 | 95 |
| 8/31/1999 | 9/17/1999 | 29.3 | 34.9 | 7.3 | 7.7 | 85 | 95 |
| 9/30/1999 | 10/18/1999 | 28.1 | 34.9 | 7.3 | 7.7 | 81.5 | 94 |
| 10/31/1999 | 11/15/1999 | 28.9 | 34.9 | 7.5 | 7.7 | 70 | 83 |
| 11/30/1999 | 12/15/1999 | 28.1 | 34.9 | 7.6 | 8 | 63 | 76 |
| 12/31/1999 | 1/14/2000 | 28 | 34.9 | 7.3 | 7.9 | 53 | 67 |
| 1/31/2000 | 2/15/2000 | 27.8 | 34.9 | 7.5 | 7.8 | 46 | 62 |
| 2/29/2000 | 3/15/2000 | 27.6 | 34.9 | 7.6 | 7.8 | 49 | 63 |
| 3/31/2000 | 4/12/2000 | 28.2 | 34.9 | 7.8 | 7.9 | 59 | 73 |
| 4/30/2000 | 5/15/2000 | 25.7 | 34.9 | 7.5 | 8.1 | 64 | 79 |
| 5/31/2000 | 6/13/2000 | 21.8 | 34.9 | 7.2 | 7.7 | 78 | 91 |
| 6/30/2000 | 7/14/2000 | 21.9 | 34.9 | 7.4 | 7.7 | 83 | 93 |
| 7/31/2000 | 8/14/2000 | 23.9 | 34.9 | 7.3 | 7.6 | 84 | 93 |
| 8/31/2000 | 9/13/2000 | 29.9 | 34.9 | 7.6 | 7.8 | 86 | 95 |
| 9/30/2000 | 10/12/2000 | 22.5 | 34.9 | 7.5 | 7.8 | 81 | 93 |
| 10/31/2000 | 11/13/2000 | 27.2 | 34.9 | 7.5 | 7.8 | 73 | 88 |
| 11/30/2000 | 12/11/2000 | 29.8 | 34.9 | 7.6 | 7.7 | 62 | 74 |
| 12/31/2000 | 1/10/2001 | 29.5 | 34.9 | 7.7 | 7.8 | 53 | 67 |
| 1/31/2001 | 2/14/2001 | 30 | 34.9 | 7.8 | 8.1 | 48 | 60 |
| 2/28/2001 | 3/15/2001 | 26.4 | 34.9 | 7.7 | 7.9 | 52 | 71 |
| 3/31/2001 | 4/12/2001 | 28.3 | 34.9 | 7.9 | 8 | 56 | 66 |
| 4/30/2001 | 5/9/2001 | 28 | 34.9 | 7.8 | 7.9 | 63 | 82 |
| 5/31/2001 | 6/11/2001 | 25 | 34.9 | 7.8 | 8.1 | 74 | 91 |
| 6/30/2001 | 7/12/2001 | 28.8 | 34.9 | 7.7 | 7.8 | 81 | 93 |
| 7/31/2001 | 8/9/2001 | 28.8 | 34.9 | 7.5 | 7.9 | 82 | 94 |
| 8/31/2001 | 9/14/2001 | 31 | 34.9 | 7.3 | 7.8 | 86 | 95 |
| 9/30/2001 | 10/10/2001 | 28.9 | 34.9 | 7.6 | 7.8 | 81 | 92 |
| 10/31/2001 | 11/14/2001 | 29.4 | 34.9 | 7.8 | 8 | 73 | 88 |
| 11/30/2001 | 12/12/2001 | 30.4 | 34.9 | 7.9 | 8 | 62 | 73 |
| 12/31/2001 | 1/14/2002 | 31.7 | 34.9 | 7.8 | 7.9 | 56 | 69 |
| 1/31/2002 | 2/14/2002 | 30.6 | 34.9 | 7.8 | 7.9 | 51.4 | 64 |
| 2/28/2002 | 3/12/2002 | 30.8 | 34.9 | 7.8 | 7.9 | 56 | 67 |
| 3/31/2002 | 4/15/2002 | 30.4 | 34.9 | 7.7 | 7.9 | 59.5 | 69 |
| 4/30/2002 | 5/14/2002 | 26.2 | 34.9 | 7.8 | 7.9 | 67.3 | 83 |
| 5/31/2002 | 6/13/2002 | 22.8 | 34.9 | 7.9 | 8 | 73.5 | 91 |
| 6/30/2002 | 7/10/2002 | 22.8 | 34.9 | 7.8 | 8 | 80.2 | 94 |
| 7/31/2002 | 8/14/2002 | 30.2 | 34.9 | 7.7 | 8 | 84 | 94 |
| 8/31/2002 | 9/16/2002 | 32.1 | 34.9 | 7.7 | 7.8 | 86.4 | 90.5 |
| 9/30/2002 | 10/11/2002 | 30.5 | 34.9 | 7.6 | 7.8 | 83.3 | 89 |
| 10/31/2002 | 11/14/2002 | 30.3 | 34.9 | 7.6 | 7.9 | 71.2 | 84 |
| 11/30/2002 | 12/13/2002 | 29.7 | 34.9 | 7.9 | 8.1 | 60 | 70.5 |
| 12/31/2002 | 1/15/2003 | 30.9 | 34.9 | 7.8 | 8.1 | 49.8 | 55.5 |
| 1/31/2003 | 2/12/2003 | 29.3 | 34.9 | 7.8 | 8.1 | 46.9 | 53 |
| 2/28/2003 | 3/31/2003 | 27.7 | 34.9 | 7.7 | 8.1 | 45.7 | 50 |
| 3/31/2003 | 4/10/2003 | 25.6 | 34.9 | 7.3 | 8.2 | 50.7 | 64 |
| 4/30/2003 | 5/13/2003 | 26.4 | 34.9 | 7.9 | 8.2 | 57.8 | 69.5 |
| 5/31/2003 | 6/12/2003 | 24.6 | 34.9 | 7.6 | 7.9 | 57.8 | 69.5 |
| 6/30/2003 | 7/11/2003 | 28.3 | 34.9 | 7.42 | 7.87 | 75.9 | 86 |
| 7/31/2003 | 8/14/2003 | 30.52 | 34.9 | 7.5 | 7.9 | 80.9 | 87.5 |
| 8/31/2003 | 9/12/2003 | 29.92 | 34.9 | 7.5 | 7.9 | 81.6 | 88.5 |
| 9/30/2003 | 10/14/2003 | 28.3 | 34.9 | 7.39 | 7.93 | 79.7 | 85.5 |
| 10/31/2003 | 11/12/2003 | 23.01 | 34.9 | 7.47 | 7.98 | 70.2 | 76.5 |
| 11/30/2003 | 12/10/2003 | 25.2 | 34.9 | 8.07 | 8.18 | 61.4 | 70 |
| 12/31/2003 | 1/13/2004 | 27.6 | 34.9 | 8.08 | 8.23 | 51.6 | 57.1 |
| 1/31/2004 | 2/13/2004 | 21.17 | 34.9 | 7.11 | 8.35 | 47.5 | 57.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2/29/2004 | 3/15/2004 | 21.3 | 34.9 | 7.94 | 8.22 | 49.35 | 52.5 |
| 3/31/2004 | 4/18/2004 | 29.74 | 34.9 | 8.07 | 8.34 | 53.5 | 58 |
| 4/30/2004 | 5/17/2004 | 30.67 | 34.9 | 8.15 | 8.38 | 59.4 | 68.5 |
| 5/31/2004 | 6/14/2004 | 30.2 | 34.9 | 7.96 | 8.1 | 71.2 | 77.5 |
| 6/30/2004 | 7/12/2004 | 27.94 | 34.9 | 7.39 | 7.94 | 76.8 | 83.5 |
| 7/31/2004 | 8/10/2004 | 27.6 | 34.9 | 7.79 | 7.79 | 84.2 | 88 |
| 8/31/2004 | 9/13/2004 | 30.76 | 34.9 | 7.8 | 7.91 | 83.8 | 88 |
| 9/30/2004 | 10/15/2004 | 29.3 | 34.9 | 7.85 | 8.33 | 81.5 | 86 |
| 10/31/2004 | 11/15/2004 | 25.3 | 32.28 | 8.05 | 8.8 | 72 | 81 |
| 11/30/2004 | 12/9/2004 | 25.62 | 32.04 | 7.96 | 8.31 | 62.4 | 67.5 |
| 12/31/2004 | 1/13/2005 | 22.24 | 30.6 | 8.07 | 8.13 | 58.2 | 69 |
| 1/31/2005 | 2/14/2005 | 23.22 | 30.6 | 8.03 | 8.27 | 50.2 | 63.5 |
| 2/28/2005 | 3/14/2005 | 21.1 | 21.9 | 8.06 | 8.28 | 49.8 | 59 |
| 3/31/2005 | 4/15/2005 | 20.9 | 23.31 | 7.93 | 8.36 | 53.9 | 60 |
| 4/30/2005 | 5/18/2005 | 23.43 | 30.6 | 7.96 | 8.2 | 59.1 | 67.5 |
| 5/31/2005 | 6/13/2005 | 20.94 | 21.36 | 7.96 | 8.27 | 70.65 | 78 |
| 6/30/2005 | 7/14/2005 | 21.25 | 24.35 | 7.02 | 7.96 | 80.7 | 88 |
| 7/31/2005 | 8/19/2005 | 26.84 | 34.68 | 7.58 | 7.93 | 83.3 | 88.5 |
| 8/31/2005 | 9/12/2005 | 31.05 | 34.05 | 7.96 | 8.08 | 83.7 | 89.5 |
| 9/30/2005 | 10/17/2005 | 22 | 30.6 | 7.92 | 8.13 | 81.25 | 84.5 |
| 10/31/2005 | 11/15/2005 | 20.91 | 25.34 | 8.03 | 8.08 | 72.3 | 82.5 |
| 11/30/2005 | 12/13/2005 | 20.97 | 31.08 | 8.05 | 8.17 | 65.7 | 73 |
| 12/31/2005 | 1/13/2006 | 21.5 | 27.36 | 8.02 | 8.12 | 54.98 | 67.5 |
| 1/31/2006 | 2/14/2006 | 25.09 | 30.78 | 8.06 | 8.09 | 55.2 | 60 |
| 2/28/2006 | 3/13/2006 | 29.5 | 31.08 | 8.01 | 8.11 | 51.7 | 57.5 |
| 3/31/2006 | 4/14/2006 | 28.9 | 30.6 | 8.05 | 8.1 | 55.9 | 62.5 |
| 4/30/2006 | 5/15/2006 | 21.36 | 30.6 | 8.06 | 8.11 | 69.1 | 74.5 |
| 5/31/2006 | 6/14/2006 | 21.4 | 25.7 | 7.98 | 8.11 | 73.6 | 83.5 |
| 6/30/2006 | 7/13/2006 | 27.64 | 33.93 | 7.98 | 8.07 | 80.1 | 86 |
| 7/31/2006 | 8/7/2006 | 30.1 | 35.06 | 7.69 | 8.16 | 83.6 | 88 |
| 8/31/2006 | 9/19/2006 | 29.27 | 35.01 | 7.96 | 8.03 | 83.5 | 88 |
| 9/30/2006 | 10/16/2006 | 28.13 | 33.6 | 7.97 | 8.05 | 79.8 | 85.5 |
| 10/31/2006 | 11/15/2006 | 24.8 | 30.6 | 7.97 | 8.14 | 72.2 | 79 |
| 11/30/2006 | 12/15/2006 | 27.5 | 30.6 | 7.91 | 8.06 | 65.2 | 71 |
| 12/31/2006 | 1/11/2007 | 26.7 | 30.6 | 8.02 | 8.08 | 57.8 | 69 |
| 1/31/2007 | 2/14/2007 | 28.1 | 30.6 | 8.01 | 8.06 | 52.5 | 59.5 |
| 2/28/2007 | 3/14/2007 | 28.83 | 31.08 | 8 | 8.07 | 47.4 | 55 |
| 3/31/2007 | 4/16/2007 | 28.4 | 30.6 | 7.99 | 8.05 | 54.9 | 65 |
| 4/30/2007 | 5/16/2007 | 27.4 | 30.6 | 7.99 | 8.07 | 70.5 | 60 |
| 5/31/2007 | 6/14/2007 | 24.8 | 31.6 | 8 | 8.08 | 71 | 79 |
| 6/30/2007 | 7/13/2007 | 24.8 | 28.4 | 7.94 | 8.07 | 78.6 | 84 |
| 7/31/2007 | 8/15/2007 | 29.7 | 35.5 | 8.04 | 8.07 | 79.3 | 86.5 |
| 8/31/2007 | 9/13/2007 | 30.9 | 34.9 | 8.02 | 8.12 | 80.7 | 85.5 |
| 9/30/2007 | 10/12/2007 | 30.2 | 33.8 | 7.96 | 8.06 | 77 | 83 |
| 10/31/2007 | 11/14/2007 | 27.8 | 33 | 7.96 | 8.09 | 70.4 | 84 |
| 11/30/2007 | 12/12/2007 | 27.6 | 31.6 | 7.91 | 8.21 | 56.8 | 65 |
| 12/31/2007 | 1/14/2008 | 25.65 | 31.08 | 8 | 8.12 | 47.3 | 55 |
| 1/31/2008 | 2/15/2008 | 28.92 | 30.78 | 7.98 | 8.07 | 43.7 | 51 |
| 2/29/2008 | 3/14/2008 | 28.8 | 30.6 | 8.03 | 8.09 | 44 | 51.5 |
| 3/31/2008 | 4/11/2008 | 27.83 | 30.75 | 8 | 8.11 | 44.2 | 51 |
| 4/30/2008 | 5/7/2008 | 27.6 | 31.8 | 7.96 | 8.04 | 55.9 | 64.5 |
| 5/31/2008 | 6/13/2008 | 26.49 | 30.78 | 7.97 | 8.02 | 66.5 | 74.5 |
| 6/30/2008 | 7/11/2008 | 29.88 | 33.48 | 7.88 | 8.07 | 76.4 | 81.5 |
| 7/31/2008 | 8/11/2008 | 29.09 | 33.48 | 7.89 | 8.11 | 81.2 | 85.5 |
| 8/31/2008 | 9/10/2008 | 27.84 | 33.48 | 8 | 8.02 | 81.2 | 84.5 |
| 9/30/2008 | 10/10/2008 | 29.2 | 32.8 | 8 | 8.07 | 76 | 83.5 |
| 10/31/2008 | 11/12/2008 | 26.7 | 32 | 8 | 8 | 67.1 | 74 |
| 11/30/2008 | | | | | | | |
| 12/31/2008 | | | | | | | |
| **018A** | | Flow | | pH | | Temperature | |
| | | 35.6 Mgal/d | 35.6 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 95 deg F |
| | | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| | Ave: | 27.3 | 33.2 | 7.8 | 8.0 | 66.7 | 75.5 |
| | max | 32.1 | 35.5 | 8.15 | 8.8 | 86.4 | 95 |
| | min | 20.9 | 21.36 | 7.02 | 7.6 | 43.7 | 50 |
| | exceedence | 0 | 0 | 0 | 1 | 0 | 0 |

**019D**

| | | Flow | Mercury | O&G | | pH | | Silver | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | .083 Mgal/d | Req. Mon. mg/L | 10 mg/L | 15 mg/L | 6.5 SU | 8.5 SU | Req. Mon. mg/L | 88.4 deg F | 90 deg F |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MO AVG | DAILY MX | MINIMUM | MAXIMUM | DAILY MX | MO AVG | DAILY MX |
| 10/31/1998 | 11/16/1998 | 0.083 | | 5 | 5 | | | | 65.7 | 70.5 |
| 11/30/1998 | 12/16/1998 | 0.083 | | 5 | 5 | | | | 53 | 55 |
| 12/31/1998 | 1/19/1999 | 0.083 | | 5 | 5 | | | | 51.6 | 55 |
| 1/31/1999 | 2/16/1999 | 0.083 | | 5 | 5 | 6.8 | 7.4 | | 45.4 | 48 |
| 2/28/1999 | 3/16/1999 | 0.083 | | 5 | 5 | 7.1 | 7.6 | | 47 | 51 |
| 3/31/1999 | 4/16/1999 | 0.083 | | 5 | 5 | 7.3 | 7.3 | | 47.3 | 48.2 |
| 4/30/1999 | 5/13/1999 | 0.083 | | 5 | 5 | 7.6 | 7.8 | | 53.6 | 55 |
| 5/31/1999 | 6/16/1999 | 0.083 | | 5 | 5 | 7.5 | 7.9 | | 59.6 | 66 |
| 6/30/1999 | 7/14/1999 | 0.083 | | 5 | 5 | 7.4 | 8.5 | | 67.1 | 71 |
| 7/31/1999 | 8/16/1999 | 0.083 | | 5 | 5 | 7.5 | 7.5 | | 71.1 | 73.4 |
| 8/31/1999 | 9/17/1999 | 0.083 | | 5 | 5 | 7.3 | 7.6 | | 71.8 | 75 |
| 9/30/1999 | 10/18/1999 | 0.083 | | 5 | 5 | 7.3 | 7.6 | | 70.9 | 74 |
| 10/31/1999 | 11/15/1999 | 0.083 | | 5 | 5 | 7.5 | 8.9 | | 64.4 | 68 |
| 11/30/1999 | 12/15/1999 | 0.083 | | 5 | 5 | 7.4 | 7.8 | | 55 | 63 |
| 12/31/1999 | 1/14/2000 | 0.083 | | 5 | 5 | 7.3 | 7.8 | | 50 | 55 |
| 1/31/2000 | 2/15/2000 | 0.083 | | 5 | 5 | 6.9 | 8.1 | | 47 | 57 |
| 2/29/2000 | 3/15/2000 | 0.083 | | 5 | 5 | 7.5 | 7.7 | | 45 | 48 |
| 3/31/2000 | 4/12/2000 | 0.083 | | 5 | 5 | 7.6 | 7.6 | | 48 | 51 |
| 4/30/2000 | 5/15/2000 | 0.083 | | 5 | 5 | 7.3 | 8 | | 52 | 53 |
| 5/31/2000 | 6/13/2000 | 0.083 | | 5 | 5 | 7.3 | 7.8 | | 58 | 61 |
| 6/30/2000 | 7/14/2000 | 0.083 | | 5 | 5 | 7.2 | 7.8 | | 65 | 68 |
| 7/31/2000 | 8/14/2000 | 0.017 | | 6 | 6 | 7.4 | 7.4 | | 67 | 67 |
| 8/31/2000 | 9/13/2000 | C | | C | C | C | C | | C | C |
| 9/30/2000 | 10/12/2000 | C | | C | C | C | C | | C | C |
| 10/31/2000 | 11/13/2000 | C | | C | C | C | C | | C | C |
| 11/30/2000 | 12/11/2000 | C | | C | C | C | C | | C | C |
| 12/31/2000 | 1/10/2001 | C | | C | C | C | C | | C | C |
| 1/31/2001 | 2/14/2001 | C | | C | C | C | C | | C | C |
| 2/28/2001 | 3/15/2001 | C | | C | C | C | C | | C | C |
| 3/31/2001 | 4/12/2001 | C | | C | C | C | C | | C | C |
| 4/30/2001 | 5/9/2001 | C | | C | C | C | C | | C | C |
| 5/31/2001 | 6/11/2001 | C | | C | C | C | C | | C | C |
| 6/30/2001 | 7/12/2001 | C | | C | C | C | C | | C | C |
| 7/31/2001 | 8/9/2001 | C | | C | C | C | C | | C | C |
| 8/31/2001 | 9/14/2001 | C | | C | C | C | C | | C | C |
| 9/30/2001 | 10/10/2001 | C | | C | C | C | C | | C | C |
| 10/31/2001 | 11/14/2001 | C | | C | C | C | C | | C | C |
| 11/30/2001 | 12/12/2001 | C | | C | C | C | C | | C | C |
| 12/31/2001 | 1/14/2002 | C | | C | C | C | C | | C | C |
| 1/31/2002 | 2/14/2002 | C | | C | C | C | C | | C | C |
| 2/28/2002 | 3/12/2002 | C | | C | C | C | C | | C | C |
| 3/31/2002 | 4/15/2002 | C | | C | C | C | C | | C | C |
| 4/30/2002 | 5/14/2002 | C | | C | C | C | C | | C | C |
| 5/31/2002 | 6/13/2002 | C | | C | C | C | C | | C | C |
| 6/30/2002 | 7/10/2002 | C | | C | C | C | C | | C | C |
| 7/31/2002 | 8/14/2002 | C | | C | C | C | C | | C | C |
| 8/31/2002 | 9/16/2002 | C | | C | C | C | C | | C | C |
| 9/30/2002 | 10/11/2002 | C | | C | C | C | C | | C | C |
| 10/31/2002 | 11/14/2002 | C | | C | C | C | C | | C | C |
| 11/30/2002 | 12/13/2002 | C | | C | C | C | C | | C | C |
| 12/31/2002 | 1/15/2003 | C | | C | C | C | C | | C | C |
| 1/31/2003 | 2/12/2003 | C | | C | C | C | C | | C | C |
| 2/28/2003 | 3/31/2003 | C | | C | C | C | C | | C | C |
| 3/31/2003 | 4/10/2003 | C | | C | C | C | C | | C | C |
| 4/30/2003 | 5/13/2003 | C | | C | C | C | C | | C | C |
| 5/31/2003 | 6/12/2003 | C | | C | C | C | C | | C | C |
| 6/30/2003 | 7/11/2003 | C | | C | C | C | C | | C | C |
| 7/31/2003 | 8/14/2003 | C | | C | C | C | C | | C | C |
| 8/31/2003 | 9/12/2003 | C | | C | C | C | C | | C | C |
| 9/30/2003 | 10/14/2003 | C | | C | C | C | C | | C | C |
| 10/31/2003 | 11/12/2003 | C | | C | C | C | C | | C | C |
| 11/30/2003 | 12/10/2003 | C | | C | C | C | C | | C | C |
| 12/31/2003 | 1/13/2004 | C | | C | C | C | C | | C | C |
| 1/31/2004 | 2/13/2004 | C | | C | C | C | C | | C | C |
| 2/29/2004 | 3/15/2004 | C | | C | C | C | C | | C | C |
| 3/31/2004 | 4/18/2004 | C | | C | C | C | C | | C | C |
| 4/30/2004 | 5/17/2004 | C | | C | C | C | C | | C | C |
| 5/31/2004 | 6/14/2004 | C | | C | C | C | C | | C | C |
| 6/30/2004 | 7/12/2004 | C | | C | C | C | C | | C | C |
| 7/31/2004 | 8/10/2004 | C | | C | C | C | C | | C | C |
| 8/31/2004 | 9/13/2004 | C | | C | C | C | C | | C | C |
| 9/30/2004 | 10/15/2004 | C | | C | C | C | C | | C | C |
| 10/31/2004 | 11/15/2004 | C | | C | C | C | C | | C | C |
| 11/30/2004 | 12/9/2004 | C | | C | C | C | C | | C | C |
| 12/31/2004 | 1/13/2005 | C | | C | C | C | C | | C | C |
| 1/31/2005 | 2/14/2005 | C | | C | C | C | C | | C | C |
| 2/28/2005 | 3/14/2005 | C | | C | C | C | C | | C | C |
| 3/31/2005 | 4/15/2005 | C | | C | C | C | C | | C | C |
| 4/30/2005 | 5/18/2005 | C | | C | C | C | C | | C | C |
| 5/31/2005 | 6/13/2005 | C | | C | C | C | C | | C | C |
| 6/30/2005 | 7/14/2005 | C | | C | C | C | C | | C | C |
| 7/31/2005 | 8/19/2005 | C | | C | C | C | C | | C | C |
| 8/31/2005 | 9/12/2005 | C | | C | C | C | C | | C | C |
| 9/30/2005 | 10/17/2005 | C | | C | C | C | C | | C | C |
| 10/31/2005 | 11/15/2005 | C | | C | C | C | C | | C | C |
| 11/30/2005 | 12/14/2005 | C | | C | C | C | C | | C | C |
| 12/31/2005 | 1/13/2006 | C | | C | C | C | C | | C | C |
| 1/31/2006 | 2/14/2006 | C | | C | C | C | C | | C | C |
| 2/28/2006 | 3/13/2006 | C | | C | C | C | C | | C | C |
| 3/31/2006 | 4/14/2006 | C | | C | C | C | C | | C | C |
| 4/30/2006 | 5/15/2006 | C | | C | C | C | C | | C | C |
| 5/31/2006 | 6/14/2006 | C | | C | C | C | C | | C | C |
| 6/30/2006 | 7/13/2006 | C | | C | C | C | C | | C | C |
| 7/31/2006 | 8/7/2006 | C | | C | C | C | C | | C | C |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8/31/2006 | 9/19/2006 | C | | C | C | C | C | | C | C |
| 9/30/2006 | 10/16/2006 | C | | C | C | C | C | | C | C |
| 10/31/2006 | 11/15/2006 | C | | C | C | C | C | | C | C |
| 11/30/2006 | 12/15/2006 | C | | C | C | C | C | | C | C |
| 12/31/2006 | 1/11/2007 | C | | C | C | C | C | | C | C |
| 1/31/2007 | 2/14/2007 | C | | C | C | C | C | | C | C |
| 2/28/2007 | 3/14/2007 | C | | C | C | C | C | | C | C |
| 3/31/2007 | 4/16/2007 | C | | C | C | C | C | | C | C |
| 4/30/2007 | 5/16/2007 | C | | C | C | C | C | | C | C |
| 5/31/2007 | 6/14/2007 | C | | C | C | C | C | | C | C |
| 6/30/2007 | 7/13/2007 | C | | C | C | C | C | | C | C |
| 7/31/2007 | 8/15/2007 | C | | C | C | C | C | | C | C |
| 8/31/2007 | 9/13/2007 | C | | C | C | C | C | | C | C |
| 9/30/2007 | 10/12/2007 | C | | C | C | C | C | | C | C |
| 10/31/2007 | 11/14/2007 | C | | C | C | C | C | | C | C |
| 11/30/2007 | 12/12/2007 | C | | C | C | C | C | | C | C |
| 12/31/2007 | 1/14/2008 | C | | C | C | C | C | | C | C |
| 1/31/2008 | 2/15/2008 | C | | C | C | C | C | | C | C |
| 2/29/2008 | 3/14/2008 | C | | C | C | C | C | | C | C |
| 3/31/2008 | 4/11/2008 | C | | C | C | C | C | | C | C |
| 4/30/2008 | 5/7/2008 | C | | C | C | C | C | | C | C |
| 5/31/2008 | 6/13/2008 | C | | C | C | C | C | | C | C |
| 6/30/2008 | 7/11/2008 | C | | C | C | C | C | | C | C |
| 7/31/2008 | 8/11/2008 | C | | C | C | C | C | | C | C |
| 8/31/2008 | 9/10/2008 | C | | C | C | C | C | | C | C |
| 9/30/2008 | 10/10/2008 | C | | C | C | C | C | | C | C |
| 10/31/2008 | 11/12/2008 | C | | C | C | C | C | | C | C |
| 11/30/2008 | | | | | | | | | | |
| 12/31/2008 | | | | | | | | | | |
| 019D | | Flow | Mercury | O&G | | pH | | Silver | Temperature | |
| | | .083 Mgal/d | Req. Mon. mg/L | 10 mg/L | 15 mg/L | 6.5 SU | 8.5 SU | Req. Mon. mg/L | 88.4 deg F | 90 deg F |
| | | MO AVG | DAILY MX | MO AVG | DAILY MX | MINIMUM | MAXIMUM | DAILY MX | MO AVG | DAILY MX |
| | Ave | 0.08 | 0.00 | 5.05 | 5.05 | 7.33 | 7.79 | 0.00 | 57.07 | 60.60 |
| | max | 0.083 | 0 | 6 | 6 | 7.6 | 8.9 | 0 | 71.8 | 75 |
| | min | 0.017 | 0 | 5 | 5 | 6.8 | 7.3 | 0 | 45 | 48 |
| | exceedence | 0 | NA | 0 | 0 | 0 | 1 | NA | 0 | 0 |

*C: NODI code which refers to "no discharge"

## 019W

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 5 | 8.5 | 8.5 |
| 1/31/1999 | 2/16/1999 | 5 | 7.4 | 7.4 |
| 4/30/1999 | 5/13/1999 | 5 | 7.9 | 7.9 |
| 7/31/1999 | 8/16/1999 | 5 | 7.4 | 7.4 |
| 10/31/1999 | 11/15/1999 | 5 | 7.3 | 7.5 |
| 1/31/2000 | 2/15/2000 | 5 | 7.4 | 7.4 |
| 4/30/2000 | 5/15/2000 | 5 | 6.7 | 6.7 |
| 7/31/2000 | 8/14/2000 | 5 | 7.3 | 7.3 |
| 10/31/2000 | 11/13/2000 | 10 | 6.9 | 6.9 |
| 1/31/2001 | 2/14/2001 | 5 | 6.4 | 6.4 |
| 4/30/2001 | 5/9/2001 | 5 | 7.1 | 7.1 |
| 7/31/2001 | 8/9/2001 | 5 | 7.8 | 7.8 |
| 10/31/2001 | 11/14/2001 | 5 | 6.9 | 6.9 |
| 1/31/2002 | 2/14/2002 | 5 | 6.8 | 6.8 |
| 4/30/2002 | 5/14/2002 | 5 | 7.4 | 7.4 |
| 7/31/2002 | 8/14/2002 | 5 | 6.9 | 6.9 |
| 10/31/2002 | 11/14/2002 | 5 | 7.4 | 7.4 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7.2 | 7.2 |
| 4/30/2003 | 5/13/2003 | 8.1 | 7.5 | 7.5 |
| 7/31/2003 | 8/14/2003 | 5 | 6.8 | 6.8 |
| 10/31/2003 | 11/12/2003 | 5 | 7.8 | 7.8 |
| 1/31/2004 | 2/13/2004 | 5 | 7.66 | 7.66 |
| 4/30/2004 | 5/17/2004 | 5 | 7.01 | 7.01 |
| 7/31/2004 | 8/10/2004 | 5 | 7.78 | 7.78 |
| 10/31/2004 | 11/15/2004 | 5 | 8.13 | 8.13 |
| 1/31/2005 | 2/14/2005 | 5 | 7.09 | 7.09 |
| 4/30/2005 | 5/18/2005 | 5 | 6.67 | 6.67 |
| 7/31/2005 | 8/19/2005 | 5 | 7.78 | 7.78 |
| 10/31/2005 | 11/15/2005 | 5 | 7.52 | 7.52 |
| 1/31/2006 | 2/14/2006 | 5 | 7.43 | 7.43 |
| 4/30/2006 | 5/15/2006 | 5 | 7.28 | 7.28 |
| 7/31/2006 | 8/7/2006 | 5 | 7.08 | 7.08 |
| 10/31/2006 | 11/15/2006 | 5 | 6.9 | 6.9 |
| 1/31/2007 | 2/14/2007 | 5 | 5.4 | 5.4 |
| 4/30/2007 | 5/16/2007 | 5 | 6.93 | 6.93 |
| 7/31/2007 | 7/13/2007 | 5 | 6.9 | 6.9 |
| 10/31/2007 | 11/14/2007 | 5 | 7.27 | 7.27 |
| 1/31/2008 | 2/15/2008 | 5 | 7.78 | 7.78 |
| 4/30/2008 | 5/10/2008 | 5 | 6.9 | 6.9 |
| 7/31/2008 | 8/11/2008 | 5 | 6.92 | 6.92 |
| 10/31/2008 | 11/12/2008 | 5 | 6.96 | 6.96 |

## 019W

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave | 5.2 | 7.2 | 7.2 |
| | max | 10 | 8.5 | 8.5 |
| | min | 5 | 5.4 | 5.4 |
| | exceedence | 0 | 2 | 0 |

**020D**

| | | Flow | pH | |
|---|---|---|---|---|
| | | 16.9 Mgal/d | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 16.9 | 7.7 | 8 |
| 11/30/1998 | 12/16/1998 | 16.9 | 7.6 | 7.7 |
| 12/31/1998 | 1/19/1999 | 16.9 | 7.2 | 7.9 |
| 1/31/1999 | 2/16/1999 | 16.9 | 7 | 7.9 |
| 2/28/1999 | 3/16/1999 | 16.9 | 7.2 | 7.5 |
| 3/31/1999 | 4/16/1999 | 16.9 | 7.1 | 8 |
| 4/30/1999 | 5/13/1999 | 16.9 | 7.9 | 8 |
| 5/31/1999 | 6/16/1999 | 16.9 | 7.9 | 8.1 |
| 6/30/1999 | 7/14/1999 | 16.9 | 7.4 | 8.1 |
| 7/31/1999 | 8/16/1999 | 16.9 | 7.6 | 7.8 |
| 8/31/1999 | 9/17/1999 | 16.9 | 7.5 | 7.9 |
| 9/30/1999 | 10/18/1999 | 16.9 | 7.4 | 7.6 |
| 10/31/1999 | 11/15/1999 | 16.9 | 7.6 | 7.9 |
| 11/30/1999 | 12/15/1999 | 16.9 | 7.7 | 8 |
| 12/31/1999 | 1/14/2000 | 16.9 | 7.7 | 7.8 |
| 1/31/2000 | 2/15/2000 | 16.9 | 6.9 | 7.9 |
| 2/29/2000 | 3/15/2000 | 16.9 | 7.6 | 7.9 |
| 3/31/2000 | 4/12/2000 | 16.9 | 7.8 | 8 |
| 4/30/2000 | 5/15/2000 | 16.9 | 7.6 | 7.7 |
| 5/31/2000 | 6/13/2000 | 16.9 | 7.3 | 7.8 |
| 6/30/2000 | 7/14/2000 | 16.9 | 7.5 | 7.8 |
| 7/31/2000 | 8/14/2000 | 16.9 | 7.7 | 7.7 |
| 8/31/2000 | 9/13/2000 | 16.9 | 7.5 | 8 |
| 9/30/2000 | 10/12/2000 | 16.9 | 7.6 | 7.8 |
| 10/31/2000 | 11/13/2000 | 16.9 | 7.6 | 8 |
| 11/30/2000 | 12/11/2000 | 16.9 | 7.6 | 7.7 |
| 12/31/2000 | 1/10/2001 | 16.9 | 7.7 | 7.8 |
| 1/31/2001 | 2/14/2001 | 16.9 | 7.7 | 8 |
| 2/28/2001 | 3/15/2001 | 16.9 | 7.5 | 7.8 |
| 3/31/2001 | 4/12/2001 | 16.9 | 7.9 | 8 |
| 4/30/2001 | 5/9/2001 | 16.9 | 7.8 | 8.1 |
| 5/31/2001 | 6/11/2001 | 16.9 | 7.8 | 8.2 |
| 6/30/2001 | 7/12/2001 | 16.9 | 7.8 | 7.9 |
| 7/31/2001 | 8/9/2001 | 16.9 | 7.5 | 7.8 |
| 8/31/2001 | 9/14/2001 | 16.9 | 7.4 | 7.8 |
| 9/30/2001 | 10/10/2001 | 16.9 | 7.7 | 7.8 |
| 10/31/2001 | 11/14/2001 | 16.9 | 7.9 | 8.1 |
| 11/30/2001 | 12/12/2001 | 16.9 | 7.8 | 8.1 |
| 12/31/2001 | 1/14/2002 | 16.9 | 7.8 | 8 |
| 1/31/2002 | 2/14/2002 | 16.9 | 7.9 | 8 |
| 2/28/2002 | 3/12/2002 | 16.9 | 7.8 | 7.9 |
| 3/31/2002 | 4/15/2002 | 16.9 | 7.8 | 8 |
| 4/30/2002 | 5/14/2002 | 16.9 | 7.8 | 7.9 |
| 5/31/2002 | 6/13/2002 | 16.9 | 7.8 | 8.1 |
| 6/30/2002 | 7/10/2002 | 16.9 | 7.9 | 8 |
| 7/31/2002 | 8/14/2002 | 16.9 | 7.8 | 8 |
| 8/31/2002 | 9/16/2002 | 16.9 | 7.7 | 8 |
| 9/30/2002 | 10/11/2002 | 16.9 | 7.7 | 8 |
| 10/31/2002 | 11/14/2002 | 16.9 | 7.7 | 7.9 |
| 11/30/2002 | 12/13/2002 | 16.9 | 7.8 | 8.1 |
| 12/31/2002 | 1/15/2003 | 16.9 | 7.8 | 8 |
| 1/31/2003 | 2/12/2003 | 16.9 | 7.7 | 8.1 |
| 2/28/2003 | 3/31/2003 | 16.9 | 7.9 | 8.1 |
| 3/31/2003 | 4/10/2003 | 16.9 | 7.8 | 8.3 |
| 4/30/2003 | 5/13/2003 | 16.9 | 7.4 | 8.3 |
| 5/31/2003 | 6/12/2003 | 16.9 | 6.8 | 8 |
| 6/30/2003 | 7/11/2003 | 16.9 | 7.59 | 7.95 |
| 7/31/2003 | 8/14/2003 | 16.9 | 7.8 | 8.1 |
| 8/31/2003 | 9/12/2003 | 16.9 | 7.6 | 8 |
| 9/30/2003 | 10/14/2003 | 16.9 | 7.56 | 8.16 |
| 10/31/2003 | 11/12/2003 | 16.9 | 7.63 | 8.07 |
| 11/30/2003 | 12/10/2003 | 16.9 | 8.19 | 8.32 |
| 12/31/2003 | 1/13/2004 | 16.9 | 8.11 | 8.49 |
| 1/31/2004 | 2/13/2004 | 16.9 | 7.96 | 8.45 |

| | | | | |
|---|---|---|---|---|
| 2/29/2004 | 3/15/2004 | 16.9 | 8.15 | 8.45 |
| 3/31/2004 | 4/18/2004 | 16.9 | 8.19 | 8.49 |
| 4/30/2004 | 5/17/2004 | C | C | C |
| 5/31/2004 | 6/14/2004 | C | C | C |
| 6/30/2004 | 7/12/2004 | C | C | C |
| 7/31/2004 | 8/10/2004 | C | C | C |
| 8/31/2004 | 9/13/2004 | C | C | C |
| 9/30/2004 | 10/15/2004 | C | C | C |
| 10/31/2004 | 11/15/2004 | C | C | C |
| 11/30/2004 | 12/9/2004 | C | C | C |
| 12/31/2004 | 1/13/2005 | C | C | C |
| 1/31/2005 | 2/14/2005 | C | C | C |
| 2/28/2005 | 3/14/2005 | C | C | C |
| 3/31/2005 | 4/15/2005 | C | C | C |
| 4/30/2005 | 5/18/2005 | C | C | C |
| 5/31/2005 | 6/13/2005 | C | C | C |
| 6/30/2005 | 7/14/2005 | C | C | C |
| 7/31/2005 | 8/19/2005 | C | C | C |
| 8/31/2005 | 9/12/2005 | C | C | C |
| 9/30/2005 | 10/17/2005 | C | C | C |
| 10/31/2005 | 11/15/2005 | C | C | C |
| 11/30/2005 | 12/13/2005 | C | C | C |
| 12/31/2005 | 1/13/2006 | C | C | C |
| 1/31/2006 | 2/14/2006 | C | C | C |
| 2/28/2006 | 3/13/2006 | C | C | C |
| 3/31/2006 | 4/14/2006 | C | C | C |
| 4/30/2006 | 5/15/2006 | C | C | C |
| 5/31/2006 | 6/14/2006 | C | C | C |
| 6/30/2006 | 7/13/2006 | C | C | C |
| 7/31/2006 | 8/7/2006 | C | C | C |
| 8/31/2006 | 9/19/2006 | C | C | C |
| 9/30/2006 | 10/16/2006 | C | C | C |
| 10/31/2006 | 11/15/2006 | C | C | C |
| 11/30/2006 | 12/15/2006 | C | C | C |
| 12/31/2006 | 1/11/2007 | C | C | C |
| 1/31/2007 | 2/14/2007 | C | C | C |
| 2/28/2007 | 3/14/2007 | C | C | C |
| 3/31/2007 | 4/16/2007 | C | C | C |
| 4/30/2007 | 5/16/2007 | C | C | C |
| 5/31/2007 | 6/14/2007 | C | C | C |
| 6/30/2007 | 7/13/2007 | C | C | C |
| 7/31/2007 | 8/15/2007 | C | C | C |
| 8/31/2007 | 9/13/2007 | C | C | C |
| 9/30/2007 | 10/12/2007 | C | C | C |
| 10/31/2007 | 11/14/2007 | C | C | C |
| 11/30/2007 | 12/12/2007 | C | C | C |
| 12/31/2007 | 1/14/2008 | C | C | C |
| 1/31/2008 | 2/15/2008 | C | C | C |
| 2/29/2008 | 3/14/2008 | C | C | C |
| 3/31/2008 | 4/11/2008 | C | C | C |
| 4/30/2008 | 5/7/2008 | C | C | C |
| 5/31/2008 | 6/13/2008 | C | C | C |
| 6/30/2008 | 7/11/2008 | C | C | C |
| 7/31/2008 | 8/11/2008 | C | C | C |
| 8/31/2008 | 9/10/2008 | C | C | C |
| 9/30/2008 | 10/10/2008 | C | C | C |
| 10/31/2008 | 11/12/2008 | C | C | C |
| 11/30/2008 | | | | |
| 12/31/2008 | | | | |
| **020D** | | Flow | pH | |
| | | 16.9 Mgal/d | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave | 16.90 | 7.66 | 7.99 |
| | max | 16.9 | 8.19 | 8.49 |
| | min | 16.9 | 6.8 | 7.5 |
| | exceedence | 0 | 0 | 0 |

*C: NODI code which refers to "no discharge"

**020W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 5 | 7.9 | 7.9 |
| 1/31/1999 | 2/16/1999 | 7 | 7.7 | 7.7 |
| 4/30/1999 | 5/13/1999 | 5 | 8.2 | 8.2 |
| 7/31/1999 | 8/16/1999 | 5 | 7.6 | 7.6 |
| 10/31/1999 | 11/15/1999 | 5 | 7.7 | 7.8 |
| 1/31/2000 | 2/15/2000 | 5 | 7.8 | 7.8 |
| 4/30/2000 | 5/15/2000 | 5 | 8 | 8 |
| 7/31/2000 | 8/14/2000 | 5 | 7.8 | 7.8 |
| 10/31/2000 | 11/13/2000 | 5 | 7.7 | 7.7 |
| 1/31/2001 | 2/14/2001 | 5 | 7.5 | 7.5 |
| 4/30/2001 | 5/9/2001 | 5 | 7.7 | 7.7 |
| 7/31/2001 | 8/9/2001 | 5 | 8.1 | 8.1 |
| 10/31/2001 | 11/14/2001 | 5 | 7.9 | 7.9 |
| 1/31/2002 | 2/14/2002 | 5 | 7.5 | 7.5 |
| 4/30/2002 | 5/14/2002 | 5 | 7.7 | 7.7 |
| 7/31/2002 | 8/14/2002 | 5 | 7.9 | 7.9 |
| 10/31/2002 | 11/14/2002 | 5 | 7.7 | 7.7 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7.9 | 7.9 |
| 4/30/2003 | 5/13/2003 | 5 | 8 | 8 |
| 7/31/2003 | 8/14/2003 | 5 | 7.2 | 7.2 |

**020W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave | 5.1 | 7.8 | 7.8 |
| | max | 7 | 8.2 | 8.2 |
| | min | 5 | 7.2 | 7.2 |
| | exceedence | 0 | 0 | 0 |

**027D**

| MP Date | Rec'd Date | Benzene 5 ug/L MO AVG | Ethylbenzene Req. Mon. ug/L MO AVG | Flow, in conduit or through treatment plant .3 Mgal/d MO AVG | .83 Mgal/d DAILY MX | .5 Mgal/d MO AVG | 1 Mgal/d DAILY MX | Methyl tert-butyl ether 100 ug/L MO AVG |
|---|---|---|---|---|---|---|---|---|
| 10/31/1998 | 11/16/1998 | 1 | 1 | 0.3 | 0.83 | | | 2 |
| 11/30/1998 | 12/16/1998 | 1 | 1 | 0.3 | 0.83 | | | 2 |
| 12/31/1998 | 1/19/1999 | 1 | 1 | 0.3 | 0.83 | | | 2 |
| 1/31/1999 | 2/16/1999 | 1 | 1 | 0.3 | 0.83 | | | 2 |
| 2/28/1999 | 3/16/1999 | 1 | 1 | | | 0.3 | 0.83 | 2 |
| 3/31/1999 | 4/16/1999 | 1 | 1 | | | 0.3 | 0.83 | 2 |
| 4/30/1999 | 5/13/1999 | 1 | 1 | | | 0.3 | 0.83 | 2 |
| 5/31/1999 | 6/16/1999 | C | C | | | 0.3 | 0.83 | C |
| 6/30/1999 | 7/14/1999 | C | C | | | 0.3 | 0.83 | C |
| 7/31/1999 | 8/16/1999 | C | C | | | 0.3 | 0.83 | C |
| 8/31/1999 | 9/17/1999 | C | C | | | 0.3 | 0.83 | C |
| 9/30/1999 | 10/18/1999 | C | C | | | 0.3 | 0.83 | C |
| 10/31/1999 | 11/15/1999 | C | C | | | 0.3 | 0.83 | C |
| 11/30/1999 | 12/15/1999 | C | C | | | 0.3 | 0.83 | C |
| 12/31/1999 | 1/14/2000 | C | C | | | 0.3 | 0.83 | C |
| 1/31/2000 | 2/15/2000 | C | C | | | 0.3 | 0.83 | C |
| 2/29/2000 | 3/15/2000 | C | C | | | 0.3 | 0.83 | C |
| 3/31/2000 | 4/12/2000 | C | C | | | 0.3 | 0.83 | C |
| 4/30/2000 | 5/15/2000 | C | C | | | 0.3 | 0.83 | C |
| 5/31/2000 | 6/13/2000 | C | C | | | 0.3 | 0.83 | C |
| 6/30/2000 | 7/14/2000 | C | C | | | 0.3 | 0.83 | C |
| 7/31/2000 | 8/14/2000 | C | C | | | 0.38 | 0.43 | C |
| 8/31/2000 | 9/13/2000 | C | C | | | 0.3 | 0.43 | C |
| 9/30/2000 | 10/12/2000 | C | C | | | | | C |
| 10/31/2000 | 11/13/2000 | C | C | | | | | C |
| 11/30/2000 | 12/11/2000 | C | C | | | 0.3 | 0.43 | C |
| 12/31/2000 | 1/10/2001 | C | C | | | 0.25 | 0.43 | C |
| 1/31/2001 | 2/14/2001 | C | C | | | 0.22 | 0.39 | C |
| 2/28/2001 | 3/15/2001 | C | C | | | 0.35 | 0.4 | C |
| 3/31/2001 | 4/12/2001 | C | C | | | 0.39 | 0.48 | C |
| 4/30/2001 | 5/9/2001 | C | C | | | 0.4 | 0.42 | C |
| 5/31/2001 | 6/11/2001 | C | C | | | 0.33 | 0.41 | C |
| 6/30/2001 | 7/12/2001 | C | C | | | 0.33 | 0.42 | C |
| 7/31/2001 | 8/9/2001 | C | C | | | 0.3 | 0.4 | C |
| 8/31/2001 | 9/14/2001 | C | C | | | 0.32 | 0.38 | C |
| 9/30/2001 | 10/10/2001 | C | C | | | 0.27 | 0.38 | C |
| 10/31/2001 | 11/14/2001 | C | C | | | 0.17 | 0.37 | C |
| 11/30/2001 | 12/12/2001 | C | C | | | 0.2 | 0.39 | C |
| 12/31/2001 | 1/14/2002 | C | C | | | 0.29 | 0.38 | C |
| 1/31/2002 | 2/14/2002 | C | C | 0.31 | 0.36 | | | C |
| 2/28/2002 | 3/12/2002 | C | C | 0.34 | 0.35 | | | C |
| 3/31/2002 | 4/15/2002 | C | C | 0.33 | 0.35 | | | C |
| 4/30/2002 | 5/14/2002 | C | C | 0.33 | 0.35 | | | C |
| 5/31/2002 | 6/13/2002 | C | C | 0.31 | 0.34 | | | C |
| 6/30/2002 | 7/10/2002 | C | C | 0.33 | 0.34 | | | C |
| 7/31/2002 | 8/14/2002 | C | C | 0.24 | 0.33 | | | C |
| 8/31/2002 | 9/16/2002 | C | C | 0.21 | 0.34 | | | C |
| 9/30/2002 | 10/11/2002 | C | C | 0.25 | 0.34 | | | C |
| 10/31/2002 | 11/14/2002 | C | C | 0.23 | 0.34 | | | C |
| 11/30/2002 | 12/13/2002 | C | C | 0.25 | 0.35 | | | C |
| 12/31/2002 | 1/15/2003 | C | C | 0.27 | 0.35 | | | C |
| 1/31/2003 | 2/12/2003 | C | C | 0.26 | 0.35 | | | C |
| 2/28/2003 | 3/31/2003 | C | C | 0.27 | 0.39 | | | C |
| 3/31/2003 | 4/10/2003 | C | C | 0.27 | 0.55 | | | C |
| 4/30/2003 | 5/13/2003 | C | C | 0.28 | 0.33 | | | C |
| 5/31/2003 | 6/12/2003 | C | C | 0.24 | 0.29 | | | C |
| 6/30/2003 | 7/11/2003 | C | C | 0.24 | 0.38 | | | C |
| 7/31/2003 | 8/14/2003 | C | C | 0.21 | 0.33 | | | C |
| 8/31/2003 | 9/12/2003 | C | C | 0.23 | 0.3 | | | C |
| 9/30/2003 | 10/14/2003 | C | C | 0.22 | 0.41 | | | C |
| 10/31/2003 | 11/12/2003 | C | C | 0.17 | 0.24 | | | C |
| 11/30/2003 | 12/10/2003 | C | C | 0.2 | 0.28 | | | C |
| 12/31/2003 | 1/13/2004 | C | C | 0.16 | 0.25 | | | C |
| 1/31/2004 | 2/13/2004 | C | C | 0.2 | 0.43 | | | C |
| 2/29/2004 | 3/15/2004 | C | C | 0.21 | 0.23 | | | C |
| 3/31/2004 | 4/18/2004 | C | C | 0.2 | 0.29 | | | C |
| 4/30/2004 | 5/17/2004 | C | C | 0.23 | 0.34 | | | C |
| 5/31/2004 | 6/14/2004 | C | C | 0.16 | 0.25 | | | C |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/30/2004 | 7/12/2004 | C | C | 0.16 | 0.21 | | | C |
| 7/31/2004 | 8/10/2004 | C | C | 0.14 | 0.29 | | | C |
| 8/31/2004 | 9/13/2004 | C | C | 0.18 | 0.31 | | | C |
| 9/30/2004 | 10/15/2004 | C | C | 0.17 | 0.24 | | | C |
| 10/31/2004 | 11/15/2004 | C | C | 0.16 | 0.27 | | | C |
| 11/30/2004 | 12/9/2004 | C | C | 0.18 | 0.28 | | | C |
| 12/31/2004 | 1/13/2005 | C | C | 0.18 | 0.3 | | | C |
| 1/31/2005 | 2/14/2005 | C | C | 0.21 | 0.38 | | | C |
| 2/28/2005 | 3/14/2005 | C | C | 0.23 | 0.3 | | | C |
| 3/31/2005 | 4/15/2005 | C | C | 0.22 | 0.31 | | | C |
| 4/30/2005 | 5/18/2005 | C | C | 0.21 | 0.26 | | | C |
| 5/31/2005 | 6/13/2005 | C | C | 0.15 | 0.22 | | | C |
| 6/30/2005 | 7/14/2005 | C | C | 0.2 | 0.3 | | | C |
| 7/31/2005 | 8/19/2005 | C | C | 0.21 | 0.29 | | | C |
| 8/31/2005 | 9/12/2005 | C | C | | | | | C |
| 9/30/2005 | 10/17/2005 | C | C | 0.23 | 0.27 | | | C |
| 10/31/2005 | 11/15/2005 | C | C | 0.22 | 0.29 | | | C |
| 11/30/2005 | 12/13/2005 | C | C | 0.18 | 0.3 | | | C |
| 12/31/2005 | 1/13/2006 | C | C | 0.21 | 0.28 | | | C |
| 1/31/2006 | 2/14/2006 | C | C | 0.15 | 0.29 | | | C |
| 2/28/2006 | 3/13/2006 | C | C | 0.09 | 0.27 | | | C |
| 3/31/2006 | 4/14/2006 | C | C | 0.15 | 0.29 | | | C |
| 4/30/2006 | 5/15/2006 | C | C | 0.15 | 0.3 | | | C |
| 5/31/2006 | 6/14/2006 | C | C | 0.22 | 0.31 | | | C |
| 6/30/2006 | 7/13/2006 | C | C | 0.19 | 0.27 | | | C |
| 7/31/2006 | 8/7/2006 | C | C | 0.15 | 0.24 | | | C |
| 8/31/2006 | 9/19/2006 | C | C | 0.15 | 0.25 | | | C |
| 9/30/2006 | 10/16/2006 | C | C | 0.15 | 0.26 | | | C |
| 10/31/2006 | 11/15/2006 | C | C | 0.21 | 0.22 | | | C |
| 11/30/2006 | 12/15/2006 | C | C | 0.16 | 0.28 | | | C |
| 12/31/2006 | 1/11/2007 | C | C | 0.14 | 0.29 | | | C |
| 1/31/2007 | 2/14/2007 | C | C | 0.18 | 0.29 | | | C |
| 2/28/2007 | 3/14/2007 | C | C | 0.19 | 0.23 | | | C |
| 3/31/2007 | 4/16/2007 | C | C | 0.23 | 0.3 | | | C |
| 4/30/2007 | 5/16/2007 | C | C | 0.2 | 0.28 | | | C |
| 5/31/2007 | 6/14/2007 | C | C | 0.16 | 0.37 | | | C |
| 6/30/2007 | 7/13/2007 | C | C | 0.12 | 0.18 | | | C |
| 7/31/2007 | 8/15/2007 | C | C | 0.11 | 0.2 | | | C |
| 8/31/2007 | 9/13/2007 | C | C | 0.18 | 0.25 | | | C |
| 9/30/2007 | 10/12/2007 | C | C | 0.14 | 0.25 | | | C |
| 10/31/2007 | 11/14/2007 | C | C | 0.15 | 0.26 | | | C |
| 11/30/2007 | 12/12/2007 | C | C | 0.12 | 0.18 | | | C |
| 12/31/2007 | 1/14/2008 | C | C | 0.15 | 0.28 | | | C |
| 1/31/2008 | 2/15/2008 | C | C | 0.15 | 0.26 | | | C |
| 2/29/2008 | 3/14/2008 | C | C | 0.14 | 0.17 | | | C |
| 3/31/2008 | 4/11/2008 | C | C | 0.12 | 0.2 | | | C |
| 4/30/2008 | 5/7/2008 | C | C | 0.13 | 0.17 | | | C |
| 5/31/2008 | 6/13/2008 | C | C | 0.14 | 0.21 | | | C |
| 6/30/2008 | 7/11/2008 | C | C | 0.11 | 0.24 | | | C |
| 7/31/2008 | 8/11/2008 | C | C | 0.16 | 0.22 | | | C |
| 8/31/2008 | 9/10/2008 | C | C | 0.21 | 0.26 | | | C |
| 9/30/2008 | 10/10/2008 | C | C | 0.19 | 0.24 | | | C |
| 10/31/2008 | 11/12/2008 | C | C | 0.11 | 0.22 | | | C |
| 11/30/2008 | | | | | | | | |
| 12/31/2008 | | | | | | | | |
| 027D | | Benzene | Ethylbenzene | Flow | | | | Methyl tert-butyl ether |
| | | 5 ug/L | Req. Mon. ug/L | .3 Mgal/d | .83 Mgal/d | .5 Mgal/d | 1 Mgal/d | 100 ug/L |
| | | MO AVG | MO AVG | MO AVG | DAILY MX | MO AVG | DAILY MX | MO AVG |
| | Ave | 1.00 | 1.00 | 0.20 | 0.31 | 0.30 | 0.63 | 2.00 |
| | max | 1 | 1 | 0.34 | 0.83 | 0.4 | 0.83 | 2 |
| | min | 1 | 1 | 0.09 | 0.17 | 0.17 | 0.37 | 2 |
| | exceedence | 0 | NA | 6 | 0 | 0 | 0 | 0 |

*C: NODI code which refers to "no discharge"

**027D (continued)**

| | | O&G | | pH | | PCBs | Temperature | | Toluene | Xylene | BTEX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 mg/L | 15 mg/L | 6.5 SU | 8.5 SU | Req. Mon. ug/L | 85 deg F | 90 deg F | Req. Mon. ug/ | Req. Mon. ug/L | 100ug/L |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | MO AVG | DAILY MX | MO AVG | MO AVG | MO AVG |
| 10/31/1998 | 11/16/1998 | 5 | 5 | 6.7 | 7 | 1 | 62.5 | 63.5 | 1 | 1 | 4 |
| 11/30/1998 | 12/16/1998 | 5 | 5 | 6.8 | 7.1 | 1 | 56 | 58 | 2 | 1 | 5 |
| 12/31/1998 | 1/19/1999 | 5 | 5 | 6.8 | 7.3 | 1 | 55 | 57 | 1 | 1 | 4 |
| 1/31/1999 | 2/16/1999 | 5 | 5 | 6.6 | 7.2 | 1 | 48.2 | 51.8 | 1 | 1 | 4 |
| 2/28/1999 | 3/16/1999 | 5 | 5 | 6.8 | 6.9 | 1 | 49.8 | 53 | 1 | 1 | 4 |
| 3/31/1999 | 4/16/1999 | 5 | 5 | 6.4 | 7.1 | 1 | 46.5 | 47.5 | 1 | 1 | 4 |
| 4/30/1999 | 5/13/1999 | 5 | 5 | 7.1 | 7.3 | 1 | 50.7 | 52.6 | 1 | 1 | 4 |
| 5/31/1999 | 6/16/1999 | 5 | 5 | 7.2 | 7.6 | C | 57.3 | 62 | C | C | C |
| 6/30/1999 | 7/14/1999 | 5 | 5 | 7.3 | 7.7 | C | 65.2 | 68.8 | C | C | C |
| 7/31/1999 | 8/16/1999 | 5 | 5 | 7.2 | 7.3 | C | 70.4 | 71.6 | C | C | C |
| 8/31/1999 | 9/17/1999 | 5 | 5 | 7.1 | 7.4 | C | 72.3 | 77 | C | C | C |
| 9/30/1999 | 10/18/1999 | 5 | 5 | 6.9 | 7.3 | C | 70.2 | 75 | C | C | C |
| 10/31/1999 | 11/15/1999 | 5 | 5 | 7 | 7.8 | C | 61.6 | 63.5 | C | C | C |
| 11/30/1999 | 12/15/1999 | 5 | 5 | 7.1 | 7.3 | C | 55 | 62 | C | C | C |
| 12/31/1999 | 1/14/2000 | 5 | 5 | 7.2 | 7.6 | C | 50 | 57 | C | C | C |
| 1/31/2000 | 2/15/2000 | 5 | 5 | 6.8 | 7.4 | C | 47 | 61 | C | C | C |
| 2/29/2000 | 3/15/2000 | 5 | 5 | 7.2 | 7.5 | C | 43 | 46 | C | C | C |
| 3/31/2000 | 4/12/2000 | 5 | 5 | 6.9 | 7.4 | C | 48 | 52 | C | C | C |
| 4/30/2000 | 5/15/2000 | 5 | 5 | 6.5 | 7.6 | C | 51 | 53 | C | C | C |
| 5/31/2000 | 6/13/2000 | 5 | 5 | 6.6 | 7.4 | C | 57 | 59 | C | C | C |
| 6/30/2000 | 7/14/2000 | 5 | 5 | 6.9 | 7.8 | C | 64 | 68 | C | C | C |
| 7/31/2000 | 8/14/2000 | 6 | 6 | 6.9 | 7.5 | C | 68 | 71 | C | C | C |
| 8/31/2000 | 9/13/2000 | 5 | 5 | 6.8 | 7 | C | 70 | 73 | C | C | C |
| 9/30/2000 | 10/12/2000 | 5 | 5 | 6.8 | 7.1 | C | 68 | 70 | C | C | C |
| 10/31/2000 | 11/13/2000 | | | | | C | | | C | C | C |
| 11/30/2000 | 12/11/2000 | 5 | 5 | 6.8 | 7.2 | C | 57 | 59 | C | C | C |
| 12/31/2000 | 1/10/2001 | 5 | 5 | 6.7 | 6.9 | C | 57 | 63 | C | C | C |
| 1/31/2001 | 2/14/2001 | 5 | 5 | 6.9 | 7.1 | C | 53 | 58 | C | C | C |
| 2/28/2001 | 3/15/2001 | 5 | 5 | 6.6 | 7.1 | C | 53 | 57 | C | C | C |
| 3/31/2001 | 4/12/2001 | 5 | 5 | 6.8 | 7 | C | 50 | 51 | C | C | C |
| 4/30/2001 | 5/9/2001 | 5 | 5 | 7 | 7.1 | C | 54 | 58 | C | C | C |
| 5/31/2001 | 6/11/2001 | 5 | 5 | 6.9 | 7.1 | C | 59 | 61 | C | C | C |
| 6/30/2001 | 7/12/2001 | 5 | 5 | 6.7 | 7.1 | C | 66 | 70 | C | C | C |
| 7/31/2001 | 8/9/2001 | 5 | 5 | 6.6 | 7.2 | C | 70 | 74 | C | C | C |
| 8/31/2001 | 9/14/2001 | 5 | 5 | 6.7 | 7.2 | C | 71 | 72 | C | C | C |
| 9/30/2001 | 10/10/2001 | 5 | 5 | 6.8 | 7.2 | C | 69 | 71 | C | C | C |
| 10/31/2001 | 11/14/2001 | 5 | 5 | 7.2 | 7.4 | C | 65 | 66 | C | C | C |
| 11/30/2001 | 12/12/2001 | 5 | 5 | 7.1 | 7.4 | C | 62 | 64 | C | C | C |
| 12/31/2001 | 1/14/2002 | 5 | 5 | 7.3 | 7.4 | C | 57 | 62 | C | C | C |
| 1/31/2002 | 2/14/2002 | 5 | 5 | 7.1 | 7.4 | C | 54 | 61 | C | C | C |
| 2/28/2002 | 3/12/2002 | 5 | 5 | 7.1 | 7.2 | C | 53 | 54 | C | C | C |
| 3/31/2002 | 4/15/2002 | 5 | 5 | 7 | 7.2 | C | 56 | 58 | C | C | C |
| 4/30/2002 | 5/14/2002 | 5 | 5 | 7 | 7.1 | C | 57 | 59 | C | C | C |
| 5/31/2002 | 6/13/2002 | 5 | 5 | 6.9 | 7.4 | C | 57 | 58 | C | C | C |
| 6/30/2002 | 7/10/2002 | 5 | 5 | 6.9 | 7.2 | C | 61 | 68 | C | C | C |
| 7/31/2002 | 8/14/2002 | 6 | 6 | 6.7 | 7.2 | C | 71 | 72 | C | C | C |
| 8/31/2002 | 9/16/2002 | 5 | 5 | 6.7 | 7.4 | C | 74 | 76 | C | C | C |
| 9/30/2002 | 10/11/2002 | 5 | 5 | 7.1 | 7.2 | C | 71 | 73 | C | C | C |
| 10/31/2002 | 11/14/2002 | 5.1 | 5.1 | 7.2 | 7.4 | C | 66 | 70 | C | C | C |
| 11/30/2002 | 12/13/2002 | 5.2 | 5.2 | 7.3 | 7.5 | C | 61 | 64 | C | C | C |
| 12/31/2002 | 1/15/2003 | 5.2 | 5.2 | 7.4 | 7.5 | C | 59 | 62 | C | C | C |
| 1/31/2003 | 2/12/2003 | 5.2 | 5.2 | 7.1 | 7.5 | C | 52 | 54 | C | C | C |
| 2/28/2003 | 3/31/2003 | 5 | 5 | 6.9 | 7.3 | C | 50.3 | 56.6 | C | C | C |
| 3/31/2003 | 4/10/2003 | 4 | 10.8 | 7 | 7.4 | C | 55.2 | 63.5 | C | C | C |
| 4/30/2003 | 5/13/2003 | 5 | 5 | 7.1 | 7.2 | C | 53 | 58.4 | C | C | C |
| 5/31/2003 | 6/12/2003 | 6.2 | 9.6 | 6.7 | 7.2 | C | 59.6 | 66.8 | C | C | C |
| 6/30/2003 | 7/11/2003 | 5 | 5 | 6.6 | 7.1 | C | 61.8 | 63.5 | C | C | C |
| 7/31/2003 | 8/14/2003 | 5 | 5 | 6.6 | 7 | C | 68.6 | 71.9 | C | C | C |
| 8/31/2003 | 9/12/2003 | 5 | 5 | 6.6 | 6.8 | C | 71.3 | 72.5 | C | C | C |
| 9/30/2003 | 10/14/2003 | 5 | 5 | 6.72 | 7.32 | C | 68.9 | 69.8 | C | C | C |
| 10/31/2003 | 11/12/2003 | 5 | 5 | 6.89 | 7.19 | C | 64.68 | 66.5 | C | C | C |
| 11/30/2003 | 12/10/2003 | 5 | 5 | 7.21 | 7.35 | C | 61.55 | 62.4 | C | C | C |
| 12/31/2003 | 1/13/2004 | 5 | 5 | 7.23 | 7.57 | C | 57.6 | 59.9 | C | C | C |
| 1/31/2004 | 2/13/2004 | 5 | 5 | 6.98 | 7.42 | C | 52.4 | 53.2 | C | C | C |
| 2/29/2004 | 3/15/2004 | 5 | 5 | 6.93 | 7.38 | C | 50.7 | 52.7 | C | C | C |
| 3/31/2004 | 4/18/2004 | 5 | 5 | 7.09 | 7.18 | C | 56.24 | 60.8 | C | C | C |
| 4/30/2004 | 5/17/2004 | 5 | 5 | 6.93 | 7.32 | C | 56.43 | 58.2 | C | C | C |
| 5/31/2004 | 6/14/2004 | 5 | 5 | 7.15 | 7.29 | C | 61.7 | 63.3 | C | C | C |
| 6/30/2004 | 7/12/2004 | 5 | 5 | 7.08 | 7.28 | C | 65.2 | 69.8 | C | C | C |
| 7/31/2004 | 8/10/2004 | 5 | 5 | 6.97 | 7.41 | C | 69.1 | 70.1 | C | C | C |
| 8/31/2004 | 9/13/2004 | 5 | 5 | 7.01 | 7.13 | C | 70.52 | 72.1 | C | C | C |
| 9/30/2004 | 10/15/2004 | 5 | 5 | 7.11 | 7.49 | C | 70 | 71.2 | C | C | C |
| 10/31/2004 | 11/15/2004 | 5 | 5 | 6.89 | 7.19 | C | 64.38 | 66 | C | C | C |
| 11/30/2004 | 12/9/2004 | 5 | 5 | 7.12 | 7.21 | C | 58.1 | 62.2 | C | C | C |
| 12/31/2004 | 1/13/2005 | 5 | 5 | 6.99 | 7.36 | C | 54.9 | 58.8 | C | C | C |
| 1/31/2005 | 2/14/2005 | 5 | 5 | 7.06 | 7.33 | C | 52.2 | 53.9 | C | C | C |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/28/2005 | 3/14/2005 | 5 | 5 | 7.1 | 7.53 | C | 50.86 | 55.9 | C | C | C |
| 3/31/2005 | 4/15/2005 | 5 | 5 | 7.08 | 7.22 | C | 49.5 | 51.8 | C | C | C |
| 4/30/2005 | 5/18/2005 | 5 | 5 | 7.05 | 7.21 | C | 53.8 | 55.7 | C | C | C |
| 5/31/2005 | 6/13/2005 | 5 | 5 | 7.03 | 7.19 | C | 56.2 | 56.6 | C | C | C |
| 6/30/2005 | 7/14/2005 | 5 | 5 | 7 | 7.07 | C | 64 | 67.1 | C | C | C |
| 7/31/2005 | 8/19/2005 | 5 | 5 | 6.85 | 7 | C | 71.35 | 74.3 | C | C | C |
| 8/31/2005 | 9/12/2005 | 5 | 5 | 6.92 | 7.33 | C | 72.5 | 73.5 | C | C | C |
| 9/30/2005 | 10/17/2005 | 5 | 5 | 7.27 | 7.52 | C | 69.8 | 71.2 | C | C | C |
| 10/31/2005 | 11/15/2005 | 5 | 5 | 7.07 | 7.38 | C | 61.4 | 64.4 | C | C | C |
| 11/30/2005 | 12/13/2005 | 5 | 5 | 7.04 | 7.31 | C | 58 | 60.2 | C | C | C |
| 12/31/2005 | 1/13/2006 | 5 | 5 | 7.06 | 7.28 | C | 51.7 | 57.9 | C | C | C |
| 1/31/2006 | 2/14/2006 | 5 | 5 | 6.98 | 7.14 | C | 52.5 | 54.8 | C | C | C |
| 2/28/2006 | 3/13/2006 | 5 | 5 | 7.09 | 7.16 | C | 50.3 | 52.1 | C | C | C |
| 3/31/2006 | 4/14/2006 | 5 | 12.7 | 6.97 | 7.32 | C | 49.2 | 50.5 | C | C | C |
| 4/30/2006 | 5/15/2006 | 5 | 5 | 7.11 | 7.36 | C | 53.1 | 55.2 | C | C | C |
| 5/31/2006 | 6/14/2006 | 5 | 5 | 6.89 | 7.39 | C | 56.2 | 62.2 | C | C | C |
| 6/30/2006 | 7/13/2006 | 5 | 5 | 6.86 | 6.95 | C | 65.7 | 69.2 | C | C | C |
| 7/31/2006 | 8/7/2006 | 5 | 5 | 6.84 | 7.09 | C | 70.8 | 72.5 | C | C | C |
| 8/31/2006 | 9/19/2006 | 5 | 5 | 6.96 | 7.14 | C | 71.8 | 73.9 | C | C | C |
| 9/30/2006 | 10/16/2006 | 5 | 5 | 6.94 | 7.11 | C | 68.3 | 68.8 | C | C | C |
| 10/31/2006 | 11/15/2006 | 5 | 5 | 6.92 | 7.05 | C | 62.8 | 68 | C | C | C |
| 11/30/2006 | 12/15/2006 | 5 | 5 | 7.02 | 7.07 | C | 55.7 | 59.1 | C | C | C |
| 12/31/2006 | 1/11/2007 | 5 | 5 | 6.96 | 7.14 | C | 55.5 | 57.1 | C | C | C |
| 1/31/2007 | 2/14/2007 | 5 | 5 | 7.01 | 7.25 | C | 52.6 | 56.4 | C | C | C |
| 2/28/2007 | 3/14/2007 | 5 | 5 | 7.02 | 7.15 | C | 47.3 | 53.2 | C | C | C |
| 3/31/2007 | 4/16/2007 | 5 | 5 | 6.92 | 7.08 | C | 47.2 | 49.1 | C | C | C |
| 4/30/2007 | 5/16/2007 | 5 | 5 | 6.9 | 7.08 | C | 53.5 | 54.9 | C | C | C |
| 5/31/2007 | 6/14/2007 | 5 | 5 | 6.98 | 7.18 | C | 59.7 | 63.6 | C | C | C |
| 6/30/2007 | 7/13/2007 | 5 | 5 | 6.95 | 7.08 | C | 65.6 | 68.4 | C | C | C |
| 7/31/2007 | 8/15/2007 | 5 | 5 | 6.93 | 7.04 | C | 68.7 | 71.1 | C | C | C |
| 8/31/2007 | 9/13/2007 | 5 | 5 | 6.93 | 7.15 | C | 72.2 | 73.6 | C | C | C |
| 9/30/2007 | 10/12/2007 | 5 | 5 | 6.96 | 7.08 | C | 70.35 | 71.9 | C | C | C |
| 10/31/2007 | 11/14/2007 | 5 | 5 | 7.02 | 7.07 | C | 67.06 | 70.1 | C | C | C |
| 11/30/2007 | 12/12/2007 | 5 | 5 | 6.98 | 7.03 | C | 59 | 60.2 | C | C | C |
| 12/31/2007 | 1/14/2008 | 5 | 5 | 7.04 | 7.08 | C | 58.4 | 61 | C | C | C |
| 1/31/2008 | 2/15/2008 | 5 | 5 | 7.02 | 7.21 | C | 53.3 | 57.2 | C | C | C |
| 2/29/2008 | 3/14/2008 | 5 | 5 | 7.01 | 7.07 | C | 49.3 | 50.8 | C | C | C |
| 3/31/2008 | 4/11/2008 | 5 | 5 | 6.91 | 7.09 | C | 50.8 | 53.4 | C | C | C |
| 4/30/2008 | 5/7/2008 | 5 | 5 | 6.84 | 7.08 | C | 54.42 | 59.6 | C | C | C |
| 5/31/2008 | 6/13/2008 | 5 | 5 | 6.96 | 7.04 | C | 58.35 | 64.4 | C | C | C |
| 6/30/2008 | 7/11/2008 | 5 | 5 | 6.84 | 7.08 | C | 66.7 | 70.3 | C | C | C |
| 7/31/2008 | 8/11/2008 | 5 | 5 | 6.9 | 6.99 | C | 71.6 | 73 | C | C | C |
| 8/31/2008 | 9/10/2008 | 5 | 5 | 6.85 | 7.01 | C | 70.3 | 70.8 | C | C | C |
| 9/30/2008 | 10/10/2008 | 5 | 5 | 6.88 | 7.12 | C | 67.8 | 70.1 | C | C | C |
| 10/31/2008 | 11/12/2008 | 5 | 5 | 6.97 | 7.09 | C | 60.8 | 65.6 | C | C | C |
| 11/30/2008 | | | | | | | | | | | |
| 12/31/2008 | | | | | | | | | | | |
| 027D | | O&G | | pH | | PCBs | Temperature | | Toluene | Xylene | BTEX |
| | | 10 mg/L | 15 mg/L | 6.5 SU | 8.5 SU | etectable limit (ug | 85 deg F | 90 deg F | Req. Mon. ug/ | Req. Mon. ug/L | 100ug/L |
| | | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | MO AVG | DAILY MX | MO AVG | MO AVG | MO AVG |
| | Ave | 5.02 | 5.17 | 6.95 | 7.24 | 1.00 | 59.77 | 62.78 | 1.14 | 1.00 | 4.14 |
| | max | 6.2 | 12.7 | 7.4 | 7.8 | 1 | 74 | 77 | 2 | 1 | 5 |
| | min | 4 | 5 | 6.4 | 6.8 | 1 | 43 | 46 | 1 | 1 | 4 |
| | exceedence | 0 | 0 | 1 | 0 | 7 | 0 | 0 | NA | NA | 0 |

*C: NODI code which ref *C: NODI code which refers to "no discharge"

## 027W

| MP Date | Rec'd Date | O&G 10 mg/L MO AVG | pH 6.5 SU MINIMUM | pH 8.5 SU MAXIMUM |
|---|---|---|---|---|
| 10/31/1998 | 11/16/1998 | 5 | 7.1 | 7.1 |
| 1/31/1999 | 2/16/1999 | 5 | 7.8 | 7.8 |
| 4/30/1999 | 5/13/1999 | 5 | 7.7 | 7.7 |
| 7/31/1999 | 8/16/1999 | 5 | 6.6 | 6.6 |
| 10/31/1999 | 11/15/1999 | 5 | 7.3 | 7.6 |
| 1/31/2000 | 2/15/2000 | 5 | 7.5 | 7.5 |
| 4/30/2000 | 5/15/2000 | 5 | 6.3 | 6.3 |
| 7/31/2000 | 8/14/2000 | 5 | 6.8 | 6.8 |
| 10/31/2000 | 11/13/2000 | 5 | 7 | 7 |
| 1/31/2001 | 2/14/2001 | 5 | 6.9 | 6.9 |
| 4/30/2001 | 5/9/2001 | 5 | 6.9 | 6.9 |
| 7/31/2001 | 8/9/2001 | 5 | 7.4 | 7.4 |
| 10/31/2001 | 11/14/2001 | 5 | 7.1 | 7.1 |
| 1/31/2002 | 2/14/2002 | 5 | 7.3 | 7.3 |
| 4/30/2002 | 5/14/2002 | 5 | 6.9 | 6.9 |
| 7/31/2002 | 8/14/2002 | 5 | 7.1 | 7.1 |
| 10/31/2002 | 11/14/2002 | 5 | 7.3 | 7.3 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7.6 | 7.6 |
| 4/30/2003 | 5/13/2003 | 5 | 7.8 | 7.8 |
| 7/31/2003 | 8/14/2003 | 5 | 6.9 | 6.9 |
| 10/31/2003 | 11/12/2003 | 5 | 7.4 | 7.4 |
| 1/31/2004 | 2/13/2004 | 5 | 7.33 | 7.33 |
| 4/30/2004 | 5/17/2004 | 5 | 6.79 | 6.79 |
| 7/31/2004 | 8/10/2004 | 5 | 7.72 | 7.72 |
| 10/31/2004 | 11/15/2004 | 5 | 7.29 | 7.29 |
| 1/31/2005 | 2/14/2005 | 5 | 7.12 | 7.12 |
| 4/30/2005 | 5/18/2005 | 5 | 6.74 | 6.74 |
| 7/31/2005 | 8/19/2005 | 5 | 7.92 | 7.92 |
| 10/31/2005 | 11/15/2005 | 5 | 7.28 | 7.28 |
| 1/31/2006 | 2/14/2006 | 5 | 6.99 | 6.99 |
| 4/30/2006 | 5/15/2006 | 5 | 7.39 | 7.39 |
| 7/31/2006 | 8/7/2006 | 5 | 7.19 | 7.19 |
| 10/31/2006 | 11/15/2006 | 5 | 7.1 | 7.1 |
| 1/31/2007 | 2/14/2007 | 5 | 6.9 | 6.9 |
| 4/30/2007 | 5/16/2007 | 5 | 6.95 | 6.95 |
| 7/31/2007 | 7/13/2007 | 5 | 6.98 | 6.98 |
| 10/31/2007 | 11/14/2007 | 5 | 7.11 | 7.11 |
| 1/31/2008 | 2/15/2008 | 5 | 7.8 | 7.8 |
| 4/30/2008 | 5/10/2008 | 5 | 7.12 | 7.12 |
| 7/31/2008 | 8/11/2008 | 5 | 7.02 | 7.02 |
| 10/31/2008 | 11/12/2008 | 5 | 7.12 | 7.12 |

## 027W

| | | O&G 10 mg/L MO AVG | pH 6.5 SU MINIMUM | pH 8.5 SU MAXIMUM |
|---|---|---|---|---|
| | Ave | 5.0 | 7.2 | 7.2 |
| | max | 5.2 | 7.92 | 7.92 |
| | min | 5 | 6.3 | 6.3 |
| | exceedence | 0 | 1 | 0 |

**028D**

| | | Flow | | pH | | Temperature | | Volatile Compounds (GC/MS) |
|---|---|---|---|---|---|---|---|---|
| | | .0036 Mgal/d | .0048 Mgal/d | 6.5 SU | 8.5 SU | 85 deg F | 90 deg F | Req. Mon. ug/L |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX | MO AVG |
| 10/31/1998 | 11/16/1998 | 0.0036 | 0.0048 | 6.8 | 6.9 | 62.9 | 64.2 | 87 |
| 11/30/1998 | 12/16/1998 | 0.0036 | 0.0048 | 6.6 | 6.8 | 50 | 58 | 78 |
| 12/31/1998 | 1/19/1999 | 0.0036 | 0.0048 | 6.6 | 7.2 | 53.4 | 55 | 89 |
| 1/31/1999 | 2/16/1999 | 0.0036 | 0.0048 | 6.6 | 7.3 | 48.2 | 51 | 235 |
| 2/28/1999 | 3/16/1999 | 0.0036 | 0.0048 | 6.6 | 6.9 | 49.1 | 52 | 64 |
| 3/31/1999 | 4/16/1999 | 0.0036 | 0.0048 | 6.3 | 7.1 | 47.4 | 48.4 | 95 |
| 4/30/1999 | 5/13/1999 | 0.0036 | 0.0048 | 7 | 7 | 50.2 | 52 | 71 |
| 5/31/1999 | 6/16/1999 | 0.0036 | 0.0048 | 6.8 | 7.3 | 56.5 | 62 | 37.6 |
| 6/30/1999 | 7/14/1999 | 0.0036 | 0.0048 | 6.8 | 7.1 | 64 | 67.6 | 50.8 |
| 7/31/1999 | 8/16/1999 | 0.0036 | 0.0048 | 6.8 | 6.9 | 70.1 | 71.6 | 63.7 |
| 8/31/1999 | 9/17/1999 | 0.0036 | 0.0048 | 6.8 | 6.9 | 70.7 | 73.4 | 100 |
| 9/30/1999 | 10/18/1999 | 0.0036 | 0.0048 | 6.7 | 7 | 69.7 | 73 | 101 |
| 10/31/1999 | 11/15/1999 | 0.0036 | 0.0048 | 6.6 | 7 | 63.5 | 66.2 | 39 |
| 11/30/1999 | 12/15/1999 | 0.0036 | 0.0048 | 6.8 | 6.9 | 56 | 63 | 40 |
| 12/31/1999 | 1/14/2000 | 0.0036 | 0.0048 | 6.8 | 7.2 | 50 | 54 | 10 |
| 1/31/2000 | 2/15/2000 | 0.0036 | 0.0048 | 6.6 | 7 | 45 | 49 | 35 |
| 2/29/2000 | 3/15/2000 | 0.0036 | 0.0048 | 6.8 | 7.1 | 43 | 47 | 40 |
| 3/31/2000 | 4/12/2000 | 0.0036 | 0.0048 | 6.9 | 7.1 | 60 | 65 | 30.1 |
| 4/30/2000 | 5/15/2000 | 0.0036 | 0.0048 | 6.7 | 7.4 | 58 | 64 | 26 |
| 5/31/2000 | 6/13/2000 | 0.0036 | 0.0048 | 6.5 | 7.1 | 61 | 64 | 24 |
| 6/30/2000 | 7/14/2000 | 0.0036 | 0.0048 | 6.9 | 6.9 | 64 | 69 | 29.9 |
| 7/31/2000 | 8/14/2000 | 0.007 | 0.048 | 6.9 | 6.9 | 69 | 69 | |
| 8/31/2000 | 9/13/2000 | C | C | C | C | C | C | C |
| 9/30/2000 | 10/12/2000 | C | C | C | C | C | C | C |
| 10/31/2000 | 11/13/2000 | C | C | C | C | C | C | C |
| 11/30/2000 | 12/11/2000 | C | C | C | C | C | C | C |
| 12/31/2000 | 1/10/2001 | C | C | C | C | C | C | C |
| 1/31/2001 | 2/14/2001 | C | C | C | C | C | C | C |
| 2/28/2001 | 3/15/2001 | C | C | C | C | C | C | C |
| 3/31/2001 | 4/12/2001 | C | C | C | C | C | C | C |
| 4/30/2001 | 5/9/2001 | C | C | C | C | C | C | C |
| 5/31/2001 | 6/11/2001 | C | C | C | C | C | C | C |
| 6/30/2001 | 7/12/2001 | C | C | C | C | C | C | C |
| 7/31/2001 | 8/9/2001 | C | C | C | C | C | C | C |
| 8/31/2001 | 9/14/2001 | C | C | C | C | C | C | C |
| 9/30/2001 | 10/10/2001 | C | C | C | C | C | C | C |
| 10/31/2001 | 11/14/2001 | C | C | C | C | C | C | C |
| 11/30/2001 | 12/12/2001 | C | C | C | C | C | C | C |
| 12/31/2001 | 1/14/2002 | C | C | C | C | C | C | C |
| 1/31/2002 | 2/14/2002 | C | C | C | C | C | C | C |
| 2/28/2002 | 3/12/2002 | C | C | C | C | C | C | C |
| 3/31/2002 | 4/15/2002 | C | C | C | C | C | C | C |
| 4/30/2002 | 5/14/2002 | C | C | C | C | C | C | C |
| 5/31/2002 | 6/13/2002 | C | C | C | C | C | C | C |
| 6/30/2002 | 7/10/2002 | C | C | C | C | C | C | C |
| 7/31/2002 | 8/14/2002 | C | C | C | C | C | C | C |
| 8/31/2002 | 9/16/2002 | C | C | C | C | C | C | C |
| 9/30/2002 | 10/11/2002 | C | C | C | C | C | C | C |
| 10/31/2002 | 11/14/2002 | C | C | C | C | C | C | C |
| 11/30/2002 | 12/13/2002 | C | C | C | C | C | C | C |
| 12/31/2002 | 1/15/2003 | C | C | C | C | C | C | C |
| 1/31/2003 | 2/12/2003 | C | C | C | C | C | C | C |
| 2/28/2003 | 3/31/2003 | C | C | C | C | C | C | C |
| 3/31/2003 | 4/10/2003 | C | C | C | C | C | C | C |
| 4/30/2003 | 5/13/2003 | C | C | C | C | C | C | C |
| 5/31/2003 | 6/12/2003 | C | C | C | C | C | C | C |
| 6/30/2003 | 7/11/2003 | C | C | C | C | C | C | C |
| 7/31/2003 | 8/14/2003 | C | C | C | C | C | C | C |
| 8/31/2003 | 9/12/2003 | C | C | C | C | C | C | C |
| 9/30/2003 | 10/14/2003 | C | C | C | C | C | C | C |
| 10/31/2003 | 11/12/2003 | C | C | C | C | C | C | C |
| 11/30/2003 | 12/10/2003 | C | C | C | C | C | C | C |
| 12/31/2003 | 1/13/2004 | C | C | C | C | C | C | C |
| 1/31/2004 | 2/13/2004 | C | C | C | C | C | C | C |
| 2/29/2004 | 3/25/2004 | C | C | C | C | C | C | C |
| 3/31/2004 | 4/18/2004 | C | C | C | C | C | C | C |
| 4/30/2004 | 5/17/2004 | C | C | C | C | C | C | C |
| 5/31/2004 | 6/14/2004 | C | C | C | C | C | C | C |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/30/2004 | 7/12/2004 | C | C | C | C | C | C | C |
| 7/31/2004 | 8/10/2004 | C | C | C | C | C | C | C |
| 8/31/2004 | 9/13/2004 | C | C | C | C | C | C | C |
| 9/30/2004 | 10/15/2004 | C | C | C | C | C | C | C |
| 10/31/2004 | 11/15/2004 | C | C | C | C | C | C | C |
| 11/30/2004 | 12/9/2004 | C | C | C | C | C | C | C |
| 12/31/2004 | 1/13/2005 | C | C | C | C | C | C | C |
| 1/31/2005 | 2/14/2005 | C | C | C | C | C | C | C |
| 2/28/2005 | 3/14/2005 | C | C | C | C | C | C | C |
| 3/31/2005 | 4/15/2005 | C | C | C | C | C | C | C |
| 4/30/2005 | 5/18/2005 | C | C | C | C | C | C | C |
| 5/31/2005 | 6/13/2005 | C | C | C | C | C | C | C |
| 6/30/2005 | 7/14/2005 | C | C | C | C | C | C | C |
| 7/31/2005 | 8/19/2005 | C | C | C | C | C | C | C |
| 8/31/2005 | 9/12/2005 | C | C | C | C | C | C | C |
| 9/30/2005 | 10/17/2005 | C | C | C | C | C | C | C |
| 10/31/2005 | 11/5/2005 | C | C | C | C | C | C | C |
| 11/30/2005 | 12/13/2005 | C | C | C | C | C | C | C |
| 12/31/2005 | 1/13/2006 | C | C | C | C | C | C | C |
| 1/31/2006 | 2/14/2006 | C | C | C | C | C | C | C |
| 2/28/2006 | 3/13/2006 | C | C | C | C | C | C | C |
| 3/31/2006 | 4/14/2006 | C | C | C | C | C | C | C |
| 4/30/2006 | 5/15/2006 | C | C | C | C | C | C | C |
| 5/31/2006 | 6/14/2006 | C | C | C | C | C | C | C |
| 6/30/2006 | 7/13/2006 | C | C | C | C | C | C | C |
| 7/31/2006 | 8/7/2006 | C | C | C | C | C | C | C |
| 8/31/2006 | 9/19/2006 | C | C | C | C | C | C | C |
| 9/30/2006 | 10/16/2006 | C | C | C | C | C | C | C |
| 10/31/2006 | 11/15/2006 | C | C | C | C | C | C | C |
| 11/30/2006 | 12/15/2006 | C | C | C | C | C | C | C |
| 12/31/2006 | 1/11/2007 | C | C | C | C | C | C | C |
| 1/31/2007 | 2/14/2007 | C | C | C | C | C | C | C |
| 2/28/2007 | 3/14/2007 | C | C | C | C | C | C | C |
| 3/31/2007 | 4/16/2007 | C | C | C | C | C | C | C |
| 4/30/2007 | 5/16/2007 | C | C | C | C | C | C | C |
| 5/31/2007 | 6/14/2007 | C | C | C | C | C | C | C |
| 6/30/2007 | 7/13/2007 | C | C | C | C | C | C | C |
| 7/31/2007 | 8/15/2007 | C | C | C | C | C | C | C |
| 8/31/2007 | 9/13/2007 | C | C | C | C | C | C | C |
| 9/30/2007 | 10/12/2007 | C | C | C | C | C | C | C |
| 10/31/2007 | 11/14/2007 | C | C | C | C | C | C | C |
| 11/30/2007 | 12/12/2007 | C | C | C | C | C | C | C |
| 12/31/2007 | 1/14/2008 | C | C | C | C | C | C | C |
| 1/31/2008 | 2/15/2008 | C | C | C | C | C | C | C |
| 2/29/2008 | 3/14/2008 | C | C | C | C | C | C | C |
| 3/31/2008 | 4/11/2008 | C | C | C | C | C | C | C |
| 4/30/2008 | 5/7/2008 | C | C | C | C | C | C | C |
| 5/31/2008 | 6/13/2008 | C | C | C | C | C | C | C |
| 6/30/2008 | 7/11/2008 | C | C | C | C | C | C | C |
| 7/31/2008 | 8/11/2008 | C | C | C | C | C | C | C |
| 8/31/2008 | 9/10/2008 | C | C | C | C | C | C | C |
| 9/30/2008 | 10/10/2008 | C | C | C | C | C | C | C |
| 10/31/2008 | 11/12/2008 | C | C | C | C | C | C | C |
| 11/30/2008 | | | | | | | | |
| 12/31/2008 | | | | | | | | |
| 028D | | Flow | | pH | | Temperature | | Volatile Compounds (GC/MS) |
| | | .0036 Mgal/d | .0048 Mgal/d | 6.5 SU | 8.5 SU | 85 deg F | 90 deg F | Req. Mon. ug/L |
| | | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX | MO AVG |
| | Ave: | 0.00 | 0.01 | 6.72 | 7.05 | 57.35 | 60.84 | 64.10 |
| | max | 0.007 | 0.048 | 7 | 7.4 | 70.7 | 73.4 | 235 |
| | min | 0.0036 | 0.0048 | 6.3 | 6.8 | 43 | 47 | 10 |
| | exceedence | 1 | 1 | 1 | 0 | 0 | 0 | NA |

*C: NODI code which refers to "no discharge"

**028W**

| MP Date | Rec'd Date | O&G 10 mg/L MO AVG | pH 6.5 SU MINIMUM | pH 8.5 SU MAXIMUM |
|---|---|---|---|---|
| 10/31/1998 | 11/16/1998 | 5 | 6.8 | 6.8 |
| 1/31/1999 | 2/16/1999 | 5 | 7.3 | 7.3 |
| 4/30/1999 | 5/13/1999 | 5 | 7.3 | 7.3 |
| 7/31/1999 | 8/16/1999 | 5 | 6.8 | 6.8 |
| 10/31/1999 | 11/15/1999 | 5 | 6.8 | 6.8 |
| 1/31/2000 | 2/15/2000 | 5 | 7.1 | 7.1 |
| 4/30/2000 | 5/15/2000 | 5 | 7.1 | 7.1 |
| 7/31/2000 | 8/14/2000 | 5 | 6.6 | 6.6 |
| 10/31/2000 | 11/13/2000 | 5 | 6.7 | 6.7 |
| 1/31/2001 | 2/14/2001 | 5 | 5.8 | 5.8 |
| 4/30/2001 | 5/9/2001 | 5 | 8 | 8 |
| 7/31/2001 | 8/9/2001 | 5 | 7.7 | 7.7 |
| 10/31/2001 | 11/14/2001 | 5 | 7 | 7 |
| 1/31/2002 | 2/14/2002 | 5 | 6.9 | 6.9 |
| 4/30/2002 | 5/14/2002 | 5 | 6.9 | 6.9 |
| 7/31/2002 | 8/14/2002 | 5 | 7.2 | 7.2 |
| 10/31/2002 | 11/14/2002 | 5 | 7.1 | 7.1 |
| 1/31/2003 | 2/12/2003 | 5.2 | 6.9 | 6.9 |
| 4/30/2003 | 5/13/2003 | 5 | 7 | 7 |
| 7/31/2003 | 8/14/2003 | 5 | 7.4 | 7.4 |
| 10/31/2003 | 11/12/2003 | 5 | 7.6 | 7.6 |
| 1/31/2004 | 2/13/2004 | 5 | 7.47 | 7.47 |
| 4/30/2004 | 5/17/2004 | 5 | 6.67 | 6.67 |
| 7/31/2004 | 8/10/2004 | 5 | 7.55 | 7.55 |
| 10/31/2004 | 11/15/2004 | 5 | 7.19 | 7.19 |
| 1/31/2005 | 2/14/2005 | 5 | 6.79 | 6.79 |
| 4/30/2005 | 5/18/2005 | 5 | 6.57 | 6.57 |
| 7/31/2005 | 8/19/2005 | 5 | 7.49 | 7.49 |
| 10/31/2005 | 11/15/2005 | 5 | 7.38 | 7.38 |
| 1/31/2006 | 2/14/2006 | 5 | 6.87 | 6.87 |
| 4/30/2006 | 5/15/2006 | 5 | 7.24 | 7.24 |
| 7/31/2006 | 8/7/2006 | 5 | 7.28 | 7.28 |
| 10/31/2006 | 11/15/2006 | 5 | 7 | 7 |
| 1/31/2007 | 2/14/2007 | 5.1 | 6.3 | 6.3 |
| 4/30/2007 | 5/16/2007 | 5 | 7.08 | 7.08 |
| 7/31/2007 | 7/13/2007 | 5 | 6.86 | 6.86 |
| 10/31/2007 | 11/14/2007 | 5 | 6.93 | 6.93 |
| 1/31/2008 | 2/15/2008 | 5 | 7.42 | 7.42 |
| 4/30/2008 | 5/10/2008 | 0.5 | 7.04 | 7.04 |
| 7/31/2008 | 8/11/2008 | 5 | 6.95 | 6.95 |
| 10/31/2008 | 11/12/2008 | 5 | 7.04 | 7.04 |

**028W**

| MP Date | Rec'd Date | O&G 10 mg/L MO AVG | pH 6.5 SU MINIMUM | pH 8.5 SU MAXIMUM |
|---|---|---|---|---|
| | Ave | 4.9 | 7.1 | 7.1 |
| | max | 5.2 | 8 | 8 |
| | min | 0.5 | 5.8 | 5.8 |
| | exceedence | 0 | 2 | 0 |

**029A**

| | | Cadmium | Chromium | Flow | | pH | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|
| | | Req. Mon. mg/L | Req. Mon. mg/L | 28.8 Mgal/d | 54.7 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 95 deg F |
| MP Date | Rec'd Date | DAILY MX | DAILY MX | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| 10/31/1998 | 11/16/1998 | | | 0.0045 | 0.14 | | | | |
| 11/30/1998 | 12/16/1998 | | | | | | | | |
| 12/31/1998 | 1/19/1999 | | | | | | | | |
| 1/31/1999 | 2/16/1999 | | | | | | | | |
| 2/28/1999 | 3/16/1999 | | | | | | | | |
| 3/31/1999 | 4/16/1999 | | | | | | | | |
| 4/30/1999 | 5/13/1999 | | | | | | | | |
| 5/31/1999 | 6/16/1999 | | | | | | | | |
| 6/30/1999 | 7/14/1999 | | | | | | | | |
| 7/31/1999 | 8/16/1999 | | | | | | | | |
| 8/31/1999 | 9/17/1999 | | | | | | | | |
| 9/30/1999 | 10/18/1999 | | | | | | | | |
| 10/31/1999 | 11/15/1999 | | | | | | | | |
| 11/30/1999 | 12/15/1999 | | | | | | | | |
| 12/31/1999 | 1/14/2000 | | | | | | | | |
| 1/31/2000 | 2/15/2000 | | | | | | | | |
| 2/29/2000 | 3/15/2000 | | | | | | | | |
| 3/31/2000 | 4/12/2000 | | | | | | | | |
| 4/30/2000 | 5/15/2000 | | | | | | | | |
| 5/31/2000 | 6/13/2000 | | | 0.015 | 0.465 | 7.5 | 7.5 | 54 | 54 |
| 6/30/2000 | 7/14/2000 | | | | | | | | |
| 7/31/2000 | 8/14/2000 | | | | | | | | |
| 8/31/2000 | 9/13/2000 | | | | | | | | |
| 9/30/2000 | 10/12/2000 | | | | | | | | |
| 10/31/2000 | 11/13/2000 | | | | | | | | |
| 11/30/2000 | 12/11/2000 | | | | | | | | |
| 12/31/2000 | 1/10/2001 | | | | | | | | |
| 1/31/2001 | 2/14/2001 | | | | | | | | |
| 2/28/2001 | 3/15/2001 | | | | | | | | |
| 3/31/2001 | 4/15/2001 | | | | | | | | |
| 4/30/2001 | 5/9/2001 | | | | | | | | |
| 5/31/2001 | 6/11/2001 | | | | | | | | |
| 6/30/2001 | 7/12/2001 | | | | | | | | |
| 7/31/2001 | 8/9/2001 | | | | | | | | |
| 8/31/2001 | 9/14/2001 | | | | | | | | |
| 9/30/2001 | 10/10/2001 | | | | | | | | |
| 10/31/2001 | 11/14/2001 | | | | | | | | |
| 11/30/2001 | 12/12/2001 | | | | | | | | |
| 12/31/2001 | 1/14/2002 | | | | | | | | |
| 1/31/2002 | 2/14/2002 | | | | | | | | |
| 2/28/2002 | 3/12/2002 | | | | | | | | |
| 3/31/2002 | 4/15/2002 | | | | | | | | |
| 4/30/2002 | 5/14/2002 | | | | | | | | |
| 5/31/2002 | 6/13/2002 | | | | | | | | |
| 6/30/2002 | 7/10/2002 | | | | | | | | |
| 7/31/2002 | 8/14/2002 | | | | | | | | |
| 8/31/2002 | 9/16/2002 | | | | | | | | |
| 9/30/2002 | 10/11/2002 | | | | | | | | |
| 10/31/2002 | 11/14/2002 | | | | | | | | |
| 11/30/2002 | 12/13/2002 | | | | | | | | |
| 12/31/2002 | 1/15/2003 | | | | | | | | |
| 1/31/2003 | 2/12/2003 | | | | | | | | |
| 2/28/2003 | 3/31/2003 | | | | | | | | |
| 3/31/2003 | 4/10/2003 | | | | | | | | |
| 4/30/2003 | 5/13/2003 | | | | | | | | |
| 5/31/2003 | 6/12/2003 | | | | | | | | |
| 6/30/2003 | 7/11/2003 | | | | | | | | |
| 7/31/2003 | 8/14/2003 | | | | | | | | |
| 8/31/2003 | 9/12/2003 | | | | | | | | |
| 9/30/2003 | 10/14/2003 | | | | | | | | |
| 10/31/2003 | 11/12/2003 | | | | | | | | |
| 11/30/2003 | 12/10/2003 | | | | | | | | |
| 12/31/2003 | 1/13/2004 | | | | | | | | |
| 1/31/2004 | 2/13/2004 | | | | | | | | |
| 2/29/2004 | 3/15/2004 | | | | | | | | |
| 3/31/2004 | 4/18/2004 | | | | | | | | |
| 4/30/2004 | 5/17/2004 | | | | | | | | |
| 5/31/2004 | 6/14/2004 | | | | | | | | |
| 6/30/2004 | 7/12/2004 | | | | | | | | |
| 7/31/2004 | 8/10/2004 | | | | | | | | |
| 8/31/2004 | 9/13/2004 | | | | | | | | |
| 9/30/2004 | 10/15/2004 | | | | | | | | |
| 10/31/2004 | 11/15/2004 | | | | | | | | |
| 11/30/2004 | 12/9/2004 | | | | | | | | |
| 12/31/2004 | 1/13/2005 | | | | | | | | |
| 1/31/2005 | 2/14/2005 | | | | | | | | |
| 2/28/2005 | 3/14/2005 | | | | | | | | |
| 3/31/2005 | 4/15/2005 | | | | | | | | |
| 4/30/2005 | 5/18/2005 | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5/31/2005 | 6/13/2005 | | | | | | | | |
| 6/30/2005 | 7/14/2005 | | | | | | | | |
| 7/31/2005 | 8/19/2005 | | | | | | | | |
| 8/31/2005 | 9/12/2005 | | | | | | | | |
| 9/30/2005 | 10/17/2005 | | | | | | | | |
| 10/31/2005 | 11/15/2005 | | | | | | | | |
| 11/30/2005 | 12/13/2005 | | | | | | | | |
| 12/31/2005 | 1/13/2006 | | | | | | | | |
| 1/31/2006 | 2/14/2006 | | | | | | | | |
| 2/28/2006 | 3/13/2006 | | | | | | | | |
| 3/31/2006 | 4/14/2006 | | | | | | | | |
| 4/30/2006 | 5/15/2006 | | | | | | | | |
| 5/31/2006 | 6/14/2006 | | | | | | | | |
| 6/30/2006 | 7/13/2006 | | | | | | | | |
| 7/31/2006 | 8/7/2006 | | | | | | | | |
| 8/31/2006 | 9/19/2006 | | | | | | | | |
| 9/30/2006 | 10/16/2006 | | | | | | | | |
| 10/31/2006 | 11/15/2006 | | | | | | | | |
| 11/30/2006 | 12/15/2006 | | | | | | | | |
| 12/31/2006 | 1/11/2007 | | | | | | | | |
| 1/31/2007 | 2/14/2007 | | | | | | | | |
| 2/28/2007 | 3/14/2007 | | | | | | | | |
| 3/31/2007 | 4/16/2007 | | | | | | | | |
| 4/30/2007 | 5/16/2007 | | | | | | | | |
| 5/31/2007 | 6/14/2007 | | | | | | | | |
| 6/30/2007 | 7/13/2007 | | | | | | | | |
| 7/31/2007 | 8/15/2007 | | | | | | | | |
| 8/31/2007 | 9/13/2007 | | | | | | | | |
| 9/30/2007 | 10/12/2007 | | | | | | | | |
| 10/31/2007 | 11/14/2007 | | | | | | | | |
| 11/30/2007 | 12/12/2007 | | | | | | | | |
| 12/31/2007 | 1/14/2008 | | | | | | | | |
| 1/31/2008 | 2/15/2008 | | | | | | | | |
| 2/29/2008 | 3/14/2008 | | | | | | | | |
| 3/31/2008 | 4/11/2008 | | | | | | | | |
| 4/30/2008 | 5/7/2008 | | | | | | | | |
| 5/31/2008 | 6/13/2008 | | | | | | | | |
| 6/30/2008 | 7/11/2008 | | | | | | | | |
| 7/31/2008 | 8/11/2008 | | | | | | | | |
| 8/31/2008 | 9/10/2008 | | | | | | | | |
| 9/30/2008 | 10/10/2008 | | | | | | | | |
| 10/31/2008 | 11/12/2008 | | | | | | | | |
| 11/30/2008 | | | | | | | | | |
| 12/31/2008 | | | | | | | | | |
| 029A | | Cadmium | Chromium | Flow | | pH | | Temperature | |
| | | Req. Mon. mg/L | Req. Mon. mg/L | 28.8 Mgal/d | 54.7 Mgal/d | 6.5 SU | 8.5 SU | 90 deg F | 95 deg F |
| | | DAILY MX | DAILY MX | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX |
| | Ave: | 0 | 0 | 0.010 | 0.303 | 7.5 | 7.5 | 54 | 54 |
| | max | 0 | 0 | 0.015 | 0.465 | 7.5 | 7.5 | 54 | 54 |
| | min | 0 | 0 | 0.0045 | 0.14 | 7.5 | 7.5 | 54 | 54 |
| | exceedence | NA | NA | 0 | 0 | 0 | 0 | 0 | 0 |

**030W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 5 | 7.2 | 7.2 |
| 1/31/1999 | 2/16/1999 | 5 | 7.2 | 7.2 |
| 4/30/1999 | 5/13/1999 | 8 | 6.9 | 6.9 |
| 7/31/1999 | 8/16/1999 | 5 | 6.8 | 6.8 |
| 10/31/1999 | 11/15/1999 | 5 | 6.9 | 6.9 |
| 1/31/2000 | 2/15/2000 | 5 | 7.5 | 7.5 |
| 4/30/2000 | 5/15/2000 | 5 | 7 | 7 |
| 7/31/2000 | 8/14/2000 | 6.8 | 6.9 | 6.9 |
| 10/31/2000 | 11/13/2000 | 5 | 6.5 | 6.5 |
| 1/31/2001 | 2/14/2001 | 5 | 6.8 | 6.8 |
| 4/30/2001 | 5/9/2001 | 5 | 7.4 | 7.4 |
| 7/31/2001 | 8/9/2001 | 5 | 7.2 | 7.2 |
| 10/31/2001 | 11/14/2001 | 5 | 7.1 | 7.1 |
| 1/31/2002 | 2/14/2002 | 5 | 6.6 | 6.6 |
| 4/30/2002 | 5/14/2002 | 5 | 6.9 | 6.9 |
| 7/31/2002 | 8/14/2002 | 5 | 7.1 | 7.1 |
| 10/31/2002 | 11/14/2002 | 5 | 7 | 7 |
| 1/31/2003 | 2/12/2003 | 5.2 | 6.8 | 6.8 |
| 4/30/2003 | 5/13/2003 | 5 | 7 | 7 |
| 7/31/2003 | 8/14/2003 | 5 | 7.5 | 7.5 |
| 10/31/2003 | 11/12/2003 | 5 | 7.7 | 7.7 |
| 1/31/2004 | 2/13/2004 | 5 | 7.5 | 7.5 |
| 4/30/2004 | 5/17/2004 | 5 | 6.77 | 6.77 |
| 7/31/2004 | 8/10/2004 | 5 | 7.6 | 7.6 |
| 10/31/2004 | 11/15/2004 | 5 | 7.08 | 7.08 |
| 1/31/2005 | 2/14/2005 | 5 | 7.03 | 7.03 |
| 4/30/2005 | 5/18/2005 | 5 | 6.69 | 6.69 |
| 7/31/2005 | 8/19/2005 | 5 | 7.55 | 7.55 |
| 10/31/2005 | 11/15/2005 | 5 | 7.31 | 7.31 |
| 1/31/2006 | 2/14/2006 | 5 | 7.28 | 7.28 |
| 4/30/2006 | 5/15/2006 | 5 | 7.21 | 7.21 |
| 7/31/2006 | 8/7/2006 | 5 | 7.05 | 7.05 |
| 10/31/2006 | 11/15/2006 | 5 | 7.1 | 7.1 |
| 1/31/2007 | 2/14/2007 | 5 | 7.1 | 7.1 |
| 4/30/2007 | 5/16/2007 | 5 | 7.11 | 7.11 |
| 7/31/2007 | 7/13/2007 | 5 | 6.99 | 6.99 |
| 10/31/2007 | 11/14/2007 | 5 | 6.89 | 6.89 |
| 1/31/2008 | 2/15/2008 | 8.5 | 7.55 | 7.55 |
| 4/30/2008 | 5/10/2008 | 0.5 | 6.9 | 6.9 |
| 7/31/2008 | 8/11/2008 | 5 | 6.88 | 6.88 |
| 10/31/2008 | 11/12/2008 | 5 | 6.99 | 6.99 |

**030W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave | 5.1 | 7.1 | 7.1 |
| | max | 8.5 | 7.7 | 7.7 |
| | min | 0.5 | 6.5 | 6.5 |
| | exceedence | 0 | 0 | 0 |

**031D**

| | | Flow | | O&G | | pH | | Temperature | | Volatile fraction organics |
|---|---|---|---|---|---|---|---|---|---|---|
| | | .762 Mgal/d | 2.2 Mgal/d | 10 mg/L | 15 mg/L | 6.5 SU | 8.5 SU | 90 deg F | 90 deg F | Req. Mon. mg/L |
| MP Date | Rec'd Date | MO AVG | DAILY MX | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX | DAILY MX |
| 10/31/1998 | 11/16/1998 | 0.762 | 2.2 | 5 | 5 | | | 63.7 | 66 | 147 |
| 11/30/1998 | 12/16/1998 | 0.762 | 2.2 | 5 | 5 | | | 59 | 60 | 256.4 |
| 12/31/1998 | 1/19/1999 | 0.762 | 2.2 | 5 | 5 | | | 55 | 59 | 62.8 |
| 1/31/1999 | 2/16/1999 | 0.762 | 2.2 | 5 | 5 | 6.7 | 7.2 | 48 | 51 | 0.393 |
| 2/28/1999 | 3/16/1999 | 0.762 | 2.2 | 5 | 5 | 6.6 | 6.9 | 46.5 | 53 | 0.257 |
| 3/31/1999 | 4/16/1999 | 0.762 | 2.2 | 5 | 5 | 6.4 | 6.5 | 45.8 | 47.1 | 0.265 |
| 4/30/1999 | 5/13/1999 | 0.762 | 2.2 | 5 | 5 | 6.8 | 7.4 | 51.5 | 52.3 | 0.538 |
| 5/31/1999 | 6/16/1999 | 0.762 | 2.2 | 5 | 5 | 7.1 | 7.5 | 56.8 | 62 | 0.038 |
| 6/30/1999 | 7/14/1999 | 0.762 | 2.2 | 5 | 5 | 6.8 | 7.1 | 64.4 | 66.3 | 0.281 |
| 7/31/1999 | 8/16/1999 | 0.762 | 2.2 | 5 | 5 | 6.9 | 7 | 71.2 | 73.4 | 0.106 |
| 8/31/1999 | 9/17/1999 | 0.762 | 2.2 | 5 | 5 | 7 | 7.1 | 71.1 | 73.4 | 0.095 |
| 9/30/1999 | 10/18/1999 | 0.762 | 2.2 | 5 | 5 | 6.7 | 7 | 70 | 74 | 0.164 |
| 10/31/1999 | 11/15/1999 | 0.762 | 2.2 | 5 | 5 | 6.7 | 7.1 | 63.6 | 66.2 | 0.049 |
| 11/30/1999 | 12/15/1999 | 0.762 | 2.2 | 5 | 5 | 6.8 | 7.1 | 56 | 61 | 0.162 |
| 12/31/1999 | 1/14/2000 | 0.762 | 2.2 | 5 | 5 | 7 | 7.6 | 50 | 53 | 0.029 |
| 1/31/2000 | 2/15/2000 | 0.762 | 2.2 | 5 | 5 | 6.6 | 7.1 | 45 | 48 | 0.046 |
| 2/29/2000 | 3/15/2000 | 0.762 | 2.2 | 5 | 5 | 6.9 | 7.1 | 44 | 47 | 0.078 |
| 3/31/2000 | 4/12/2000 | 0.762 | 2.2 | 5 | 5 | 6.9 | 7.1 | 59 | 51 | 0.307 |
| 4/30/2000 | 5/15/2000 | 0.762 | 2.2 | 5 | 5 | 6.7 | 7.4 | 51 | 52 | 0.149 |
| 5/31/2000 | 6/13/2000 | 0.762 | 2.2 | 5 | 5 | 6.4 | 7.1 | 56 | 61 | 0.07 |
| 6/30/2000 | 7/14/2000 | 0.762 | 2.2 | 5 | 5 | 6.6 | 6.9 | 64 | 67 | 0.034 |
| 7/31/2000 | 8/14/2000 | 0.152 | 2.2 | 5 | 5 | 6.8 | 6.8 | 67 | 67 | |
| 8/31/2000 | 9/13/2000 | C | C | C | C | C | C | C | C | C |
| 9/30/2000 | 10/12/2000 | C | C | C | C | C | C | C | C | C |
| 10/31/2000 | 11/13/2000 | C | C | C | C | C | C | C | C | C |
| 11/30/2000 | 12/11/2000 | C | C | C | C | C | C | C | C | C |
| 12/31/2000 | 1/10/2001 | C | C | C | C | C | C | C | C | C |
| 1/31/2001 | 2/14/2001 | C | C | C | C | C | C | C | C | C |
| 2/28/2001 | 3/15/2001 | C | C | C | C | C | C | C | C | C |
| 3/31/2001 | 4/12/2001 | C | C | C | C | C | C | C | C | C |
| 4/30/2001 | 5/9/2001 | C | C | C | C | C | C | C | C | C |
| 5/31/2001 | 6/11/2001 | C | C | C | C | C | C | C | C | C |
| 6/30/2001 | 7/12/2001 | C | C | C | C | C | C | C | C | C |
| 7/31/2001 | 8/9/2001 | C | C | C | C | C | C | C | C | C |
| 8/31/2001 | 9/14/2001 | C | C | C | C | C | C | C | C | C |
| 9/30/2001 | 10/10/2001 | C | C | C | C | C | C | C | C | C |
| 10/31/2001 | 11/14/2001 | C | C | C | C | C | C | C | C | C |
| 11/30/2001 | 12/12/2001 | C | C | C | C | C | C | C | C | C |
| 12/31/2001 | 1/14/2002 | C | C | C | C | C | C | C | C | C |
| 1/31/2002 | 2/14/2002 | C | C | C | C | C | C | C | C | C |
| 2/28/2002 | 3/12/2002 | C | C | C | C | C | C | C | C | C |
| 3/31/2002 | 4/15/2002 | C | C | C | C | C | C | C | C | C |
| 4/30/2002 | 5/14/2002 | C | C | C | C | C | C | C | C | C |
| 5/31/2002 | 6/13/2002 | 0.762 | 2.2 | 5 | 5 | 6.5 | 7.1 | 57 | 61 | 0.025 |
| 6/30/2002 | 7/10/2002 | C | C | C | C | C | C | C | C | C |
| 7/31/2002 | 8/14/2002 | C | C | C | C | C | C | C | C | C |
| 8/31/2002 | 9/16/2002 | C | C | C | C | C | C | C | C | C |
| 9/30/2002 | 10/11/2002 | C | C | C | C | C | C | C | C | C |
| 10/31/2002 | 11/14/2002 | 0.762 | 2.2 | 5.1 | 5.1 | 6.8 | 7 | 63 | 66 | 0.546 |
| 11/30/2002 | 12/13/2002 | C | C | C | C | C | C | C | C | C |
| 12/31/2002 | 1/15/2003 | C | C | C | C | C | C | C | C | C |
| 1/31/2003 | 2/12/2003 | C | C | C | C | C | C | C | C | C |
| 2/28/2003 | 3/31/2003 | C | C | C | C | C | C | C | C | C |
| 3/31/2003 | 4/10/2003 | C | C | C | C | C | C | C | C | C |
| 4/30/2003 | 5/13/2003 | C | C | C | C | C | C | C | C | C |
| 5/31/2003 | 6/12/2003 | C | C | C | C | C | C | C | C | C |
| 6/30/2003 | 7/11/2003 | C | C | C | C | C | C | C | C | C |
| 7/31/2003 | 8/14/2003 | C | C | C | C | C | C | C | C | C |
| 8/31/2003 | 9/12/2003 | C | C | C | C | C | C | C | C | C |
| 9/30/2003 | 10/14/2003 | C | C | C | C | C | C | C | C | C |
| 10/31/2003 | 11/12/2003 | C | C | C | C | C | C | C | C | C |
| 11/30/2003 | 12/10/2003 | C | C | C | C | C | C | C | C | C |
| 12/31/2003 | 1/13/2004 | C | C | C | C | C | C | C | C | C |
| 1/31/2004 | 2/13/2004 | C | C | C | C | C | C | C | C | C |
| 2/29/2004 | 3/15/2004 | C | C | C | C | C | C | C | C | C |
| 3/31/2004 | 4/18/2004 | C | C | C | C | C | C | C | C | C |
| 4/30/2004 | 5/17/2004 | C | C | C | C | C | C | C | C | C |
| 5/31/2004 | 6/14/2004 | C | C | C | C | C | C | C | C | C |
| 6/30/2004 | 7/12/2004 | C | C | C | C | C | C | C | C | C |
| 7/31/2004 | 8/10/2004 | C | C | C | C | C | C | C | C | C |
| 8/31/2004 | 9/13/2004 | C | C | C | C | C | C | C | C | C |
| 9/30/2004 | 10/15/2004 | C | C | C | C | C | C | C | C | C |
| 10/31/2004 | 11/15/2004 | C | C | C | C | C | C | C | C | C |
| 11/30/2004 | 12/9/2004 | C | C | C | C | C | C | C | C | C |
| 12/31/2004 | 1/13/2005 | C | C | C | C | C | C | C | C | C |
| 1/31/2005 | 2/14/2005 | C | C | C | C | C | C | C | C | C |
| 2/28/2005 | 3/14/2005 | C | C | C | C | C | C | C | C | C |
| 3/31/2005 | 4/15/2005 | C | C | C | C | C | C | C | C | C |
| 4/30/2005 | 5/18/2005 | C | C | C | C | C | C | C | C | C |
| 5/31/2005 | 6/13/2005 | C | C | C | C | C | C | C | C | C |
| 6/30/2005 | 7/14/2005 | C | C | C | C | C | C | C | C | C |
| 7/31/2005 | 8/19/2005 | C | C | C | C | C | C | C | C | C |
| 8/31/2005 | 9/12/2005 | C | C | C | C | C | C | C | C | C |
| 9/30/2005 | 10/17/2005 | C | C | C | C | C | C | C | C | C |
| 10/31/2005 | 11/15/2005 | C | C | C | C | C | C | C | C | C |
| 11/30/2005 | 12/13/2005 | C | C | C | C | C | C | C | C | C |
| 12/31/2005 | 1/13/2006 | C | C | C | C | C | C | C | C | C |
| 1/31/2006 | 2/14/2006 | C | C | C | C | C | C | C | C | C |
| 2/28/2006 | 3/13/2006 | C | C | C | C | C | C | C | C | C |
| 3/31/2006 | 4/14/2006 | C | C | C | C | C | C | C | C | C |
| 4/30/2006 | 5/15/2006 | C | C | C | C | C | C | C | C | C |
| 5/31/2006 | 6/14/2006 | C | C | C | C | C | C | C | C | C |
| 6/30/2006 | 7/13/2006 | C | C | C | C | C | C | C | C | C |
| 7/31/2006 | 8/7/2006 | C | C | C | C | C | C | C | C | C |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8/31/2006 | 9/18/2006 | C | C | C | C | C | C | C | C | C |
| 9/30/2006 | 10/16/2006 | C | C | C | C | C | C | C | C | C |
| 10/31/2006 | 11/15/2006 | C | C | C | C | C | C | C | C | C |
| 11/30/2006 | 12/15/2006 | C | C | C | C | C | C | C | C | C |
| 12/31/2006 | 1/11/2007 | C | C | C | C | C | C | C | C | C |
| 1/31/2007 | 2/14/2007 | C | C | C | C | C | C | C | C | C |
| 2/28/2007 | 3/14/2007 | C | C | C | C | C | C | C | C | C |
| 3/31/2007 | 4/16/2007 | C | C | C | C | C | C | C | C | C |
| 4/30/2007 | 5/16/2007 | C | C | C | C | C | C | C | C | C |
| 5/31/2007 | 6/14/2007 | C | C | C | C | C | C | C | C | C |
| 6/30/2007 | 7/13/2007 | C | C | C | C | C | C | C | C | C |
| 7/31/2007 | 8/15/2007 | C | C | C | C | C | C | C | C | C |
| 8/31/2007 | 9/13/2007 | C | C | C | C | C | C | C | C | C |
| 9/30/2007 | 10/12/2007 | C | C | C | C | C | C | C | C | C |
| 10/31/2007 | 11/14/2007 | C | C | C | C | C | C | C | C | C |
| 11/30/2007 | 12/12/2007 | C | C | C | C | C | C | C | C | C |
| 12/31/2007 | 1/14/2008 | C | C | C | C | C | C | C | C | C |
| 1/31/2008 | 2/15/2008 | C | C | C | C | C | C | C | C | C |
| 2/29/2008 | 3/14/2008 | C | C | C | C | C | C | C | C | C |
| 3/31/2008 | 4/11/2008 | C | C | C | C | C | C | C | C | C |
| 4/30/2008 | 5/7/2008 | C | C | C | C | C | C | C | C | C |
| 5/31/2008 | 6/13/2008 | C | C | C | C | C | C | C | C | C |
| 6/30/2008 | 7/11/2008 | C | C | C | C | C | C | C | C | C |
| 7/31/2008 | 8/11/2008 | C | C | C | C | C | C | C | C | C |
| 8/31/2008 | 9/10/2008 | C | C | C | C | C | C | C | C | C |
| 9/30/2008 | 10/10/2008 | C | C | C | C | C | C | C | C | C |
| 10/31/2008 | 11/12/2008 | C | C | C | C | C | C | C | C | C |
| 11/30/2008 | | | | | | | | | | |
| 12/31/2008 | | | | | | | | | | |
| 031D | | Flow | | O&G | | pH | | Temperature | | VOCs |
| | | .782 Mgal/d | 2.2 Mgal/d | 10 mg/L | 15 mg/L | 6.5 SU | 8.5 SU | 90 deg F | 90 deg F | Req. Mon. mg/L |
| | | MO AVG | DAILY MX | MO AVG | DAILY MX | MINIMUM | MAXIMUM | MO AVG | DAILY MX | DAILY MX |
| | Ave | 0.7 | 2.2 | 5.0 | 5.0 | 6.7 | 7.1 | 57.4 | 59.9 | 20.4 |
| | max | 0.762 | 2.2 | 5.1 | 5.1 | 7.1 | 7.6 | 71.2 | 74 | 256.4 |
| | min | 0.152 | 2.2 | 5 | 5 | 6.4 | 6.5 | 44 | 47 | 0.025 |
| | exceedence | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | NA |

*C: NODI code which refers to "no discharge"

**031W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| MP Date | Rec'd Date | MO AVG | MINIMUM | MAXIMUM |
| 10/31/1998 | 11/16/1998 | 5 | 7.1 | 7.1 |
| 1/31/1999 | 2/16/1999 | 5 | 7.2 | 7.2 |
| 4/30/1999 | 5/13/1999 | 5 | 7.2 | 7.2 |
| 7/31/1999 | 8/16/1999 | 5 | 6.8 | 6.8 |
| 10/31/1999 | 11/15/1999 | 5 | 6.9 | 7 |
| 1/31/2000 | 2/15/2000 | 5 | 7.5 | 7.5 |
| 4/30/2000 | 5/15/2000 | 5 | 6.8 | 6.8 |
| 7/31/2000 | 8/14/2000 | 5 | 6.9 | 6.9 |
| 10/31/2000 | 11/13/2000 | 5 | 6.5 | 6.5 |
| 1/31/2001 | 2/14/2001 | 5 | 6.2 | 6.2 |
| 4/30/2001 | 5/9/2001 | 5 | 7.6 | 7.6 |
| 7/31/2001 | 8/9/2001 | 5 | 7.6 | 7.6 |
| 10/31/2001 | 11/14/2001 | 5.3 | 7 | 7 |
| 1/31/2002 | 2/14/2002 | 5 | 7.2 | 7.2 |
| 4/30/2002 | 5/14/2002 | 5 | 6.3 | 6.3 |
| 7/31/2002 | 8/14/2002 | 5 | 6.7 | 6.7 |
| 10/31/2002 | 11/14/2002 | 5 | 7 | 7 |
| 1/31/2003 | 2/12/2003 | 5.2 | 7.1 | 7.1 |
| 4/30/2003 | 5/13/2003 | 5 | 6.9 | 6.9 |
| 7/31/2003 | 8/14/2003 | 5 | 6.8 | 6.8 |
| 10/31/2003 | 11/12/2003 | 5 | 7.3 | 7.3 |
| 1/31/2004 | 2/13/2004 | 5 | 7.35 | 7.35 |
| 4/30/2004 | 5/17/2004 | 5 | 6.88 | 6.88 |
| 7/31/2004 | 8/10/2004 | 5 | 7.67 | 7.67 |
| 10/31/2004 | 11/15/2004 | 5 | 6.96 | 6.96 |
| 1/31/2005 | 2/14/2005 | 5 | 7.08 | 7.08 |
| 4/30/2005 | 5/18/2005 | 5 | 6.63 | 6.63 |
| 7/31/2005 | 8/19/2005 | 5 | 7.65 | 7.65 |
| 10/31/2005 | 11/15/2005 | 5 | 7.29 | 7.29 |
| 1/31/2006 | 2/14/2006 | 5 | 7.05 | 7.05 |
| 4/30/2006 | 5/15/2006 | 5 | 7.22 | 7.22 |
| 7/31/2006 | 8/7/2006 | 5 | 7.04 | 7.04 |
| 10/31/2006 | 11/15/2006 | 5 | 7.01 | 7.01 |
| 1/31/2007 | 2/14/2007 | 5 | 7.3 | 7.3 |
| 4/30/2007 | 5/16/2007 | 5 | 7.01 | 7.01 |
| 7/31/2007 | 7/13/2007 | 5 | 7.05 | 7.05 |
| 10/31/2007 | 11/14/2007 | 5 | 6.98 | 6.98 |
| 1/31/2008 | 2/15/2008 | 5 | 7.71 | 7.71 |
| 4/30/2008 | 5/10/2008 | 0.5 | 6.85 | 6.85 |
| 7/31/2008 | 8/11/2008 | 5 | 6.92 | 6.92 |
| 10/31/2008 | 11/12/2008 | 5 | 6.87 | 6.87 |

**031W**

| | | O&G | pH | |
|---|---|---|---|---|
| | | 10 mg/L | 6.5 SU | 8.5 SU |
| | | MO AVG | MINIMUM | MAXIMUM |
| | Ave | 4.90 | 7.05 | 7.05 |
| | max | 5.3 | 7.71 | 7.71 |
| | min | 0.5 | 6.2 | 6.2 |
| | exceedence | 0 | 2 | 0 |

**032W**

| MP Date | Rec'd Date | O&G 10 mg/L MO AVG | pH 6.5 SU MINIMUM | pH 8.5 SU MAXIMUM |
|---|---|---|---|---|
| 10/31/1998 | 11/16/1998 | 5 | 7.1 | 7.1 |
| 1/31/1999 | 2/16/1999 | 5 | 7.4 | 7.9 |
| 4/30/1999 | 5/13/1999 | 5 | 4.8 | 7.3 |
| 7/31/1999 | 8/16/1999 | 5 | 4.9 | 7.2 |
| 10/31/1999 | 11/15/1999 | 5 | 6.3 | 6.7 |
| 1/31/2000 | 2/15/2000 | 5 | 6.1 | 6.8 |
| 4/30/2000 | 5/15/2000 | 5 | 4.9 | 7.5 |
| 7/31/2000 | 8/14/2000 | 5 | 4.6 | 5.6 |
| 10/31/2000 | 11/13/2000 | 5 | 4.9 | 6.1 |
| 1/31/2001 | 2/14/2001 | 5 | 4.6 | 5.7 |
| 4/30/2001 | 5/9/2001 | 5 | 4.4 | 6.8 |
| 7/31/2001 | 8/9/2001 | 5 | 4.6 | 7.7 |
| 10/31/2001 | 11/14/2001 | 5 | 4.6 | 6.7 |
| 1/31/2002 | 2/14/2002 | 5 | 5.4 | 7.4 |
| 4/30/2002 | 5/14/2002 | C | C | C |
| 7/31/2002 | 8/14/2002 | C | C | C |
| 10/31/2002 | 11/14/2002 | C | C | C |
| 1/31/2003 | 2/12/2003 | C | C | C |
| 4/30/2003 | 5/13/2003 | C | C | C |
| 7/31/2003 | 8/14/2003 | C | C | C |
| 10/31/2003 | 11/12/2003 | C | C | C |
| 1/31/2004 | 2/13/2004 | C | C | C |
| 4/30/2004 | 5/17/2004 | C | C | C |
| 7/31/2004 | 8/10/2004 | C | C | C |
| 10/31/2004 | 11/15/2004 | C | C | C |
| 1/31/2005 | 2/14/2005 | C | C | C |
| 4/30/2005 | 5/18/2005 | C | C | C |
| 7/31/2005 | 8/19/2005 | C | C | C |
| 10/31/2005 | 11/15/2005 | C | C | C |
| 1/31/2006 | 2/14/2006 | C | C | C |
| 4/30/2006 | 5/15/2006 | C | C | C |
| 7/31/2006 | 8/7/2006 | C | C | C |
| 10/31/2006 | 11/15/2006 | C | C | C |
| 1/31/2007 | 2/14/2007 | C | C | C |
| 4/30/2007 | 5/16/2007 | C | C | C |
| 7/31/2007 | 7/13/2007 | C | C | C |
| 10/31/2007 | 11/14/2007 | C | C | C |
| 1/31/2008 | 2/15/2008 | C | C | C |
| 4/30/2008 | 5/10/2008 | C | C | C |
| 7/31/2008 | 8/11/2008 | C | C | C |
| 10/31/2008 | 11/12/2008 | C | C | C |

**032W**

| MP Date | Rec'd Date | O&G 10 mg/L MO AVG | pH 6.5 SU MINIMUM | pH 8.5 SU MAXIMUM |
|---|---|---|---|---|
| | Ave: | 5.0 | 5.3 | 6.9 |
| | max | 5 | 7.4 | 7.9 |
| | min | 5 | 4.4 | 5.6 |
| | exceedence | 0 | 12 | 0 |

*C: NODI code which refers to "no discharge"

**Attachment H**
**GE Stormwater Sampling Results**[1]

| Parameter | Outfall 001 | Outfall 010 | Outfall 007 | Outfall 019 | Outfall 027 | Outfall 028 | Outfall 030 | Outfall 031 | Outfall 032 |
|---|---|---|---|---|---|---|---|---|---|
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| O&G | ND | ND | ND | ND | 2 | 2 | ND | 2 | ND |
| BOD | 3 | ND | 40 | 3 | ND | 2 | ND | ND | ND |
| COD | 162 | 510 | 343 | 321 | 149 | 264 | 113 | 71 | ND |
| TSS | 32 | ND | ND | 45 | 54 | 7.5 | 39 | ND | 3 |
| Total Phosphorus | 0.63 | 0.35 | 0.21 | 0.89 | 0.345 | 0.05 | 0.2 | 0.14 | 0.02 |
| pH | 7.5-7.7 | 7.4-7.6 | 7.5-7.6 | 7.3-7.5 | 7.4-7.6 | 7.6-7.7 | 7.3-7.7 | 7.6-7.6 | 6.9-7.8 |
| Color | 130 | 60 | 75 | 425 | 205 | 107.5 | 52 | 130 | 16 |
| Nitrate-Nitrite | 0.31 | 0.31 | 0.33 | 0.37 | 0.305 | 0.775 | 0.47 | 0.3 | 0.2 |
| Sulfate (as SO4) | 1800 | 1748 | 558 | 1500 | 442 | 758 | 490 | 152 | ND |
| Aluminum | 1.29 | 1 | 0.477 | 1.77 | 1.79 | 0.48 | 0.645 | 0.381 | ND |
| Barium | 0.04 | 0.0238 | 0.107 | 0.026 | 0.0375 | 0.06165 | 0.011 | 0.0556 | ND |
| Cobalt, total | ND | 0.11 | ND | ND | ND | ND | ND | ND | ND |
| Iron, total | 1.41 | 0.992 | 0.935 | 4.03 | 3.125 | 1.825 | 0.716 | 1.99 | ND |
| Titanium, total | 0.065 | 0.05235 | 0.03572 | 0.096 | 0.089 | 0.02668 | 0.026 | 0.02401 | ND |
| Antimony, total | 0.131 | 0.144 | 0.0808 | 0.111 | 0.097 | 0.1045 | ND | 0.0852 | ND |
| Arsenic, total | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Beryllium, total | 0.003 | 0.00732 | 0.00908 | 0.002 | 0.001 | 0.00604 | ND | 0.00508 | ND |
| Cadmium, total | 0.022 | 0.04429 | 0.03213 | 0.029 | 0.0105 | 0.028095 | 0.006 | 0.02046 | ND |
| Chromium, total | 0.04 | 0.06387 | 0.03105 | 0.04 | 0.036 | 0.038645 | 0.018 | 0.03156 | ND |
| Copper, total | 0.077 | 0.0967 | 0.058 | 0.119 | 0.0715 | 0.08105 | 0.061 | 0.0475 | ND |
| Lead, total | 0.0862 | 0.79 | 0.0052 | 0.137 | 0.08165 | 0.0134 | 0.114 | ND | ND |
| Mercury, total | ND | ND | 0.0007 | 0.002 | ND | ND | ND | 0.0002 | 0.0004 |
| Nickel, total | 0.065 | 0.129 | 0.144 | 0.078 | 0.048 | 0.0942 | ND | 0.0974 | ND |
| Selenium, total | ND | 0.011 | ND | ND | ND | ND | ND | ND | ND |
| Silver, total | 0.0019 | 0.0032 | 0.0018 | 0.0031 | 0.0095 | 0.00235 | 0.0004 | ND | 0.0003 |
| Thallium, Total | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Zinc, total | 0.389 | 0.0673 | 0.0631 | 0.291 | 0.1515 | 0.1305 | 0.134 | 0.0676 | 0.11 |
| Cyanide | 0.015 | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenols, total | ND | ND | ND | ND | 0.16 | ND | 0.12 | ND | ND |
| GC/MS Volatiles (VOCs) | 0.0068 | 0.001 | 0.039 | 0.002 | 0.1129 | 0.109 | 1.1764 | 0.483 | 0.0059 |
| GC/MS Acid Extractables | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| GC/MS Base/Neutral Extra | 0.013 | 0.01 | 0.007 | 0.006 | 0.014 | 0.0125 | ND | 0.02 | 0.009 |
| GC/MS PCBs | ND | ND | ND | ND | ND | ND | ND | ND | ND |

1. NPDES Permit Renewal Application Revision, June 1998, Section 3 - EPA NPDES Form 2F: Storm Water Discharge Information

**Attachment I**

**GE Process Water Sampling Results[1]**

| Parameter | Outfall 014 | Outfall 018 | Outfall 020 |
|---|---|---|---|
| | mg/L | mg/L | mg/L |
| O&G | | 1 | 1 |
| BOD | 2 | 3 | 2 |
| COD | 163 | 590 | 625 |
| TSS | 14 | 9 | 26 |
| pH | 7.73-7.85 | 7.92 | 7.89-7.92 |
| Color | | 39 | 55 |
| Nitrate-Nitrite | | ND | ND |
| Sulfate (as SO4) | 2255 | 2150 | 2155 |
| Aluminum | ND | 0.62 | 0.76 |
| Barium | ND | ND | ND |
| Cobalt, total | ND | 0.11 | 0.24 |
| Iron, total | 0.13 | 0.25 | 0.54 |
| Titanium, total | ND | 0.017 | 0.03 |
| Antimony, total | ND | ND | 0.07 |
| Arsenic, total | ND | 0.06 | 0.07 |
| Beryllium, total | ND | ND | ND |
| Cadmium, total | ND | 0.025 | 0.03 |
| Chromium, total | 0.013 | 0.032 | 0.04 |
| Copper, total | ND | 0.07 | 0.06 |
| Lead, total | 0.002 | 0.0057 | 0.0079 |
| Mercury, total | ND | 0.0004 | 0.0005 |
| Nickel, total | ND | ND | ND |
| Selenium, total | ND | 0.45 | 0.47 |
| Silver, total | ND | ND | ND |
| Thallium, Total | ND | ND | ND |
| Zinc, total | ND | 0.06 | 0.06 |
| Cyanide | ND | ND | ND |
| Phenols, total | 0.2 | 0.55 | ND |
| Methylene Chloride | | 1.5 ug/L | 1.7 ug/L |
| Butyl Benzyl Phthalate | | | 2 ug/L |
| Di-N-Butyl Phthalate | 1 ug/L | | 7 ug/L |

1. NPDES Permit Renewal Application Revision, June 1998,
Section 2 - EPA NPDES Form 2C: Wastewater Discharge Information.

**Attachment J: Requirements for Cooling Water Intake Structures Under CWA § 316(b)**

Table of Contents



## 1. Introduction

NPDES permit requirements for cooling water intake structures (CWISs) are based on CWA § 316(b), 33 U.S.C. § 1326(b), which requires "that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact" BTA). The operation of CWISs can cause or contribute to a variety of adverse environmental effects, such as killing or injuring tiny aquatic organisms, including but not limited to fish larvae and eggs, by entraining them in the water withdrawn from a water body and sent through the facility's cooling system, and by killing or injuring larger organisms, including but not limited to juvenile and adult fish, by impinging them against the intake structure's screens, racks, or other structures. Section 316(b) applies if the applicant for a discharge permit seeks to withdraw cooling water from a water of the United States. Therefore, CWA § 316(b) applies to this permit due to the operation of CWISs at the GE Aviation facility.

In the absence of applicable regulations, for many years EPA has made § 316(b) determinations on a case-by-case basis based on best professional judgment (BPJ), for both new and existing facilities with regulated CWISs. In December 2001, EPA promulgated new, final § 316(b) regulations that provide specific technology-based requirements for *new* facilities of any kind with a CWIS with an intake flow greater than two (2) MGD. 66 Fed. Reg. 65255 (Dec. 18, 2001) (Phase I rule). The Phase I rule is in effect but does not apply to this permit because the GE Aviation facility in Lynn, MA, is not a new facility.

In July 2004, EPA published final regulations applying § 316(b) to large, *existing* power plants (Phase II rule), defined in 40 CFR § 125.91 as existing point sources employing CWISs designed to withdraw at least 50 MGD or more and generating and transmitting electric power as their primary activity. Following litigation that resulted in the remand to EPA of many of the rule's provisions, *see Riverkeeper, Inc. v. U.S. EPA*, 475F.3d 83 (2d Cir. 2007); *rev'd in part, Entergy Corp. v. Riverkeeper, Inc.*, ___ U.S. ___, 129 S.Ct. 1498, 1510 (2009), the Agency suspended the Phase II rule in July 2007. 72 FR 37107 (July 9, 2007). The suspension left only 40 CFR § 125.90(b) in effect, which provides that in the absence of applicable categorical standards, BTA determinations are to be made on a case-by-case, BPJ basis.

On June 16, 2006, EPA published the Phase III Rule under § 316(b) of the CWA, which established categorical requirements for new offshore oil and gas extraction facilities that have a design intake flow threshold of greater than 2 MGD, but dictated that the BTA would be determined on a case-by-case, BPJ basis for existing facilities with a design intake flow less than 50 MGD. 71 FR 35006 (June 16, 2006). As with the Phase I and II Rules, the Phase III Rule was challenged in federal court. EPA defended the Phase III Rule's provisions regarding new offshore oil and gas facilities but, following the Supreme Court's 2009 decision in *Entergy*, the Agency sought a voluntary remand of the Phase III Rule to the extent that it addressed existing facilities. EPA explained that it planned to reconsider the Phase III Rule decision with regard to existing facilities in conjunction with its reconsideration of the Phase II Rule. In other words, EPA planned to consider requirements for all existing facilities together. The Fifth Circuit granted EPA's motion, while at the same time affirming the Phase III Rule's provisions pertaining to new offshore oil and gas extraction facilities. *See ConocoPhillips Co. v. EPA*, 612 F.3d 822, 842 ($5^{th}$ Cir. 2010).

EPA is currently considering the development of new regulations to apply CWA § 316(b) to CWISs at existing facilities. The Agency is contemplating, among other things, the possibility of addressing all existing facilities in one rule (i.e., combining what were formerly referred to as Phase II and Phase III facilities).

In any event, there are no effective national categorical standards applying § 316(b) to the CWISs at the GE Aviation facility. As a result, EPA has developed technology-based requirements for the facility's CWISs by applying CWA § 316(b) on a BPJ, site-specific basis.

## 2. Methodology for the BPJ Application of CWA § 316(b)

Neither the CWA nor EPA regulations dictate a specific methodology for developing BPJ-based limits under § 316(b). As dictated by the text of § 316(b), however, the permit limits must ensure that the design, location, capacity and construction of CWISs reflect the BTA. In addition, the language of § 316(b) directs that the BTA is an "available" technology that is deemed the "best" for "minimizing" adverse environmental impacts.[1] EPA has read CWA § 316(b) to intend that entrainment and impingement be regarded as "adverse impacts" that must be minimized by application of the BTA. This might or might not require complete elimination of such impacts in a given case.

In addition, EPA has looked by analogy to factors considered in the development of effluent limitations under the CWA and EPA regulations for guidance concerning additional factors to consider in making a BTA determination under CWA § 316(b). In setting effluent limitations on either a national categorical basis or a site-specific BPJ basis, EPA considers a number of factors specified in the statute and regulations. *See, e.g.,* 33 U.S.C. §§ 1311(b)(2)(A) and 1314(b)(2); 40 C.F.R. § 125.3(d)(3).[2] These factors

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[1] Thus, a proper determination based on a BPJ analysis results in a valid, facility-specific BTA determination. In *NRDC v. EPA*, 859 F.2d 156, 199 (D.C. Cir. 1988) (industry and environmental group challenge to 1979 revisions to NPDES regulations, including the ban on backsliding from BPJ limits), the court explained:

> [i]n what EPA characterizes as a 'mini-guideline' process, the permit writer, after full consideration of the factors set forth in section 304(b), 33 U.S.C. § 1314(b) (which are the same factors used in establishing effluent guidelines), establishes the permit conditions 'necessary to carry out the provisions of [the CWA].' § 1342(a)(1). These conditions include the appropriate ... BAT effluent limitations for the particular point source. ... [T]he resultant BPJ limitations are as correct and as statutorily supported as permit limits based upon an effluent limitations guideline.

*Id. See also Texas Oil & Gas Ass'n v. EPA*, 161 F.3d 923, 929 (5th Cir. 1998) ("[For BPJ permits i]ndividual judgments thus take the place of uniform national guidelines, but the technology-based standard remains the same.").

include: (1) the age of the equipment and facilities involved, (2) the process employed, (3) the engineering aspects of applying various control techniques, (4) process changes, (5) cost, and (6) non-water quality environmental impacts (including energy issues). According to 40 C.F.R. § 125.3(c)(2), a BPJ-based BAT analysis also should consider the "appropriate technology for the category of point sources of which the applicant is a member, based on all available information," and "any unique factors relating to the applicant." In addition, the United States Supreme Court recently confirmed that EPA is authorized to consider a comparative assessment of the costs and benefits of technology options in determining the BTA under CWA § 316(b). *See Entergy Corp. v. Riverkeeper, Inc.,* ___ U.S. ___, 129 S.Ct. 1498, 1510 (2009). As indicated above, a permit writer developing permit limits on a site-specific, BPJ basis applies the same performance-based approach to an individual point source that EPA would apply to whole categories and classes of point sources when it develops national categorical standards.[3]

*2.1. Best performing technology – Closed-Cycle Cooling*

In applying the BAT standard for setting effluent limits, the CWA calls for EPA to look to the single "best" performing plant in the industry (in terms of effluent reduction) as the starting point for determining the "best available" technology for the industry.[4] EPA has also determined that it may look to any viable "transfer technologies"—that is, technology from another industry that can be "transferred" to the industry in question—as well as technologies shown to be viable in research even if not yet implemented at a full-scale facility.[5] Similarly, EPA's regulations for developing BAT-based effluent limits

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[2] *See also NRDC v. EPA*, 863 F.2d at 1425 ("in issuing permits on a case-by-case basis using its 'Best Professional Judgment,' EPA does not have unlimited discretion in establishing permit limitations. EPA's own regulations implementing [CWA § 402(a)(1)] enumerate the statutory factors that must be considered in writing permits.").

[3] *See, e.g., Texas Oil & Gas Ass'n*, 161 F.3d at 929 (under 40 C.F.R. § 125.3, "EPA must determine on a case-by-case basis what effluent limitations represent the BAT level, using its 'best professional judgment.' Individual judgments thus take the place of uniform national guidelines, but the technology-based standard remains the same.") (citation omitted); *NRDC v. EPA*, 859 F.2d at 201('in establishing BPJ limits, EPA considers the same statutory factors used to establish national effluent guidelines. BPJ limits thus represent the level of technology control mandated by the CWA for the particular point source."); *Trustees for Alaska v. EPA*, 749 F.2d 549, 553 (9th Cir. 1984) (EPA must consider statutorily enumerated factors in its BPJ determination of effluent limits); USEPA NPDES Permit Writer's Manual (1996) at 69-70. *See also NRDC v. EPA*, 863 F.2d at 1425 ("courts reviewing permits issued on a BPJ basis hold EPA to the same factors that must be considered in establishing the national effluent limitations" (citations omitted)).

[4] *E.g., Texas Oil & Gas Ass'n v. United States E.P.A.*, 161 F.3d 923, 928 (5th Cir. 1998); *Association of Pacific Fisheries v. Environmental Protection Agency*, 615 F.2d 794, 816-17 (9th Cir. 1980); *American Meat Inst. v. E.P.A.*, 526 F.2d 442, 462-63 (7th Cir. 1975).

[5] These approaches to determining BAT are supported by the CWA's legislative history and have been upheld by the courts. *E.g., Am. Petroleum Inst. v. EPA,* 858 F.2d 261, 264-65 (5th Cir.

under BPJ require EPA to begin by identifying the "appropriate technology for the category of point sources of which the applicant is a member, based on all available information." 40 C.F.R. § 125.3(c)(2). These practices with regard to developing BAT effluent limitations are consistent with EPA's development of BTA standards under § 316(b) and it is logical to apply them to this BPJ development of BTA standards.

Therefore, to ensure that the location, design, construction, and capacity of GE Aviation's CWIS reflect the best technology available for minimizing adverse environmental impacts, EPA's analysis begins with an inquiry into the capabilities of the best-performing CWISs in the same industrial category.[6] Although GE Aviation is a manufacturing facility, the power generating capability at the Power Plant, along with the operation of the CWISs and discharge of NCCW, make GE Aviation similar in important ways to steam electric power plants. Therefore, for the purposes of this discussion and analysis, GE Aviation will be compared directly to power plants whose primary function is the generation and transmission of electricity by means of the steam cycle.

Given that GE Aviation is an existing facility that would require retrofitting to achieve technologically-driven improvements, EPA can look to the *existing* steam electric facilities that have achieved the greatest reductions in adverse environmental impacts from their CWISs through technological retrofits. In addition, EPA can look to technologies shown to be feasible for use at GE Aviation even if not previously used to retrofit an existing facility. For example, in this regard, EPA could look to technologies being used at *new* power plants to determine if they would be feasible for application at GE Aviation.[7]

As a general matter, the best performing facilities in terms of reducing entrainment and impingement by CWISs at existing open-cycle cooling power plants are those facilities that have converted from open-cycle cooling to closed-cycle cooling using some type of "wet" cooling tower technology. Converting to closed-cycle cooling can reduce water withdrawals by more than 90 percent and thereby achieve a corresponding reduction in entrainment and impingement. EPA's research has identified a number of facilities that have made this type of technological improvement. *See Draft Permit Determinations Document for Brayton Point Station NPDES Permit,* at pp. 7-37 to 7-38; *Responses to*

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1988); *Pacific Fisheries,* 615 F.2d at 816-17; *BASF Wyandotte Corp. v. Costle,* 614 F.2d 21, 22 (1st Cir. 1980); *Am. Iron & Steel Inst. v. EPA,* 526 F.2d 1027, 1061 (3d Cir. 1975); *Am. Meat Inst.,* 526 F.2d at 462-63.

[6] It is important to emphasize that this is a site-specific determination and is <u>not</u> a finding regarding what would constitute appropriate national, industry category-wide BTA-based requirements under § 316(b).

[7] Thus, one can consider whether a technology used at a *new* power plant could constitute a viable "transfer technology" for use at an *existing* plant.

*Comments for Brayton Point Station NPDES Permit*, at p. IV-115.[8,9] A facility could also reduce its intake flow without changing technology by simply reducing the volume of its water withdrawals, but achieving significant reductions with this approach would most likely necessitate significant reductions in electrical generation. More modest flow reductions could lessen the effect on electrical generation but would also result in correspondingly more modest reductions in environmental impacts.[10]

EPA concludes that converting to a closed-cycle cooling system using wet cooling towers would *generally* be the best performing technology with regard to reducing the adverse environmental impacts of existing power plants with CWISs. Nevertheless, converting to closed-cycle cooling might not be determined to be the BTA either for a particular facility on a BPJ basis or for an entire category of facilities on a national basis. This could be so for a number of possible reasons. For example, closed-cycle cooling might not be feasible at some plants. This BPJ permit determination for the GE Aviation facility does not, and is not required to, evaluate all of these factors for any other facility or for the entire category of point sources nationally. Thus, a conclusion regarding the best-performing CWIS technology for use as a reference point in the BTA analysis for this permit is not a determination of the BTA for any other facility, much less for the entire category of facilities nationally.

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[8] In the Phase I CWA § 316(b) Rule, EPA determined that entrainment and impingement mortality reductions commensurate with the use of closed-cycle cooling reflect the BTA for *new* facilities with CWISs. *See* 40 C.F.R. Part 125, Subpart I (Phase I CWA § 316(b) Rule).

[9] Although the use of "dry" cooling might achieve an even greater marginal reduction in entrainment and impingement, EPA has not identified a single case of a facility retrofitting from open-cycle cooling to dry cooling. Although EPA is unaware of any technical reason that such a conversion would necessarily be impracticable at all facilities—though it seems likely that it would be infeasible at a larger proportion of existing facilities than would a conversion to wet cooling because of factors such as the greater space needed for dry cooling—it would likely achieve only a small marginal additional reduction over the high end of the reduction range for wet cooling towers and would be significantly more expensive. In the absence of examples of such a conversion ever having been implemented, EPA is not prepared to determine that converting to dry cooling is the required BTA for an existing facility like the GE Aviation plant. It should also be noted that in developing the Phase I Rule, EPA similarly declined to mandate dry cooling as the required BTA for new facilities, while recognizing that dry cooling was a *permissible* technology that would satisfy § 316(b) if a facility chose to install it.

[10] Cutbacks in water withdrawals, despite the resulting cutbacks in generation, have been required in some permits, sometimes on a seasonal basis, in order to reduce adverse CWIS impacts. *See, e.g.*, Bulletin, Marine Resources Advisory Council, Vol. IX, No. 4, "Effects of Power Plants on Hudson River Fish," (requirements for plant included scheduled plant outages); *In the Matter of Fla. Power Corp., Crystal River Power Plant, Units 1, 2, and 3, Citrus County, Florida* (Findings and Determinations Pursuant to 33 U.S.C. § 1326; NPDES Permit No. FL0000159).

### *2.2. Consideration of site-specific factors*

Because a BPJ-based application of CWA § 316(b)'s BTA standard is conducted on a case-by-case, site-specific basis, EPA must evaluate whether the technologies under consideration are practicable (or feasible) for use at the particular facility in question. In other words, although a technology works at one facility, it might not actually be feasible at another plant due to site-specific issues (*e.g.,* space limitations). Thus, a technology that works at another facility but is not feasible at GE Aviation would not be the BTA for this permit. Conversely, a feasible technology for GE Aviation might not be feasible for another facility.

Again turning for guidance to the process for devising BPJ-based effluent limits, EPA regulations direct the Agency to consider "unique factors relating to the applicant." 40 C.F.R. § 125.3(c)(2). This parallels the above-described site-specific evaluation that EPA conducts in its BPJ application of CWA § 316(b).

### *2.3. Additional Considerations*

In addition to considering the location, design, construction and capacity of the CWIS technology options and the extent to which they can reduce the direct adverse environmental impacts of the intake, EPA has also considered various factors that the Agency considers in setting effluent limitations, looking to the effluent limitations development process for guidance for this BTA determination under CWA § 316(b). For example, and as noted earlier, in developing BAT limits on a BPJ basis, EPA considers the six factors set forth in the statute and regulations for developing BAT effluent limitations: (1) the age of the equipment and facilities involved, (2) the process employed, (3) the engineering aspects of applying various control techniques, (4) process changes, (5) cost, and (6) non-water quality environmental impacts (including energy issues). *See* 33 U.S.C. § 1314(b)(2)(B); 40 C.F.R. § 125.3(d)(3). *See also* USEPA NPDES Permit Writer's Manual (1996) at 70.

The CWA sets up a loose framework for assessing these statutory factors in setting BAT limits.[11] It does not require their comparison, merely their consideration.[12] "[I]n enacting

[11] *BP Exploration & Oil, Inc.*, 66 F.3d at 796; *Weyerhauser v. Costle*, 590 F.2d 1011, 1045 (D.C. Cir. 1978) (citing Senator Muskie's remarks on CWA § 304(b)(1) factors during debate on CWA). *See also EPA v. Nat'l Crushed Stone Ass'n*, 449 U.S. 64, 74, 101 S.Ct. 295, 300, 66 L.Ed.2d 268 (1980) (noting with regard to BPT that "[s]imilar directions are given the Administrator for determining effluent reductions attainable from the BAT except that in assessing BAT total cost is no longer to be considered in comparison to effluent reduction benefits").

[12] *Weyerhauser*, 590 F.2d at 1045 (explaining that CWA § 304(b)(2) lists factors for EPA "consideration" in setting BAT limits, while CWA § 304(b)(1) lists both factors for EPA

the CWA, 'Congress did not mandate any particular structure or weight for the many consideration factors. Rather, it left EPA with discretion to decide how to account for the consideration factors, and how much weight to give each factor.'"[13] In sum, when EPA considers the statutory factors in setting BAT limits, it is governed by a standard of reasonableness.[14] It has "considerable discretion in evaluating the relevant factors and determining the weight to be accorded to each in reaching its ultimate BAT determination."[15] One court has succinctly summarized the standard for judging EPA's consideration of the statutory factors in setting BAT effluent limits: "[s]o long as the required technology reduces the discharge of pollutants, our inquiry will be limited to whether the Agency considered the cost of technology, along with other statutory factors, and whether its conclusion is reasonable."[16]

Thus, in determining the BTA for this permit, EPA has the discretion to consider the above-listed factors and to decide how to consider and weigh them in making its decision. Again, the factors from the effluent limitation development process are not strictly applicable as a matter of law to a BTA determination under § 316(b) because they are not specified in § 316(b). Nevertheless, EPA has looked to the effluent limitation development process for guidance and will consider these factors, and perhaps other factors, to the extent the Agency deems them relevant to its determination of the BTA. Ultimately, EPA's determination of the BTA must be reasonable.

Finally, as also indicated above, the United States Supreme Court recently held that EPA is authorized, though not statutorily required, to consider a comparative assessment of an option's costs and benefits in determining the BTA under CWA § 316(b). *Entergy,* 129 S.Ct. 1498, 1508-1510, *rev'g in part, Riverkeeper*, 475F.3d 83. As the Supreme Court explained, in its determination, "EPA sought only to avoid extreme disparities between

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consideration and factors for EPA "comparison" -- *e.g.*, "total cost versus effluent reduction benefits" -- in setting BPT limits).

[13] *BP Exploration & Oil, Inc.*, 66 F.3d at 796; *Weyerhauser v. Costle*, 590 F.2d at 1045.

[14] *BP Exploration & Oil*, 66 F.3d at 796; *Am. Iron & Steel Inst. v. EPA*, 526 F.2d 1027, 1051 (1975), *modified in other part*, 560 F.2d 589 (3d Cir. 1977), *cert. denied*, 435 U.S. 914 (1978).

[15] *Texas Oil & Gas Ass'n*, 161 F.3d at 928; *NRDC v. EPA*, 863 F.2d at 1426. *See also Weyerhauser*, 590 F.2d at 1045 (discussing EPA's discretion in assessing BAT factors, court noted that "[s]o long as EPA pays some attention to the congressionally specified factors, the section [304(b)(2)] on its face lets EPA relate the various factors as it deems necessary").

[16] *Ass'n of Pacific Fisheries v. EPA*, 615 F.2d 794, 818 (9th Cir. 1980) (industry challenge to BAT limitations for seafood processing industry). *See also Chemical Manufacturers Ass'n (CMA) v. EPA*, 870 F.2d 177, 250 n.320 (5th Cir. 1989), *citing* Congressional Research Service, *A Legislative History of the Water Pollution Control Act Amendments of 1972* at 170 (1973) (hereinafter "*1972 Legislative History*") (in determining BAT, "'[t]he Administrator will be bound by a test of reasonableness.'"); *NRDC v. EPA*, 863 F.2d at 1426 (same); *American Iron & Steel Inst.*, 526 F.2d at 1051 (same).

costs and benefits." *Entergy*, 129 S.Ct. at 1509. As the Court also explained, EPA had for decades engaged in this type of cost/benefit comparison using a "wholly disproportionate test" to ensure that costs were not unreasonable when considered in light of environmental benefits.[17] *Id.* at 1509 (citing *In re Public Service Co. of New Hampshire*, 1 E. A. D. 332, 340 (1977); *In re Central Hudson Gas and Electric Corp.*, EPA Decision of the General Counsel, NPDES Permits, No. 63, pp. 371, 381 (July 29, 1977)). In *Public Service*, EPA's Administrator stated that "I do not believe that it is reasonable to interpret Section 316(b) as requiring the use of technology whose cost is wholly disproportionate to the environmental benefit to be gained." In *Central Hudson*, *id.*, EPA's then General Counsel stated that:

> ... EPA must ultimately demonstrate that the present value of the cumulative annual cost of modifications to cooling water intake structures is not wholly out of proportion to the magnitude of the estimated environmental gains (including attainment of the objectives of the Act and § 316(b)) to be derived from the modifications.

The relevant "objectives of the Act and § 316(b)" include the following: minimizing adverse environmental impacts from cooling water intake structures; restoring and maintaining the physical and biological integrity of the Nation's waters; and achieving, wherever attainable, water quality that provides for the protection and propagation of fish, shellfish and wildlife, and provides for recreation, in and on the water. 33 U.S.C. §§ 1251(a)(1) and (2), 1326(b).

### *2.4. State Water Quality Standards*

In addition to satisfying technology-based requirements, NPDES permit limits for CWISs must also satisfy any more stringent provisions of state water quality standards (WQS) or other state legal requirements that may apply, as well as any applicable conditions of a state certification under CWA § 401. *See* CWA §§ 301(b)(1)(C), 401(a)(1), 401(d), 510; 40 C.F.R. §§ 122.4(d), 122.44(d). *See also* 40 C.F.R. § 125.84(e). This means that permit conditions for CWISs must satisfy numeric and narrative water quality criteria and protect designated uses that may apply from the state's WQS.

The CWA authorizes states to apply their WQS to the effects of CWISs and to impose more stringent water pollution control standards than those dictated by federal technology standards.[18] The United States Supreme Court has held that once the CWA § 401 state

[17] As the Court described, in developing the Phase II Rule, EPA had (for the first time) used a "significantly greater than test." The Court also indicated that either test was permissible under the statute. 129 S.Ct. at 1509.

[18] The regulation governing the development of WQS notes that "[a]s recognized by section 510 of the Clean Water Act, States may develop water quality standards more stringent than required by this regulation." 40 C.F.R. § 131.4(a). The Supreme Court has cited this regulation in support of the view that states could adopt water quality requirements more stringent than federal requirements. *PUD No. 1 of Jefferson County v. Wash. Dep't of Ecology*, 511 U.S. 700, 705

certification process has been triggered by the existence of a discharge, then the certification may impose conditions and limitations on the activity as a whole – not merely on the discharge – to the extent that such conditions are needed to ensure compliance with state WQS or other applicable requirements of state law.[19]

With respect to cooling water withdrawals, both sections 301(b)(1)(C) and 401 authorize the Region to ensure that such withdrawals are consistent with state WQS, because the permit must assure that the overall "activity" associated with a discharge will not violate applicable WQS. *See PUD No. 1*, 511 U.S. at 711-12 (Section 401 certification); *Riverkeeper I,* 358 F.3d at 200-202; *In re Dominion Energy Brayton Point, LLC*, 12 E.A.D. 490, 619-41 (EAB 2006). Therefore, in EPA-issued NPDES permits, limits addressing CWISs must satisfy: (1) the BTA standard of CWA § 316(b); (2) applicable state water quality requirements; and (3) any applicable conditions of a state certification under CWA § 401. The standards that are most stringent ultimately determine the final permit limits.

The Massachusetts Department of Environmental Protection (MassDEP) has designated the Saugus River in the vicinity of this discharge a Class SB, Outstanding Resource Water. Class SB "waters are designated as a habitat for fish [and] other aquatic life." 314 C.M.R. 4.05(2)(b). Massachusetts has indicated that this designated use means that SB waters are intended to provide, at a minimum, a good quality, healthful fish habitat (as opposed to a habitat of only minimal or low quality).[20] SB waters are also designated to provide a recreational fishing resource. Though the standard for Class SB waters does not include any specific numeric criteria that apply to cooling water intakes, it is nevertheless clear that MassDEP must impose the conditions it concludes are necessary to protect the designated uses of the river, including that it provide good quality habitat for fish and other aquatic life and a recreational fishing resource. In addition, 314 C.M.R. Section 4.05(1) of the Massachusetts WQS provides that each water classification "is identified by the most sensitive, and therefore governing, water uses to be achieved and protected." This means that where a classification lists several uses, permit requirements must be sufficient to protect the most sensitive use.

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(1994). *See also* 33 U.S.C. § 1370; 40 C.F.R. § 125.80(d). *See also* 40 C.F.R. § 125.80(d); *Riverkeeper, Inc. v. U.S. Environmental Protection Agency,* 358 F.3d 174, 200-201 (2d Cir. 2004) ("*Riverkeeper I*").

[19] *PUD No. 1*, 511 U.S. at 711-12. holds that "in setting discharge conditions to achieve WQS, a state can and should take account of the effects of other aspects of the activity that may affect the discharge conditions that will be needed to attain WQS. The text [of CWA § 401d)] refers to the compliance of the applicant, not the discharge. Section 401(d) thus allows the State to impose "other limitations" on the project in general to assure compliance with various provisions of the Clean Water Act and with "any other appropriate requirement of State law." For example, a state could impose certification conditions related to CWISs on a permit for a facility with a discharge, if those conditions were necessary to assure compliance with a requirement of state law, such as to protect a designated use under state WQS. *See id.* at 713 (holding that § 401 certification may impose conditions necessary to comply with designated uses).

[20] By contrast, the state's WQS require Class SA waters to provide "excellent" quality habitat for fish. 314 C.M.R. 4.05(4)(a).

Massachusetts interprets its WQS as being applicable to cooling water withdrawals. EPA agrees with the Commonwealth's interpretation. First, the Massachusetts Clean Water Act provides that "no person shall engage in any other activity which may reasonably result, directly or indirectly, in the discharge of pollutants to waters of the [state] without a currently valid permit from the Department." M.G.L. ch. 21, § 43(2) and 314 C.M.R. 3.04. MassDEP's position has been that the cooling water withdrawal associated with a once-through cooling water operation is an integral component of the "activity" that directly results in a thermal discharge. Therefore, the GE Aviation facility's cooling water withdrawal is an activity subject to regulation under the permit that MassDEP must issue to authorize the discharge of thermal pollution under the Commonwealth's Clean Water Act. Second, the state's CWA provides that MassDEP water permits may specify "technical controls and other components of treatment works to be constructed or installed . . . which [MassDEP] deems necessary to safeguard the quality of the receiving waters." M.G.L. ch. 21, § 43(7). "Treatment works" is broadly defined to include "any and all devices, processes and properties, real or personal, used in the collection, pumping, transmission . . . recycling . . . or reuse of waterborne pollutants." M.G.L. ch. 21, § 26A and 314 CMR 3.02. MassDEP has concluded that a CWIS constitutes an integral component of a facility's once-through cooling water "treatment works," and therefore, MassDEP has further authority to regulate such structures.

More recently, Massachusetts has amended its WQS to make explicit its interpretation of the implicit meaning of its pre-existing WQS. On December 29, 2006, Massachusetts amended 314 C.M.R. 4.05 to clarify that "in the case of a CWIS regulated by EPA under [CWA § 316(b)], the Department has the authority under [CWA § 401,] M.G.L. c. 21, §§ 26 through 53 and 314 C.M.R. 3.00 to condition the CWIS to assure compliance of the withdrawal activity with 314 C.M.R. 4.00, including, but not limited to, compliance with narrative and numerical criteria and protection of existing and designated uses." 314 C.M.R. 4.05(3)(b)(2)(d). On January 11, 2007, Massachusetts submitted this revision (among others) to EPA for review pursuant to Section 303(c) of the Act. On July 29, 2007, EPA wrote a letter to MassDEP stating that "there is nothing in the CWA that prohibits MassDEP from adopting and enforcing WQS related to CWISs to ensure that water withdrawals are conducted in a manner that protect[s] designated and existing uses and compl[ies] with narrative and numeric criteria." Letter from Stephen S. Perkins, EPA, to Arleen O'Donnell, MassDEP (July 29, 2007), at 3. Litigation has ensued in the state courts regarding the state's amendment to the WQS, but the state's underlying interpretation of the meaning of the pre-existing WQS still stands.

In summary, the Massachusetts WQSs apply to CWISs and the GE permit's requirements must be sufficient to ensure that the facility's CWISs neither cause nor contribute to violations of the WQS and satisfy the terms of the state's water quality certification under CWA § 401. EPA anticipates that the MassDEP will provide this certification before the issuance of the final permit.

### 3. Biological Impacts of Cooling Water Intake Structures

The principal adverse environmental impacts typically associated with CWISs evaluated by EPA are the *entrainment* of fish eggs, larvae, and other small forms of aquatic life through the plant's cooling system, and the *impingement* of fish and other larger forms of aquatic life on the intake screens. *See* 66 FR at 65292 ("[I]t is reasonable to interpret adverse environmental impact as including impingement and entrainment, diminishment of compensatory reserve, stresses to the population or ecosystem, harm to threatened and endangered species, and impairment of State or authorized Tribal water quality standards."). Entrainment and impingement can kill large numbers of the aforementioned aquatic organisms and contribute to diminished populations of local species of commercial and/or recreational importance, locally important forage species, and local threatened or endangered species. As such, CWISs can have effects across the food web. In effect, CWISs can substantially degrade the quality of aquatic habitat by adding to the ecosystem a significant anthropogenic source of mortality to resident organisms. In addition to considering these adverse impacts directly, their effects as cumulative impacts or stressors in conjunction with other existing stressors on the species should also be considered. Furthermore, losses of particular species could contribute to a decrease in the balance and diversity of the ecosystem's overall assemblage of organisms. *See* 66 FR 65256, 65262-65 (Dec. 18, 2001) (preamble to Final Phase I rule under CWA § 316(b)).

Entrainment of organisms occurs when a facility withdraws water into the CWIS from an adjacent water body. Fish eggs and larvae in the water are typically small enough to pass through intake screens and become entrained along with the cooling water within the facility. As a result, the eggs and larvae are exposed to shear forces from mechanical pumps, physical stress or injury from contact with pipe surfaces, elevated temperatures from waste heat removal, and, in some cases, high concentrations of chlorine or other biocides. 66 FR at 65263. These organisms are typically killed or otherwise harmed as a result of entrainment. The number of organisms entrained is dependent upon the volume and velocity of cooling water flow through the plant and the concentration of organisms in the source water body that are small enough to pass through the screens of CWIS. The extent of entrainment can be affected by the intake structure's location, the biological community in the water body, the characteristics of any intake screening system or other entrainment reduction equipment used by the facility, and by season. 66 FR at 65263.

Impingement of organisms occurs when a facility draws water through its CWIS and organisms too large to pass through the screens, and unable to swim away, become trapped against the screens and other parts of the intake structure. In some cases, contact with screens or other equipment can cause an organism to lose its protective slime and/or scales, or suffer other injuries, which may result in delayed mortality. The quantity of organisms impinged is a function of the intake structure's location and depth, the velocity of water drawn to the entrance of the intake structure (approach velocity) and through the screens (through-screen velocity), the seasonal abundance of various species of fish, and the size of various fish relative to the size of the mesh in any intake barrier system (e.g., screens). 66 FR at 65263. For resident fish in the Saugus River, the CWISs pose multiple threats to single populations in that organisms are exposed to entrainment mortality as eggs and larvae and impingement mortality as juveniles and adults. It should be noted that this discussion focuses on fish because more information is available on CWIS impacts to fish, but CWISs can also harm other types of organisms (*e.g.*, shellfish).

### *3.1. Local Biology--Common and Notable Species Present*

Several impingement and entrainment studies that were conducted in this reach of the Saugus River are available for characterization of local and anadromous fish and shellfish communities (MRI 1988, 1989, 1991, 1997). Impingement and entrainment sampling was conducted at GE's Power Plant CWIS from 1994 to 1996 using the same traveling screens currently in use (MRI 1997). To EPA's knowledge, no studies have been conducted to characterize impingement and entrainment specifically at either the Test Cell or Gear Plant CWISs. Impingement and entrainment sampling was also conducted from 1985 to 1988 across the Saugus River at the Wheelabrator Saugus CWIS and this provides additional data on the ambient biological conditions in the Saugus River. The Wheelabrator Saugus report provides impingement and entrainment rates at Wheelabrator Saugus at the time, though the facility has since updated the intake technology at its CWIS. These studies comprise the most recent impingement and entrainment data available for the Saugus River.

The Saugus River fish assemblage in the vicinity of the facility is composed not only of marine and estuarine species (e.g., winter flounder and Atlantic mackerel), but also freshwater species that can withstand high levels of salinity (e.g., chain pickerel), and anadromous (*e.g.*, alewife and rainbow smelt) and catadromous fish (*e.g.*, American eel). Many of these estuarine species are broadcast spawners that disperse their eggs to the water column. The eggs and larvae of these species float with the currents throughout the water column until they reach their juvenile life stage. Juvenile fishes school in the shallow, protected waters until they mature, at which point they move to deeper water.

Several of the fishes noted in the studies are desired species for recreational and commercial fishermen (e.g., winter flounder, bay anchovy, Atlantic cod, and Atlantic mackerel). In fact, of the 42 species or groups of species recognized as commercial fishery resources by the National Marine Fisheries Service Northeast Fisheries Science Center, at least 20 species are present near the facility according to the 1989 and/or 1997 MRI studies. In addition, 12 of the species sampled during the MRI studies have fishery management plans or restrictions managed by the New England Fishery Management Council. Generally, these fishery management plans are designed to reduce fishing mortality and promote rebuilding of stocks to sustainable biomass levels in response to population declines resulting from overfishing. Several of the species subject to impingement and entrainment, including yellowtail flounder, American plaice, cod, white hake, and haddock, are overfished (meaning that stock biomass remains low compared to maximum sustainable yield biomass) and/or overfishing is currently occurring (meaning fishing mortality remains high compared to maximum sustainable yield). In addition to fishes, several species of invertebrates, including commercially and/or recreationally important species such as the horseshoe crab and American lobster, are present in the Saugus River.

*3.2. Entrainment and Impingement*

The quantity of organisms entrained and impinged at a CWIS is generally a function of the intake structure's location, design, flow capacity (and resulting intake velocity), frequency of operation (i.e., capacity utilization), and the abundance of organisms within the influence of the cooling water intake current. The productive biological community of the Saugus River near GE's CWISs provides for conditions such as high egg and larval densities, numerous juvenile and adult fish and invertebrates, and anadromous fish migrating to spawning habitat, all of which could potentially lead to high rates of entrainment and impingement. This section discusses the potential for adverse environmental impacts to aquatic organisms as a result of the operation of GE's CWISs.

*3.3. Entrainment Impacts*

Fish eggs, larvae, and other aquatic organisms small enough to pass through the mesh of intake screens are entrained in water drawn into a facility's cooling system. Organisms carried through the cooling system are exposed to high shear stress and a rapid increase in water temperature as heat is transferred to the cooling water from the facility's condensers. Finally, after being discharged, organisms that survive traveling through the facility's cooling water system may then be exposed to rapid decreases in water temperature as the heated cooling water mixes with the receiving waters. These physical, chemical, and thermal stressors, individually or in combination, can kill or injure the entrained organisms. EPA assumes 100% mortality of entrained organisms in the absence of site-specific analysis of demonstrating some lesser percentage of mortality.

The permittee monitored entrained organisms in the Power Plant discharge stream (Outfall 018) in combination with ichthyoplankton sampling in the Saugus River opposite the intake from November 1994 through October 1996 (MRI 1997). Overall 41 species or groups of species were identified in the samples (4 present as eggs only, 23 present as larvae only, and 14 present as both eggs and larvae). Labrid (tautog/cunner), fourspot/windowpane flounder, and Atlantic mackerel eggs were numerically dominant, as were larval sand lance, cunner, grubby, Atlantic mackerel, Atlantic herring, winter flounder, rock gunnel, and fourbeard rockling. In both years the ichthyoplankton in-river sample and entrainment samples were dominated by eggs (approximately 66% of total sample). MRI (1997) did not provide an estimate of an annual entrainment rate or the total number of organisms entrained during the study period. Based on the permitted flow volume (35.9 MGD) and the geometric mean number of eggs and larvae for the numerically dominant species (3 species of eggs and 8 species of larvae) over the two sampling years, however, EPA calculated that the Power Plant CWIS has the potential to entrain over 69 million eggs and larvae annually.

Densities of eggs and larvae collected at the Power Plant and in the Saugus River exhibit strong seasonal patterns distributed throughout the year; however, there is considerable variability between peak seasons for different species. For instance, Atlantic herring larvae were present from November through May, while cunner larvae were present from June through September. This distribution indicates that entrainment is likely to occur year-round at the Power Plant CWIS. Peak larval densities for all species typically occurred between mid-March and late August, however, suggesting that this is the time period with the highest entrainment potential (see Table 3 of March 2006 TetraTech Report).

Wheelabrator Saugus (WS), located across and upstream from the Power Plant CWIS, conducted entrainment and river ichthyoplankton sampling from February 1984 through May 1988. The WS intakes are located on opposite shores of the Saugus River in distinct habitats, with GE's Power Plant CWIS located in deep water and the WS CWIS located in tidal flats with abundant vegetation. As a result, the two CWISs entrain a different composition of species. WS's entrainment samples, unlike GE Aviation's, were dominated by sculpin, Atlantic silverside, and Atlantic tomcod larvae. However, both facilities entrain large numbers of winter flounder and rock gunnel larvae, as well as labrid and windowpane eggs, suggesting the effects of entrainment at the GE and WS CWISs may have individual and cumulative adverse impacts on local fish communities.

### *3.4. Impingement Impacts*

The impingement of organisms occurs when water is drawn into a facility through GE's CWIS and organisms become trapped against the traveling screens. Impinged fish may suffer from improper gill movement, de-scaling, starvation, exhaustion or other injury while trapped against intake screens. If an organism is returned to the waterbody through a debris return trough, it may suffer further injuries from contact with debris in the trough or the trough itself. Upon being returned to the waterbody, any injured or disoriented organisms may be more susceptible to predation. *See* 66 FR 65263 (Preamble to the Phase I Rule).

Impingement was measured at the GE Power Plant CWIS from November 1994 through October 1996. According to the 1997 MRI Report, a total of 29 finfish species and 10 invertebrate species were impinged during the study. Grubby were the most commonly impinged fish in both years (representing 48% of total) and were most numerous in samples from mid-October to February. Winter flounder were the second most commonly collected fish (26% of total), and were taken at the highest rates in November and January. Cunner, windowpane, shorthorn sculpin, and threespine stickleback were also commonly impinged. GE Aviation estimated an average fish impingement rate of 1,580 fish per billion gallons withdrawn from the Saugus River. Based on average monthly flows at the Power Plant CWIS between October 1998 and October 2008, and the average number of fish impinged per million gallons per month over the 1994-1996 impingement study (from Table 3 of MRI 1997), EPA estimates that GE Aviation impinges as many as 64,000 adult and juvenile fish at the Power Plant CWIS. Most impinged individuals at GE Aviation were young-of-the-year through Age 2 with few adults of any species impinged. Rainbow smelt were impinged on three occasions between October and February. The largest single impingement event occurred in

October 1996, when 2,555 individuals were impinged, including large numbers of grubby, winter flounder, windowpane flounder, and rainbow smelt.

The following four species constituted the vast majority of invertebrates impinged at GE's Power Plant CWIS between 1994 and 1996: green crab (*Carcinus maenas*), sevenspine bay shrimp (*Crangon septemspinosa*), Atlantic rock/jonah crab (*Cancer irroratus/borealis*), and American lobster (*Homarus americanus*). No impingement rate was estimated for total invertebrates; however, observed impingement rates as high as 16,550 per 24 hours for sevenspine bay shrimp, 585 individuals per 24 hours for green crab, and 22 individuals per 24 hours for American lobster were documented.

Commonly impinged species during a study of impingement at WS from 1986 to 1988 were similar to those at GE Aviation. The five most abundant species included winter flounder, grubby, and windowpane. Mummichog and northern pipefish were also impinged in high numbers, which is indicative of the WS CWIS's location in a tidal flat. The impingement rate at WS was substantially lower than at GE Aviation, with approximately 149 fish impinged per billion gallons of water withdrawn.

While it is important to understand an intake structure's potential to impinge organisms, it is also important to assess the capability of the intake system's design and operation to effectively return impinged organisms back to the receiving waters alive and uninjured. At the time of the MRI (1997) study, the impingement rates and initial survival of impinged organisms at the Power Plant CWIS were assessed by catching all materials washed off the collecting screens in a 1/4-inch mesh collecting pen attached to the end of the screenwash sluiceway. The initial reported survival of impinged fish following handling by the collecting screens was 99.7% for grubby and winter flounder, 100% for cunner, windowpane, and shorthorn sculpin, and 82.6% for all remaining species. The study did not address latent (e.g., >24 hours) survival. It is important to observe latent survival in impingement studies because injuries caused from impingement (*e.g.*, loss of protective slime or de-scaling) may cause mortality even in individuals that initially survive.

### *3.5. Summary of Entrainment and Impingement*

The biological monitoring results from studies at GE Aviation indicate that the operation of the facility's CWIS results in adverse environmental impacts through the entrainment of ichthyoplankton (larvae and eggs) and the impingement of fish and invertebrates from the Saugus River. The MRI studies demonstrate that impingement and entrainment is occurring at GE at all times of the year, with peak entrainment occurring from mid-March through August and peak impingement occurring from October through early-March. See MRI 1997 Tables 7 and 8. Operations at GE Aviation impact both resident and migrating fish, including species experiencing population declines and recreationally and commercially important species.

## 4. Assessment of Cooling Water Intake Structure (CWIS) Technologies and Determination of Best Technology Available (BTA) under Section 316(b)

This section evaluates GE Aviation's existing CWISs and discusses potentially available technological alternatives for ensuring that the location, design, construction, and capacity of each CWIS reflects the BTA for minimizing adverse environmental impacts, as required by CWA § 316(b). This discussion considers engineering, environmental, economic, and other issues related to each alternative (See Section 2 of this Attachment for discussion of the methodology underlying the application of BPJ in this determination), and concludes with EPA's determination of the CWIS BTA for this permit renewal.

As explained in more detail below, there is a range of alternatives for minimizing the adverse environmental impacts of CWISs. Each available alternative has advantages and disadvantages, both inherent to the technology and as applied specifically at GE Aviation, and no one alternative commends itself as perfect, proven, and fully protective of the environment. For this analysis, EPA has considered the permit record, including the many recent submittals made by the permittee, such as GE Aviation's February 2008 Cooling Tower Analysis Technology and Biological Assessment Information and its March 2008 response to EPA' s CWA § 308(a) information request letter.

### *4.1. Gear Plant CWIS*

The Gear Plant CWIS is located at the end of a 700-foot long pier on the southeastern portion of the GE facility (see Figure 1 March 2008 Cooling Water Intake Structure Information Document). The current 1993 permit limits this intake to an average monthly flow of 28.8 mgd and maximum daily flow of 54.7 mgd.

The permittee has recently proposed, however, to permanently retire the Gear Plant CWIS from operation. The MEPA Notification Form, submitted in April 2010, notified the state of GE Aviation's plans to demolish the saltwater intake wharf, close the associated discharge outfall, and install a new electrical line to Building 7 as part of the plan to demolish the Gear Plant. Commencement of this construction work is scheduled for October 1, 2010. Because this CWIS will no longer be operated and will likely be demolished during the next permit cycle, no BTA determination is required for this CWIS.

### *4.2. Power Plant CWIS*

a. <u>Existing Technology</u>

GE Aviation's Power Plant CWIS is located in a pumphouse along the northern shore of the river (*see* Figure 1 March 2008 Cooling Water Intake Structure Information Document). This reach of the river is relatively straight, especially compared to the meandering reaches upstream of the facility, and the northern shoreline is generally relatively deep (19.5 feet at the traveling screens) and does not contain the shallow salt marsh and tidal flat habitat that is prevalent both downstream and on the opposite shore.

The CWIS is located in highly productive tidal waters, which raises concern for the organisms that use this habitat. Tidal rivers and estuaries are among the most productive ecosystems and provide spawning and nursery habitat for many aquatic species, as well as permanent habitat for adult organisms. As stated above, GE Aviation's CWISs are located in a state-designated Area of Critical Environmental Concern (ACEC) that encompasses the Rumney Marsh, one of the most extensive and biologically significant salt marsh systems in the Greater Boston area.

The CWIS consists of three intake bays leading to a single concrete intake equalization basin that supplies non-contact cooling water to the Power Plant. Excess flows from the equalization basin are returned to the river through Outfall 020. The opening to each intake bay (approximately 7 feet wide and 7 feet tall) is submerged, oriented towards the bottom of the structure (about 12 feet below mean low water), and equipped with sliding gates that can isolate the intake bay from the river.

The Power Plant CWIS's three intake bays are each equipped with a conventional single-entry, single-exit vertical traveling screen fitted with 3/8-inch (9.5 mm) wire mesh screen panels. Fixed bar racks (with approximately 7 inches spacing between vertical bars) are attached to a curtain wall, located upstream of these traveling screens, to exclude large debris. The traveling screens are operated continuously when the associated cooling water intake pumps are in operation. Each screen section is washed with a single high-pressure spray supplied by two screen wash pumps that withdraw approximately 1,000 gpm from the equalization basin. No biocides or other chemicals are used at this CWIS. Debris and any impinged organisms washed from the screens are deposited into an enclosed, fiberglass return pipe that discharges to an underwater location in the river approximately 80 feet downstream of the pumphouse.

At each screen, a variable frequency drive[21] (VFD) pump with a design capacity of 40,000 gallons per minute (gpm) withdraws water from the Saugus River, for a total design capacity of 172.8 million gallons per day (MGD). This seawater is fed into the intake equalization basin, which in turn supplies the condenser pumps. The Power Plant is equipped with two 10-megawatt (MW) turbines and one 15-MW turbine. Six condenser cooling pumps (two per unit), each with a design flow of 6,750 gpm, withdraw non-contact cooling water from the equalization basin for a total design capacity of 58.3 MGD. Thus, the CWIS's VFD pumps are capable of withdrawing more water from the river than the condenser pumps are able to withdraw from the equalization basin, which can result in a greater volume of water being withdrawn from the river than can actually

[21] A variable frequency drive (VFD) is an electrical motor that adjusts the power supplied to the pump, thereby changing the speed at which the pump operates. This allows the pump to operate at less than its maximum capacity and more efficiently meet the water needs of the facility. If the VFD is used to reduce the volume of water being pumped from the river, it should result in a proportional reduction in impingement and entrainment.

be used for cooling. The existing permit for this facility, however, limits the volume of non-contact cooling water discharged at Outfall 018 to a maximum daily volume of 35.6 MGD and average monthly volume of 30.0 MGD. According to the permittee, the facility typically meets its cooling water demand by operating three of the six available condenser cooling pumps at a total capacity of 29.2 MGD. One of the six pumps is currently operated with a VFD. Overflow from the concrete equalization basin spills over a stop-log weir and returns to the Saugus River via a concrete channel through Outfall 020.

The permittee currently operates an auxiliary closed-loop cooling system at the Power Plant. This system consists of a once-through non-contact cooling water loop, heat exchangers, and a recirculating freshwater cooling loop. The saltwater cooling loop uses water withdrawn from the intake basin to cool the freshwater loop. The design capacity for the saltwater loop is 4,000 gpm (5.8 MGD), but operates at an annual average of 2,000 gpm (2.9 MGD). The cooling flow required by the saltwater loop is included in the permitted capacity of 35.6 MGD.

A low through-screen velocity (TSV), which describes the velocity through the openings in a screen, tends to minimize impingement by allowing adult and juvenile fish to swim away from the screens, whereas a strong TSV traps fish. EPA recommends a protective TSV of 0.5 fps based on studies cited, and analysis provided, in the preamble to the Phase I Rule. See 65 FR 49087-88 and EPA 2000b. While many species and life stages were able to swim against a TSV as high as 1.0 fps, a more conservative TSV limit of 0.5 fps protected 96 percent of tested fish. Therefore, a lower TSV would protect the largest range of species and juvenile life stages. Moreover, a lower TSV also provides a margin of safety for circumstances in which screens become occluded by debris during the operation of a facility and velocity increases through the portions of a screen that remain clear. In its Cooling Water Intake Structure Information Document submitted March 2008, GE Aviation calculated a TSV of 1.61 fps for each seawater pump at 40,000 gpm. The intake is permitted at 35.6 mgd, which is typically met by operating a single pump. Therefore, at the design capacity (40,000 gpm) the TSV at a single operating pump would be 1.61 fps. At the required intake capacity (approximately 25,000 gpm), the TSV at a single operating seawater pump would be 1 fps.

Based on review of existing technology and biological monitoring data, EPA concludes that under the current conditions the Power Plant CWIS does not minimize adverse environmental impacts due to impingement and entrainment. The existing TSV of 1 to 1.61 fps does not adequately protect juvenile and adult fish from impingement. In addition, the traveling screens do not effectively protect fish that are impinged during transport. Fish are rinsed with a high pressure spray and deposited in the same return trough as debris and both practices could cause physical injury. In addition, a once-through cooling system with 9.5-mm mesh on the existing screens is not adequate to minimize entrainment of fish eggs and larvae. Technologies to improve survival of impinged fish, as well as to minimize impingement and entrainment through either physical exclusion (e.g., screening systems) or intake flow/capacity reductions (from operational or technological measures) are potentially available BTA options.

EPA evaluated several technologies in light of site-specific factors to determine which options would to ensure that the location, design, and capacity of the Power Plant CWIS reflects the BTA for minimizing adverse environmental impacts.

b. Location of CWIS

The location of a CWIS in the waterbody is an important factor influencing its adverse environmental impacts. For example, a CWIS located in the productive littoral zone (i.e., light-penetrating) rather than deeper waters could result in greater entrainment impacts; likewise, a CWIS located in a nearshore marine environment (such as an estuary) has a higher potential for entrainment than an intake located in offshore deeper waters where eggs and larvae are not as prevalent (EPA Technical Development Document for the Phase I Rule, Chapter 5).

EPA evaluated the existing location of the Power Plant CWIS in the waterbody (e.g., proximity to a shoreline), the type of waterbody, and the depth of the intake structure to determine if it meets the requirements of BTA under CWA § 316(b). As noted above, GE is located on the tidally influenced Saugus River, which is not an ideal location for a CWIS. Estuaries, such as the tidal portion of the Saugus River, are highly productive, ecologically critical to other marine systems, and valuable to people. Estuaries maintain hydrologic balance, filter pollutants from water, and provide habitat for birds, mollusks, crustaceans, fish, and other commercially and ecologically important organisms (Millennium Ecosystem Assessment 2005). In developing national standards for § 316(b), EPA recognized that tidal rivers and estuaries are sensitive waterbodies and merit the highest levels of protection, as impacts from both impingement and entrainment are concerns. Estuaries provide foraging habitat and migratory pathways for adult organisms, thereby increasing the abundance of impingeable organisms in the waterbody, as well as spawning and nursery habitat for many species, which increases the abundance of entrainable organisms (e.g., eggs and larvae). *See e.g.*, 67 FR 17140 (April 9, 2002) (preamble to the Proposed Phase II rule).

The depth of the river near GE varies and is subject to significant tidal action. At the Power Plant CWIS and the entrance to the canal leading to the Test Cell CWIS, the river is approximately 19.5 feet deep (at mean low tide) and there is a 9.5 foot differential between the mean water level at low tide and at high tide in the vicinity of the facility. According to maps of the area (see Figures 1 and 2), the river is generally deeper along its northern side and a navigation channel is maintained for commercial fishing vessel traffic.

By drawing water from the bottom layers of the river, the Power Plant CWIS may minimize impacts on pelagic species typically found higher in the water column, such as Atlantic mackerel and Atlantic silverside. However, benthic species associated with the river bottom, such as winter flounder and grubby, may experience greater impacts from the depth of the intake opening. In fact, the majority of numerically dominant finfish impinged at GE Aviation's Power Plant CWIS were either benthic (e.g., grubby, shorthorn sculpin, windowpane, winter flounder) or demersal[22] (e.g., cunner and tautog). In this case, benthic and demersal species were among the numerically dominant species impinged between 1994 and 1996, suggesting that the submerged intake location at GE Aviation's Power Plant CWIS may disproportionately impinge species associated with the benthos. Entrainment, however, does not appear to be associated with the location of the submerged intake opening at GE Aviation, as all of the commonly entrained eggs are buoyant (e.g., cunner/tautog, Atlantic mackerel, windowpane). While some of the commonly entrained larval species are benthic or demersal (e.g., grubby and sand lance), buoyant eggs comprised more than 60% of the numerically dominant ichthyoplankton entrained in both years (MRI 1997).

An alternative CWIS location is not known to be available to GE Aviation at this time. Construction of a new intake would almost certainly result in adverse environmental impacts to sensitive habitat. The CWIS is already located in one of the deepest parts of the river, and moving its location downstream could disturb shallow, productive salt marsh habitat, as well as tidal river habitat, and might impact more species than the existing CWIS does at its current depth. Moving the CWIS into shallow salt marsh habitat might also increase entrainment, among other harms, because the tidal flats and aquatic vegetation provides habitat for spawning fish. This type of environment also might not be an adequate source of water for cooling, due to shallow conditions at low tide and the threat of screen clogging by vegetation. Finally, moving the intake miles downstream and out to deeper offshore waters is not a viable option and would cause serious adverse environmental effects in the Saugus River and the coastal environment. Indeed, it seems unlikely that any of these options would receive the many necessary regulatory approvals that would be required from state and federal agencies. In light of the above considerations, EPA has determined that moving the location of the Power Plant CWIS is not the BTA at this facility.

c. Design, Construction, and Capacity of the CWIS

In addition to its location, Section 316(b) requires that the CWIS's design, construction, and capacity reflect the BTA for minimizing impingement and entrainment. *Capacity* refers to the volume of water being withdrawn by a given CWIS, while the *design* and *construction* of the CWIS can refer to any equipment or other technologies (e.g., screening mechanisms, fish return systems) employed to minimize adverse impacts. In this case, EPA evaluated the availability of capacity reductions, either through conversion to closed cycle cooling, or through the installation and operation of variable frequency drives, as well as a variety of potential technologies (e.g., wedgewire screens, traveling screens, and aquatic filter barriers) designed to minimize impingement and entrainment.

*i. Closed-Cycle Cooling*

[22] Demersal describes species associated with the benthos, for instance, because they forage heavily on benthic invertebrates.

As noted in the CWA § 316(b) Phase I regulations, the volume of water withdrawn has a direct influence of the numbers of organisms entrained, especially with regard to pelagic (free-floating) eggs and larvae (*see* 66 FR 65273). Closed-cycle cooling using so-called "wet cooling towers" recirculates cooling water and, according to EPA estimates, can reduce cooling water intake volumes by up to 98%. As a result, closed-cycle cooling is regarded to achieve a corresponding reduction in the number of organisms entrained by the CWIS (66 FR 65273). Dry cooling towers (also referred to as air cooled condensers) do not use cooling water at all, relying instead on fans to condense steam generated by a facility's boilers. Thus, switching to dry cooling would result in a 100% reduction in cooling water use. These closed-cycle technologies are the most effective means of reducing entrainment and impingement at steam electric power plants (66 FR 65273). Reducing flow proportionally decreases entrainment by reducing the number of organisms exposed to the CWIS, whereas other technologies designed to exclude the number of organisms or deposit them away from the intake still expose eggs and larvae to CWIS infrastructure (e.g., screens) and potential injury or mortality.

As described above, the Power Plant CWIS currently operates a once-through cooling water system permitted at a maximum daily intake of 35.6 MGD to cool turbine exhaust from three sets of steam turbine condensers. Cooling water is withdrawn from the river using three large capacity pumps (equipped with manual VFDs) and deposited into the concrete intake equalization basin, from where it is pumped to cool the condensers by a set of six pumps, only one of which has a VFD. Thus, in this case, the analysis must focus on the BTA for the existing GE facility, including issues associated with retrofitting technology to the existing plant, rather than what technology might be the BTA at a new facility.

GE evaluated the feasibility of converting its once-through cooling system to a closed-cycle system by installing wet cooling towers in the February 2008 Cooling Tower Analysis Technology and Biological Assessment Information Report. GE concluded that there was insufficient space at the facility to accommodate *natural draft* wet towers, but that *mechanical draft* towers could fit on the site. According to the permittee, retrofitting with closed-cycle cooling would require the construction of 4 cooling towers cells (each 42 feet long by 42 feet wide and 30 feet high). An existing parking lot on southeast of the power plant along the Saugus River was identified as a possible site for mechanical draft cooling towers. While the proposed site has sufficient space for construction of the towers, GE stated that it is unclear if the soil will support the infrastructure. Several underground concrete bunkers, which have been properly decommissioned, were formerly located on the proposed site. As a result, the permittee states that soil conditions would need to be evaluated at the start of the design stage to determine the foundation requirements for the cooling towers and ensure that the existing soil conditions will safely support any new construction.

According to GE, retrofitting the facility with closed-cycle cooling is the most costly of the evaluated technologies and may require substantial modifications to the existing infrastructure. Based on cost estimates provided by the permittee, EPA's consultant, Abt Associates, determined that the total present value of nominal, after-tax costs as of 2010 would be $36,491,000 for this facility. This figure does not include additional costs for any plant outages. GE estimates that electrical generation would need to be temporarily shut down for as much as 1 month to complete the conversion, during which GE could purchase power. Such power purchase cost might be reduced or avoided if GE could schedule completion of any conversion during any regularly scheduled outages, such as for may take place for regular maintenance. In their evaluation, GE commented that on the significantly high costs of cooling towers, but did not conclude that this technology would be unaffordable. GE also comments that installation and operation of mechanical draft cooling towers could interfere with existing utilities, including GE high voltage power lines, control wiring, a Keyspan natural gas line, as well as steam, groundwater transport, and jet fuel lines. Again, GE provides no analysis to indicate that any of these interferences would be unavoidable, only that the existing infrastructure could pose an additional engineering challenge during construction of cooling towers. Finally, the proximity of residential structures and major transportation routes, including the Massachusetts Bay Transportation Authority commuter rail, would require careful evaluation and would likely necessitate abatement technology to minimize impacts from vapor plumes, salt drift, and noise. If needed, abatement technologies for these impacts are readily available and in use at other facilities with mechanical draft cooling towers (e.g., drift eliminators to reduce salt drift; hybrid wet/dry cooling towers to reduce vapor plumes; low-noise fans and various types of sound attenuation devices and techniques). Despite the technological and construction challenges posed by the technology, and its substantial cost, EPA concludes that mechanical draft cooling towers are available technology for use at GE Aviation. In other words, use of the technology would be economically and technologically achievable at the GE facility.

The conversion to closed-cycle would reduce required cooling water intake volume by 97%, with approximately 840 gpm withdrawn for makeup cooling water (1.2 MGD) at 2 cycles of concentration. The TSV at the existing traveling screens under the proposed makeup volume intake would be less than 0.1 fps. The low TSV would sufficiently minimize impingement of adults and juveniles, saving more than 60,000 adult and juvenile fish annually, while the reduction in intake volume would reduce entrainment by 97%, with the potential to save nearly 67 million eggs and larvae. Of the available technologies that EPA considered in this BTA determination, closed-cycle cooling is the most biologically effective technology because it will result in the greatest reduction in impingement and entrainment. An additional benefit of closed-cycle cooling would be the substantial reduction in thermal discharge from Outfall 018 that would result from using closed-cycle cooling. Outfall 018 currently discharges non-contact cooling water from the power plant. (The draft permit's thermal discharge limits are discussed in the Fact Sheet.) Discharges from the operation of cooling towers would consist primarily of boiler blowdown, which the permittee proposes would be discharged directly to the Lynn Municipal Sewer System.

*ii. Pump Modifications and Operational Measures*

Variable frequency drives (VFDs) enable the facility to reduce the volume of its water withdrawals from the Saugus River under certain circumstances. All three seawater pumps that currently supply water to the Power Plant's intake equalization basin are equipped with VFDs, which allow the facility to reduce intake flow to levels lower than the pumps' maximum design capacity. The permittee proposes also to install and operate VFDs on each of the six condenser cooling water pumps to reduce flow at the CWIS.

The facility proposes that it could reduce monthly average cooling water demands 20% from the current permit (from 35.6 MGD to 28.7 MGD) by operating both seawater pumps and condenser cooling water pumps with VFDs and reducing flow to each of the condenser units from November to March. Dividing the flow over two intake bays would reduce the through-screen velocity to 0.5 fps when operating at 35.6 MGD, and to 0.4 fps when operating at 28.7 MGD, providing adequate year-round impingement mortality control. These reductions in TSV could potentially save more than 61,000 adult and juvenile fish per year from impingement.[23] Instrumentation and controls would be installed to automate operation of the seawater pumps and reduce overflow to the intake equalization basin, which would enable the facility to coordinate the seawater and condenser cooling water pumps more closely to the Power Plants demands. EPA concludes that dividing flow between two intake bays to reduce TSV to 0.5 fps or less is an available technology for reducing impingement.

EPA evaluated the availability of VFDs to minimize both impingement and entrainment at the Power Plant CWIS. According to the permittee, the installation and operation of VFDs at all six cooling water condenser pumps would require modification of the existing condenser pump drives and the addition of a vacuum prime and maintenance system along with controls integrating stable condenser vacuum conditions. Installing VFDs for the condenser pumps is feasible, as they have been operated for several years at the seawater pumps, and one of the condenser pumps is already equipped with a VFD. The permittee has already purchased two additional VFDs for installation at the condenser pumps. The permittee estimated the capital cost for the technology to be $526,000, with no annual operation and maintenance cost. Indeed, using VFDs would be expected to reduce energy needed for the intake pump systems and, therefore, to result in a cost savings. The non-water quality impacts of using VFDs would be beneficial for the facility and would include reduced auxiliary power consumption and extended equipment life. EPA has determined that VFDs are an available technology at GE Aviation's Power Plant CWIS.

The permittee also proposes automating the operation of the seawater pumps to better correlate the supply and demand of cooling water at each set of pumps (seawater and condenser) and minimize "spillover" from the intake equalization basin. It should be

[23] EPA, in preparation of the § 316(b) Phase I Rule for New Facilities, estimated that a conservative through screen velocity of 0.5 fps would protect 96 percent of the tested fish. See 66 FR 65274 (December 18, 2001) and Draft Background and Justification for Using a Through-Screen Velocity of 0.5 Foot per Second as a Threshold Criterion Value for the Section 316(b) Rulemaking, June 2000 (DCN:1-1054-TC).

understood that presently the seawater pumps withdraw more water than the facility actually needs for cooling. Thus, the withdrawal by the seawater pumps results in entrainment and impingement, but some of this water is not actually needed for cooling and is discharged back to the river as spillover from the intake equalization basin. Based on historical monthly water demands, the permittee estimates that these operational measures would result in a 20% reduction in average monthly cooling water demands over the course of a year. However, the timing of flow reductions would be critical to realizing the full benefit of the proposed action in terms of entrainment reductions. Actual intake flow reductions realized on a monthly basis would depend on inlet water temperatures, condenser loads, facility power demands, off site power availability, and thermal discharge limits.

According to the MRI biological monitoring reports, densities of eggs and larvae in the Saugus River are lowest in fall and winter and highest in spring and summer. Therefore, flow reductions occurring mainly in fall and winter would reduce entrainment by less than flow reductions during spring and summer when eggs and larvae are abundant. In supplemental responses to EPA on May 21, 2009, and May 24, 2010, the permittee estimated that flow reductions from the use of VFDs would potentially occur from November through March. In addition, GE indicated that it could shut down some non-critical equipment on weekends in order to maintain a 20% flow reduction on an average weekly basis year-round. Use of VFDs to reduce flows during fall and winter months when entrainment potential is lower, combined with weekend shutdowns to reduce flows on an average weekly basis, may provide a year-round flow reduction of 20% compared to the current permit. Such a year-round flow reduction could reduce entrainment by 20% and potentially save as many as 13.8 million eggs and larvae annually. Other technologies evaluated in this assessment can potentially reduce entrainment more than the proposed 20% flow reduction, but VFDs and equipment shutdowns offer a relatively inexpensive method to reduce unnecessary CWIS withdrawals that would otherwise result in mortality. Furthermore, if used in conjunction with another available technology (e.g., a screening technology), an even greater entrainment reduction could be achieved than would be attained by using either technology individually. Therefore, VFDs are an available technology and could be determined to be one component of BTA for this facility.

*iii. Wedgewire Screens*

A wedgewire screen uses a "v" or wedge-shaped wire welded to a framing system to form a slotted screening element (EPRI 2007). Wedgewire screens can potentially reduce both impingement and entrainment, depending on the slot size, through both physical exclusion and hydrodynamic effects. Small slot size (0.5 – 3 mm) wedgewire screens have been used or tested at a number of facilities, including Chalk Point Station, Charles Point Recovery Facility, Oyster Creek Nuclear Generating Station, and Arbuckle Hydroelectric Station, as well as in controlled laboratory and field studies (EPRI 2007).

In part, the performance of wedgewire screens depends on the presence of sufficient ambient current to cause organisms to bypass the structure (or assist them in doing so) and to remove debris from the screen face (*See* EPA Technical Development Document for the Final Section 316(b) Phase II Rule, Feb. 12, 2004, p. A-13). A field study of 0.5 mm wedgewire screens in Narragansett Bay (an environment and aquatic community comparable to the Saugus River) demonstrated that the tidal flux at the study site provided sufficient channel velocity (greater than 0.25 fps) for operation of the screens (EPRI 2005). The mean tidal range of the Saugus River (9.5 feet) is nearly 2 times that of Narragansett Bay (4.4 feet, Spaulding and White 1990), which should provide adequate sweeping flow to maintain the performance of wedgewire screens except during slack tide (approximately 30 minutes per tidal cycle). Still, installation and operation of wedgewire screens at GE Aviation would likely require periodic operation of an airburst system to clear debris, which could be coordinated with peak tidal velocity to maximize transport of debris from the installation. The potential for biofouling would also possibly require the screens to be manually cleaned, either in place by scuba divers or by removing the screens from the water. At least one other facility in the area removes their wedgewire screens from the water annually using a rail system and jib crane to perform manual cleaning. Biofouling and other types of screen clogging are a problem because they could interfere with a facility obtaining sufficient water for cooling and could result in increased TSV, resulting in increased impingement and entrainment effects.

EPA evaluated the availability of wedgewire screens at the Power Plant CWIS. Regarding the age of the facility's existing equipment, the existing conventional screens are outdated and wedgewire screens are available and in use at other facilities, as referenced above, and would be feasible for installation at GE Aviation. The permittee estimated a capital cost of $1,513,000 and annual operation and maintenance (O&M) costs of $109,000 (net present value capital and O&M cost of $2,705,000). Wedgewire screens result in no process changes, but would change how water is withdrawn from the river. In addition, as indicated above, a compressed air system would likely be required to clear debris from the screens. Regarding the engineering feasibility of wedgewire screens, the permittee estimated that 3 screens with a slot size of 0.5 mm and diameter of 6 feet would meet the flow requirements of the Power Plant CWIS. Only 3 screens are required, and a slot size as low as 0.5 mm is viable, at GE Aviation because the facility's cooling water demand is low relative to, for example, a larger steam electric facility. Moreover, river depth in front of the Power Plant CWIS (19.5 feet) is sufficient to provide the necessary clearance of the screens without having to dredge the riverbed. Arranged side-by-side, the total screen length would be 53 feet. The permittee specified a TSV of 0.5 fps in the design of the screens, which would result in an approach velocity of only 0.09 fps with a slot size of 0.5 mm.

The deep location (19 feet) and relatively low intake volume (35.6 MGD) would enable a wedgewire screen installation at GE Aviation to be limited to 3 large diameter screens. A maximum TSV of 0.5 fps would be sufficient to minimize impingement of adult and juvenile fish at GE Aviation. Relative to the depth (19.5 feet) and width (approximately 600 feet) of the river at the proposed location, the 3 screens represent a minor structural addition to the existing CWIS. In contrast, an installation at a facility with a larger intake volume location on a shallower river would require many more screens (both due to a higher intake volume and limitations on screen diameter dictated by depth), which would be likely to present more of a structural impediment to navigation and to zones of passage for migrating or floating pelagic organisms. The policies of the Army Corps of Engineers (ACOE) do not permit structures in navigational channels or setback areas (U.S. ACOE, July 1996), and under 310 CMR 9.35(2)(a), the state further restricts impediments to navigational channels. However, based on ACOE maps of the Saugus River navigation channel, there is more than 100 feet between the channel and the intake. In fact, the distance from the intake and the shoaling area is approximately 50 feet, which is large enough to accommodate the installation with no impact to the navigational channel. Any installation designs would have to be reviewed by the ACOE, but its agency representative has maintained that it would not be opposed to structures that do not impact the channel or increase shoaling (email between E. O'Donnell and D. Gaito, 11/23/09).

EPA concludes that the site-specific conditions at GE Aviation (sufficient sweeping flow, low intake volume, limited size of installation, and adequate river depth and width at the proposed site) make wedgewire screens particularly well-suited for this facility. Based on the physical conditions and engineering considerations relevant for GE Aviation, EPA has determined that wedgewire screens are an available CWIS technology for the facility. EPA also concludes that the low TSV associated with the technology, coupled with the operation of an airburst system to maintain performance, should successfully minimize the impingement of juvenile and adult fish. EPA estimates that a TSV of 0.5 fps or less has the potential to minimize impingement mortality by 96% and could save more than 60,000 juvenile and adult fish annually at GE Aviation (see Footnote 23 on page 23 of this Fact Sheet).

EPA also considered the potential for wedgewire screens to minimize entrainment. The ability of fine mesh screens (including wedgewire screens, fine-mesh traveling screens, and aquatic filter barriers) to effectively exclude organisms from being entrained at a specific site depends on the relative sizes of the mesh and the aquatic organisms of concern. Commonly entrained organisms at GE Aviation during the MRI study (1997) included cunner/tautog eggs (approximately 0.7 to 1.14 mm in diameter), windowpane eggs (1 to 2 mm in diameter), Atlantic mackerel larvae (3.1 to 3.3 mm long at hatching), and winter flounder larvae (3 to 3.5 mm at hatching) (Bigelow and Schroeder 1953). However, a mesh size small enough to exclude the smallest egg present (in this case 0.7 mm) may not be enough because the combination of a soft bodied organism with intake velocity can result in eggs and larvae larger than the mesh size becoming entrained (EPRI 2003). Field and laboratory studies suggest that 0.5 mm mesh retained[24] significantly more eggs and larvae than 1.0 mm mesh, including species common to the Saugus River such as winter flounder, grubby, and sand lance (ESEERCO 1981, EPRI 2005, EPRI 2008). Results of the Narragansett Bay field study suggest, a 0.5 mm slot wedgewire screen effectively reduced entrainment by 83% for all larval species combined, and was

[24] Retention describes the proportion of a given type of organism that is successfully excluded by a screening system and can be measured by the number of larvae recovered in front of the screen after an experimental trial.

particularly effective in reducing entrainment of eggs (92.5% reduction), whereas a 1 mm slot size was less effective (27% reduction) (ERPI 2005). EPA concludes that these studies, combined with the size range of species common to the Saugus River, suggest that a mesh size of 0.5 mm would be necessary to minimize entrainment at GE Aviation.

The large tidal flux, low design TSV, size of eggs and larvae, and demonstrated performance of 0.5 mm-slot screens in an environment similar to the Saugus River all combine to suggest that wedgewire screens have the potential to substantially reduce entrainment at GE Aviation. However, it is important to recognize the difference between excluding eggs and larvae from being entrained and from providing for their survival. Indeed, survival is critical, but difficult, to assess when evaluating the effectiveness of a screening technology, such as wedgewire screens. To effectively reduce adverse environmental impacts associated with entrainment (i.e., mortality), eggs and larvae excluded from the intake by fine-mesh screens must also survive any impingement on those screens and be safely returned to the aquatic habitat. If egg and larval mortality by entrainment is simply replaced with mortality by impingement, the cause of the CWIS's adverse environmental impact will have been shifted from entrainment to impingement, but the adverse impact of mortality to aquatic organisms will not have been reduced.

Unfortunately, the tiny eggs and delicate larvae that are entrained through coarse mesh screens, such as are currently in use at GE Aviation, are at a high risk of being killed if they are instead impinged on a fine-mesh wedgewire screen. The egg and larval life stages are quite fragile. While the fate of eggs and larvae following any impingement on fine-mesh screens is integral to the overall performance of the technology, EPA is unaware of any studies that have evaluated the survival of eggs and larvae exposed to wedgewire screens. In laboratory tests, impingement of eggs and larvae excluded from entrainment by 0.5 mm wedgewire screens was generally low (less than 13 percent for eggs and less than 9 percent for winter flounder and rainbow smelt larvae) (EPRI 2003). However, impingement of eggs and larvae on wedgewire screens has not been studied in field settings.

The few survival studies that have been conducted have been tested with fine-mesh (0.5 mm) traveling screens (which are different from wedgewire screens). In these studies, survival is species- and stage-specific, is influenced by intake velocity, and can be poor for fragile species. In one study of a prototype screen, initial and latent survival of larvae was generally low (less than 20%) (Taft et al. 1981). High mortality was also observed in laboratory and field studies for winter flounder, alewife, bay anchovy, and common carp larvae, regardless of velocity or impingement duration (ESEERCO 1981, EPRI 2007, EPRI 2008). The limited results available suggest that, for some species, larval survival on fine mesh screens may be poor.

On the other hand, initial survival of fish eggs in the Taft et al. study (1981) was 100% for some species (e.g., weakfish, black drum, Southern Kingfish, silver perch) and 40 to 75% for other species (anchovy, herring, sardine, croaker). Hatchability and latent survival did not differ between test and control samples, suggesting that latent impacts of impingement on fish eggs may be minimal. Similarly, initial and latent survival of decapod zoea was high in both test and control samples, suggesting that mortality of crustacean larvae from fine mesh screens is low (Taft et al. 1981). The results of the limited available survival data suggest that while larvae are unlikely to survive impingement on fine mesh screens, this technology may effectively reduce entrainment mortality for eggs and crustacean larvae.

EPA estimated the potential for wedgewire screens to reduce entrainment of fish eggs and larvae, and allow for their survival, at GE Aviation based on the performance of wedgewire screens in laboratory and field studies as well as on survival studies of fine mesh screens. The eggs of species commonly entrained at GE Aviation are generally robust and, based on the information cited above, EPA estimates that impingement survival by eggs would be high. In EPRI's Narragansett Bay study with a similar biological community, approximately 92% of eggs were excluded from entrainment (EPRI 2005). At GE Aviation, EPA assumed that 92% of eggs would be excluded, and 95% of the excluded eggs would survive.[25] On the other hand, because larvae are fragile and the limited data that we have indicate that survival of larvae following contact with fine-mesh screens is low, EPA conservatively assumed that all larvae excluded from entrainment by wedgewire screens would die via contact with the screen (i.e., 0% reduction in larval mortality). Nevertheless, in this case, wedgewire screens have the potential to substantially reduce entrainment mortality even under conservative assumptions regarding survival of larvae because the ichthyoplankton composition at GE Aviation is dominated by eggs (66% of in-river and entrainment samples in both years of the Power Plant sampling study). Based on these numbers, EPA concluded that wedgewire screens could reduce entrainment mortality by nearly 59% and save as many as 40 million eggs. When used in conjunction with operational measures to reduce flows by 20% (VFDs and weekend equipment shutdowns), the added benefit for larvae could reduce entrainment mortality nearly 67% and save over 46 million eggs and larvae.

EPA concludes that the site-specific conditions at GE Aviation (sweeping flow, low intake volume, limited size of installation relative to depth and width of river) and the performance of 0.5 mm wedgewire screens in a similar biological community (Narragansett Bay) indicate that this technology could substantially reduce entrainment mortality at GE Aviation. As a result, EPA has determined that 0.5 mm slot wedgewire screens, either alone or in conjunction with flow reductions, could potentially represent the BTA for the Power Plant CWIS at GE Aviation.

*iv. Coarse Mesh Traveling Screens*

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[25] EPA assumed 95% survival of eggs based on the average of the initial survival percentage of the species with the higher egg survival rates (ranging from 75.3 – 100% survival) in the Taft et al. 1981 survival study. EPA assumed that survival of eggs with wedgewire screens would be higher than overall survival in the Taft et al. study because with wedgewire screens eggs are not exposed to a spraywash or collection trough.

The existing traveling screens at the Power Plant CWIS were installed in 1946 and primarily function to exclude debris. They are ineffective for reducing mortality from either entrainment or impingement. First, the coarse mesh size (9.5 mm) is too large to exclude eggs and larvae from being entrained. Second, the TSV exceeds EPA's recommended level under current operating regimes (permitted flow pumped through one screen with a single pump). Third, debris and organisms are deposited into a single return trough after being washed off the screens by a high pressure hose. Physical impacts from the high pressure spray and comingling with debris during transport to the river can result in injury or death. Fourth, and according to the permittee, the basket frames on the existing traveling screens do not provide a secure way to safely transport fish from the screen well to the fish return system and the metallic frames may cause injury.

EPA evaluated the feasibility of upgrading the existing coarse mesh traveling screens at the Power Plant CWIS to reduce impingement mortality. Put simply, the facility's existing conventional screens are outdated and improved technologies are available to reduce impingement mortality. One such technology is known as "Ristroph screens" (named after the designer of the equipment). Ristroph screens improve fish survival following impingement and are now commonly used at power plants nationwide (EPRI 2007). While the Power Plant's current intake screens are not equipped with non-metallic fish buckets, improved seals, or smooth texture screen material, all of these features are available on Ristroph-style screens. Moreover, a low pressure spray system would be more protective of impinged organisms and is generally considered a standard feature of Ristroph-style screens (EPRI 2007). Finally, providing separate troughs for organisms and debris removed from the intake screens would better protect the organisms in the fish return system and could be provided in conjunction with a new Ristroph screen system. In sum, installing a low-pressure spray wash, improved fish return trough, and upgrading the conventional screens consistent with Ristroph screens would likely improve the survival of impinged fish. According to GE Aviation, such upgrades could be completed at a capital cost of approximately $2,611,000, and annual operating and maintenance costs of $232,000 (net present value capital and O&M costs of $5,147,000).

Implementing coarse mesh Ristroph traveling screens would require two minor process changes. The improved screens would require more frequent maintenance than the existing screens and might require the facility to use a portion of its thermal effluent to prevent icing on the screens in the winter. There are no other significant process changes, non-water quality impacts, or feasibility issues with this technology. Based on the information provided by the permittee, EPA has determined that improvements to the existing screen and fish return, as discussed above, are available for use at GE Aviation's Power Plant CWIS to reduce impingement mortality of adult and juvenile fish.

Due to the relatively coarse mesh size, however, this screening technology, even with the improvements provided by Ristroph screens, will not reduce entrainment. The existing 9.5 mm mesh screens permit most fish eggs and larvae to enter the facility, where they likely perish. Therefore, EPA has determined that although available for implementation at GE Aviation, coarse mesh traveling screens are not BTA for this facility.

### v. *Fine-Mesh Traveling Screens*

EPA evaluated the feasibility of installing fine-mesh traveling screens – as opposed to fine-mesh wedgewire screens – at the Power Plant CWIS. Fine-mesh traveling screens, which typically include screens with mesh sizes less than 5 mm, can exclude smaller life stages from CWISs, depending on the relative sizes of the screen mesh and the organisms that are present. These screens can be installed in place of existing traveling screens or overlaid on top of existing screens. This type of screen has been implemented or studied at Big Bend Power Plant (Tampa, Florida), Somerset Station (Lake Ontario, New York), and Prairie Island Station (Mississippi River), among others (EPRI 2007).

EPA evaluated the availability of fine-mesh traveling screens for reducing impingement mortality and entrainment at the Power Plant CWIS. The existing conventional screens are outdated, as discussed above, and fine-mesh screens are an available technology that has been installed or piloted at other facilities (see above). The permittee considered three alternatives for installing fine mesh screens: 1) overlay fine-mesh screens over the existing 9.5 mm mesh screens and install Ristroph fish recovery buckets, 2) replace the existing 9.5 mm mesh with fine-mesh and install Ristroph fish recovery buckets, and 3) complete replacement of the existing 9.5 mm mesh screens with new modified "Fletcher/Ristroph" screens. Alternatives 1 and 2 could also be implemented on a seasonal basis. The permittee estimated a capital cost ranging from approximately $2.2 to $2.4 million and an annual operation and maintenance cost ranging from $269,000 to $333,000, depending on which configuration is installed. Complete replacement of the screens results in the highest capital cost, but lowest operation and maintenance costs.

The use of fine-mesh screens in any configuration would not result in any process changes or non water quality impacts. The technology would be feasible and, as referenced above, has been used at other facilities. The permittee highlighted potential screen head loss as a potential feasibility issue at GE Aviation. Head loss increases as screens become clogged with debris (a condition that may be exacerbated by finer mesh), which in combination with low tide, can cause pump vortexing and cavitation, or could result in screen failure if hydrostatic forces exceed design limits. The permittee states that if fine-mesh traveling screens were selected as BTA, a pilot study would likely be necessary to determine the rate of debris loading, associated head losses, and additional operation and maintenance requirements for this technology. The permittee did not, however, provide a reason to eliminate this technology based on these concerns.

Fine-mesh screens employ a small mesh to exclude organisms from being drawn into the CWIS. The mesh size selected may be dictated by the size of the organisms being entrained. As summarized in the discussion of wedgewire screens, the size of commonly entrained organisms at GE Aviation coupled with results from field and laboratory studies indicate that a mesh size of 0.5 mm would be necessary to minimize entrainment at the facility. As with wedgewire screens, eggs and larvae excluded from entrainment but impinged on the screens must survive and be safely returned to the aquatic habitat in order to reduce entrainment mortality. If eggs and larvae suffer impingement mortality, the cause of the CWIS's adverse environmental impact has shifted from entrainment to impingement, but mortality has not been reduced. The organisms that would be impinged on fine-mesh screens include tiny eggs and delicate larvae, which would otherwise be entrained through the existing coarse-mesh screen. These fragile life stages are at a high risk of being killed as a result of impingement. The results of limited available survival data (summarized in the discussion for wedgewire screens) suggest that while larvae are unlikely to survive impingement, fine mesh screens may effectively reduce entrainment mortality for eggs and crustaceans.

As for wedgewire screens, EPA assumed that only eggs are likely to survive impingement on fine-mesh screens. Therefore, only the entrainment mortality of eggs would be reduced by this technology. Compared to wedgewire screens, there are a few differences between the two technologies that suggest that wedgewire screens would be preferable at GE Aviation. These differences are as follows:

(1) Based on the permittee's evaluation, a 0.5 mm mesh traveling screen will result in TSVs ranging between 1 fps (with screens 100% clear) to as high as 4 fps (at 75% debris loading). Because traveling screens are used in combination with a fish return system to transport impinged organisms back to the receiving water, and because it is unlikely that eggs and small larvae can escape even a low TSV, a TSV of 0.5 fps is not required for entrainment. Nonetheless, in laboratory studies survival of impinged organisms tended to decrease as TSV increased (EPRI 2008). Moreover, because eggs and larvae are somewhat pliable, eggs and larvae that would otherwise be excluded by the small mesh size could potentially be drawn through the mesh by high TSVs, which would limit the effectiveness of this technology for reducing entrainment.

(2) With wedgewire screens, eggs and larvae never leave the receiving water even if they become impinged. Furthermore, the low TSV, low approach velocity, and additional hydrodynamic forces surrounding wedgewire screens could minimize the portion of the water column influenced by the withdrawal of water. At least one study (EPRI 2005) suggested that at a TSV of 0.5 fps, and with sufficient channel velocity, organisms more than 2 feet away from the screens would likely be swept past the structure unharmed. In contrast, any individual that enters the intake bay is likely to become impinged on a fine mesh traveling screen, where it will be exposed to the air, subject to pressurized spraywash, and transported through a fiberglass chute back to the receiving water. In the Taft et al. survival study (1981), which used a fine-mesh screen with a spraywash and collection trough, the average egg survival for all species was 75%. This could be reflective of the egg survival that could be expected at GE Aviation with a fine-mesh screen and spraywash and return system. At this lower percent survival (i.e., lower than predicted for wedgewire screens), entrainment mortality would be more than estimated for wedgewire screens (47 to 57% compared to 59 to 67%). Therefore, as compared to fine-mesh traveling screens, wedgewire screens are preferred

because they present fewer stressors for impinged eggs and larvae that could negatively impact survival.

(3) Based on the permittee's estimates, the capital cost of fine-mesh traveling screens could be $687,000 to $887,000 more than wedgewire screens. In addition, operation and maintenance costs for traveling screens are more than double that of wedgewire screens. In this case, wedgewire screens are less costly and are likely to be more effective at reducing adverse environmental impacts than fine-mesh traveling screens.

EPA has determined that while fine-mesh screens are an available technology for GE Aviation's Power Plant CWIS, and would reduce impingement and entrainment mortality, wedgewire screens would be preferred because they are likely to be more effective given that they may better prevent entrainment, present fewer stressors for impinged organisms (e.g., air exposure, spraywash), potentially impact fewer organisms, and are less costly.

*vi. Aquatic Barrier Nets/Filter Barriers*

EPA also evaluated aquatic barrier nets and filter barriers. Barrier net systems involve nets anchored in front of an intake to passively filter water and exclude organisms larger than the mesh size of the net. These systems include simple static nets, as well as more specialized filter fabric nets known as aquatic filter barriers. Both technologies seek to reduce entrainment by having a mesh size small enough to effectively exclude eggs and larvae, and reduce impingement of adult and juvenile fish with low through-screen velocities. Again, the systems' success at excluding organisms from entrainment would depend on the relative sizes of the barrier mesh and the organisms present. Aquatic filter barriers also may incorporate a compressed air system to clear debris and maintain system performance. Installations of these technologies for entrainment reduction are limited (e.g., Lovett Generating Station, Taunton River Desalination Plant, Bethleham Energy Center). However, laboratory and field results suggest that this technology could potentially be effective for reducing impingement and entrainment (ASA 2004, EPRI 2004). As with wedgewire screens, a sufficient ambient flow is required to sweep eggs, larvae, and other organisms away from the net where they could otherwise be subject to impingement, predation, and/or competition for food.

The Power Plant CWIS is located on the main navigational channel, which is likely large enough to accommodate a barrier net system. GE Aviation did not evaluate this technology, however, and provided no estimate of the appropriate size of such a system for the required intake flow. Based on information from other facilities and various studies, EPA estimated that a typical flow capacity of a fine mesh aquatic filter barrier is 10 gpm per square foot. The permitted cooling water flow for GE Aviation's Power Plant is approximately 25,000 gpm, which would require a net about 140 feet long at a depth of 18 feet. A net this size would be unlikely to impact navigation in the Saugus River, provided it did not extend more than 50 feet from the shoreline.

The low TSV (no greater than 0.5 fsp) associated with these technologies would likely be effective for reducing impingement of adults and juveniles, similar to wedgewire screens. Limited entrainment data from a full-scale deployment of an aquatic filter barrier at Lovett Generating Station on the Hudson River between 2004 and 2007 suggest that exclusion of eggs and larvae with 0.5 mm mesh is similar to that of wedgewire screens (average exclusion of all species was 79% and maximum exclusion was 95% in 2007) (ASA 2007). In one study of egg hatchability on G-weave fabric, survival of impinged river herring eggs was high (80-100%) and was not generally different from survival of the control group, suggesting that impingement had little impact on hatchability of river herring eggs under laboratory conditions (Alden 2007). These studies suggest that exclusion and survival of eggs and larvae with a 0.5 mm mesh aquatic filter barrier may be similar to that achieved by wedgewire screens. To EPA's knowledge, there is no available data on the survival of larvae, and EPA conservatively assumed that larval survival would be similar to that seen with the other screening technologies described above. In this case, entrainment mortality of eggs may be substantially reduced (nearly 59 to 67%) and as many as 40 to 46 million eggs could be saved annually.

One of the primary drawbacks of barrier net technologies is their susceptibility to debris loading. In addition to siltation and algal growth, one study demonstrated that the performance of an aquatic filter barrier was negatively affected by colonization by tubeworms, mussels, and other aquatic organisms (Henderson et al. 2001). Biofouling complicated initial deployment of an aquatic filter barrier at Lovett Station in 1993 and 1994. In 1993, the net became clogged with fine suspended sediment, which caused it to sink (LMS 1994). In situ cleaning with a high pressure spray reduced clogging. In 1994 algal buildup on the net caused two of the support piles to snap. In this case, the net had to be removed from the water and cleaned with a high pressure spray (LMS 1996). However, according to one report, the facility was able to resolve the clogging and biofouling issues and ultimately successfully deployed an aquatic filter barrier that effectively reduced entrainment and impingement by 2004 (ASA 2004).

Based on present information, EPA concludes that an aquatic filter barrier would likely reduce impingement and entrainment mortality to a level equivalent to, but not more than, wedgewire screens (i.e., 96% for impingement and 59 to 67% for entrainment). Installing and operating an aquatic filter barrier at GE Aviation could, however, require more operation and maintenance effort and expense than wedgewire screens, based on the performance and difficulties of operating an aquatic filter barrier at Lovett Station. EPA did not evaluate the cost of an aquatic filter barrier for GE Aviation because the permittee did not provide an estimate. Estimates from the Technical Development Document for the 2004 Phase II Rule indicate that an aquatic filter barrier rated for a flow of 10,000 gpm (less than half of the required flow for the Power Plant) had an average capital cost of $762,000 and average annual operation and maintenance cost of $218,000 (in 1999 dollars). Based on these costs, the expense of an aquatic filter barrier for the Power Plant would likely be similar to that of a wedgewire screen system (though the operations and maintenance costs could be higher for the aquatic filter barriers). Based on a preliminary analysis of the estimated size and effectiveness of an aquatic filter barrier at

GE Aviation, EPA concludes that this technology is available for reducing entrainment and impingement at GE Aviation's Power Plant CWIS. However, in this case, as between aquatic filter barriers and 0.5-mm slot wedgewire screens, EPA prefers the latter technology for consideration as the potential BTA for GE Aviation because aquatic filter barriers are not likely to reduce entrainment mortality more, and may reduce it less, than wedgewire screens, which have been studied in more detail and in tidal rivers similar to the Saugus River. Moreover, GE Aviation neither proposed nor evaluated the use of this technology and there is not enough site-specific information to draw clear conclusions about the application of this technology at the facility.

d. Benefits of Implementing BTA to Reduce Entrainment and Impingement

Reducing impingement and entrainment by GE Aviation's CWIS's will directly increase the number of commercial, recreational, and forage fish (eggs, larvae, juveniles and adults), as well as other types of aquatic organisms found in the river (e.g., invertebrates). The more that entrainment is reduced, the more likely it is that those reductions will contribute to increased populations of juvenile and adult fish. But reducing the loss of eggs and larvae is valuable in and of itself because of the role they play at the base of the food web and other benefits that they provide, such as contributing to species' compensatory reserve. Reducing impingement directly contributes to increased abundance of adult fish.

Beyond these direct benefits to aquatic life, reducing entrainment and impingement will also likely result in additional indirect benefits to the ecosystem and the public's use and enjoyment of it. Examples of such indirect benefits include increasing recreational and educational opportunities, increasing or maintaining biological diversity, and increasing populations of resident and migratory birds and other terrestrial wildlife dependent on the estuary for food.

The predominant benefits to be obtained in this case include non-market (e.g. recreational opportunities), indirect (e.g., ecosystem services), and non-use benefits (e.g., "existence values," "bequest values"). EPA has not endeavored to produce a monetized estimate of these benefits – such as by undertaking a stated preference study to estimate non-use benefits – because EPA decided that doing so would be prohibitively difficult, time-consuming and expensive for this permit. In addition, EPA concludes that the available information is adequate for assessing and comparing the alternative technologies. At the same time, EPA recognizes the importance of considering benefits that have not been quantified, but are potentially significant, and also recognizes that where relevant benefits have not been quantified, it is appropriate to consider them qualitatively. *See, e.g., EPA Guidelines for Preparing Economic Analyses* (EPA 2000a). Just as EPA considers the cost of technological options, it is important that the Agency also assess the benefits of these options in as complete a way as possible.

Therefore, in this case, EPA has qualitatively considered the value of the Saugus River ecosystem and the organisms that occupy it and the benefits that may result from the implementation of the various potential BTA technologies at GE Aviation's CWIS's. As explained above, EPA also has considered these benefits in light of their contribution to the "attainment of the objectives of the Act and § 316(b)." *Central Hudson, supra.* Again, the relevant "objectives of the Act and § 316(b)" include the minimization of adverse environmental impacts from cooling water intake structures, restoring and maintaining the physical and biological integrity of the Nation's waters, and achieving, wherever attainable, water quality providing for the protection and propagation of fish, shellfish and wildlife, and providing for recreation, in and on the water. 33 U.S.C. §§ 1251(a)(1) and (2), 1326(b).

Minimizing impingement and entrainment at the Power Plant CWIS would have many ecological benefits for the Saugus River ecosystem. Several commercially and recreationally important species are among the species commonly impinged or entrained, including winter flounder, windowpane flounder, Atlantic mackerel, and Atlantic herring. As stated in the discussion of entrainment impacts, fishery management plans are in place for many of these species which restrict fishing for them in order to help rebuild stocks. With fishermen facing tight controls on the beneficial harvest of, for example, adult groundfish, it would be anomalous to allow manufacturing facilities such as GE Aviation to systematically kill millions of groundfish eggs and larvae each year in the process of withdrawing cooling water from public waterways because their CWISs have not been adequately controlled by the use of available technology. Increases in forage fish and invertebrate populations (e.g., cunner, tautog, and grubby) may also benefit commercially and recreationally important fish species, as well as resident and migratory birds and other terrestrial wildlife (including State-listed threatened and endangered species), by increasing prey abundance. Anadromous species that would benefit from changes to GE's CWISs include American eel, rainbow smelt, and river herring. Both rainbow smelt and river herring have experienced declining populations in recent years, and minimizing adverse impacts to these populations is fundamental to their recovery. In fact, both rainbow smelt and river herring are listed as Species of Concern by the National Oceanographic and Atmospheric Administration (NOAA), and the Massachusetts Division of Marine Fisheries (MassDMF) provides further protection for river herring through a moratorium on the harvest, possession, and sale of river herring extended through 2011.

In addition to these direct and indirect benefits of increasing fish populations for the Saugus River ecosystem, fish populations generate a multitude of ecosystem services. Many of these ecosystem services have no direct market value and occur at regional spatial scales over the long term, making them difficult to monetize or even quantify. However, the potential benefits of increasing fish populations in terms of their functional role in natural ecosystems cannot be overlooked, and, at a minimum, these ecosystem services should be considered qualitatively.

Thus, in addition to food production, fish populations can control the growth of algae and macrophytes, supply recreational opportunities, regulate food web dynamics, recycle nutrients, serve as active and passive links between ecosystems, and maintain species and genetic biodiversity (Holmlund and Hammer 1999). Biodiversity has recently emerged as a critical measure of ecosystem resilience. Systems with high biodiversity tend to be more stable and have enhanced primary and secondary productivity, as well as lower rates of collapse of commercially important fish and invertebrate taxa over time (Worm et al. 2006). Low phenotypic diversity (i.e., the physical expression of a fish genotype), which can be a result of loss of a percentage of the population (such as through mortality associated with a CWIS), can decrease equilibrium catch and effort levels used by regulatory agencies to set quotas for commercial fishing stocks (e.g., through fishery management plans). Overestimating the maximum sustainable yield based on a conventional growth model in populations with low levels of phenotypic variance may lead to overharvesting and potentially collapse the stock (Akpalu 2009).

Clearly, the Saugus River is a productive ecosystem that provides resident and transitory populations of finfish, invertebrates, birds, and terrestrial animals; critical feeding areas for migratory birds; and spawning, nursery, and forage habitat for commercially and ecologically important species. It is also an ecosystem of public importance. Its critical functions have prompted a number of special designations recognizing the importance of the Saugus River. In 1988, Massachusetts designated the tidal area encompassing the facility and its three CWISs, known as Rumney Marsh, an Area of Critical Environmental Concern (ACEC). The boundary of this ACEC is the limit of the 100-year flood on the Lynn side of the Saugus River and includes GE's pumphouse. Rumney Marsh is one of the most extensive and biologically significant salt marsh systems in the Greater Boston area. The ACEC provides habitat for a diverse assemblage of birds and marine life, including migratory birds and at least five state-listed threatened and endangered species or species of concern. In addition to providing biological habitat, the salt marsh is significant to flood control, prevention of storm damage, pollution prevention, the protection of public and private water supplies, and public interests defined in the Wetlands Protection Act (see MGL c.131, s.40 and 310 CMR 10.00). As a result of this designation, the Massachusetts Department of Conservation and Recreation has acquired approximately 38% of the land in the ACEC boundary. In addition, MassDEP has designated the Saugus River an Outstanding Resource Water, defined as a waterbody having outstanding socio-economic, recreational, ecological, and/or aesthetic values under 314 C.M.R. 4.04(3). Finally, the Saugus River is also part of the Massachusetts Bays national estuary under the National Estuary Program, whose goal is to improve quality of estuaries of national importance.

In addition to special classifications representative of the significance of the estuary, Massachusetts has recognized the value of the Saugus River through the commitment of financial resources. For example, the state has earmarked $13.85 million for Saugus River watershed projects, including $4.25 million specifically for environmental stewardship, wetlands restoration, and open space initiatives for the Saugus River as part of the Energy and Environmental Bond Bill (signed August 14, 2008). The MA Coastal Zone Management's Wetlands Restoration Program has identified 16 potential salt marsh restoration sites (120 acres) along the Saugus River including five priority sites, and has completed 14 salt marsh restoration projects totaling 140 acres. In 2008, several priority projects were located in the ACEC, including one at Ballard Street not far upstream from GE Aviation. Recently, the city of Lynn has spent $35 million to $40 million to upgrade its municipal sewer and stormwater systems to improve water quality in the Saugus

River. Finally, programs such as annual water quality and fish monitoring programs carried out by a volunteer force and organized by the Saugus River Watershed Council show the community's dedication to preserving and restoring the Saugus River.

In summary, achieving substantial reductions in impingement and entrainment by GE Aviation's CWISs will increase the number of commercial, recreational, and forage fish (eggs, larvae, juveniles and adults) as well as invertebrate species in the Saugus River. These improvements are also likely to contribute to increased populations of adult fish. In turn, reducing adverse impacts from impingement and entrainment could provide a number of direct, indirect, and non-use benefits both within the Saugus River and at a regional scale. Benefits may include, for example, preservation of habitat for migratory birds and other terrestrial animals dependent on the salt marsh, enhanced recreational opportunities, including birdwatching, fishing, and kayaking, and preservation of Rumney Marsh, an outstanding resource water and ACEC with intrinsic biological value particularly worthy of protection, as indicated by the state's ACEC designation. While EPA has not developed a monetized estimate of these benefits, the value to the public of the Saugus River ecosystem and its natural resources is evident from the federal, state and public commitment of limited financial resources and effort to protect these natural resources and the multiple special designations given these resources to promote their protection. Moreover, substantially reducing entrainment and impingement will contribute to "attainment of the objectives of the Act and § 316(b)," including (a) minimizing adverse environmental impacts from cooling water intake structures, (b) restoring and maintaining the physical and biological integrity of the Nation's waters, (c) achieving, wherever attainable, water quality providing for the protection and propagation of fish, shellfish and wildlife, and (d) providing for recreation, in and on the water.

e. Determination of BTA for the Power Plant CWIS

In the text above, EPA has, among other things, evaluated technological options for reducing entrainment and impingement by the GE Aviation Power Plant CWIS and evaluated the benefits of achieving such reductions. Here EPA considers the technologies, including their cost and capacity to reduce mortality from entrainment and impingement, and the environmental benefits they offer in order to determine the BTA for this CWIS.

To begin with, EPA concludes that the current location, design, construction, and capacity the Power Plant's CWIS do not reflect the BTA for minimizing adverse environmental impacts. This conclusion is based on the Agency's evaluation of existing technology at the Power Plant CWIS, current levels of entrainment and impingement (from MRI 1997), and the estimated degree to which other available technologies would be capable of reducing mortality to aquatic organisms from entrainment and impingement.

In determining the BTA for the Power Plant CWIS, four available technology options stood out for consideration: (1) the VFD plan proposed by GE; (2) fine-mesh wedgewire screens;[26] (3) a combination of the VFD plan and fine-mesh wedgewire screens; or (4) converting to closed-cycle cooling using wet mechanical draft cooling towers. While all of these options are capable of achieving a 96% (or more) reduction in impingement, their estimated costs and capacity to reduce entrainment varied significantly.

The VFD plan was estimated to achieve a 20% reduction in entrainment (by reducing intake flow by a like amount) at a total capital cost of $526,000, with no annual operations and maintenance cost, for an annualized cost of approximately $41,000. The fine-mesh wedgewire screen option was estimated to be capable of reducing entrainment (and the mortality of organisms that would have been entrained in the absence of the screens) by approximately 59%, at an estimated capital cost of $1,513,000 and annual operation and maintenance costs of $109,000, for an estimated annualized cost of approximately $205,000. When combined with the VFDs, EPA estimates that the combination of technologies could at this particular facility achieve a 67% reduction in mortality at an estimated annualized cost of approximately $246,000. Finally, closed-cycle cooling was estimated to be capable of reducing entrainment by 97% at an estimated annualized cost of approximately $3,000,000, based on a total present value of nominal, after-tax costs of $36,491,000 as of 2010.

EPA has discussed the benefits of reducing entrainment and impingement above. EPA also concludes that the greater the reduction in these adverse impacts, the greater the benefits that will be achieved. That said, the Agency does not have any data in this case to indicate that there is a threshold for impact reduction below which ecological gains will be forfeited, or above which there would be no difference. On one hand, the Power Plant CWIS withdraws less than 3% of the total volume of the Saugus River over a single tidal excursion (ebb and flow). On the other hand, EPA estimated that at the permitted intake flow more than 64,000 juvenile and adults are impinged and 69 million eggs and larvae are entrained annually. EPA concludes that this represents a high level of unnecessary mortality in a productive estuary of public importance that is subject to cumulative stresses from, among other sources, municipal stormwater runoff, industrial discharges, and flow alterations.

EPA concludes that the VFD option would achieve some benefit of significance at very little cost, but rejects it as the possible BTA because other options could perform substantially better at only a relatively small cost increase. Specifically, the option of combining wedgewire screens with the VFD plan could achieve a substantially greater reduction in entrainment (approximately 67%) at a reasonable cost that is only slightly greater than the costs of VFDs alone. In other words, EPA concludes that the costs of

[26] While EPA found that fine-mesh traveling screens were an available technology, the Agency rejected them because they were not likely to perform quite as well as wedgewire screens and would be more expensive. Similarly, EPA rejected aquatic filter barriers, although an available technology, because the permittee did not provide site-specific information for this technology and because EPA estimated that it would perform either less well or, at best, equal to wedgewire screens. In contrast, EPA could make a more site-specific, detailed determination for wedgewire screens based in part on information provided by the permittee.

this option are warranted by the benefits to be achieved.[27] The closed-cycle cooling option will achieve an approximately 30% greater reduction in entrainment (approximately 97%), but at an annualized cost that is 12 times and an order of magnitude greater than the wedgewire screen-and-VFD option (approximate annualized costs of $3,000,000 vs. $246,000). Whether or not this type of cost difference would be warranted by the additional quantitative and qualitative ecological benefits will depend on the facts of the case at hand, but in this case, based on current information, EPA does not think the additional costs are warranted.[28] As a result, EPA has determined that the fine-mesh wedgewire screen-and-VFD plan constitutes the BTA for minimizing adverse environmental impact for the GE Aviation Power Plant's CWIS. The draft permit also authorizes GE to convert to closed-cycle cooling instead of wedgewire screens, as doing so would reduce adverse environmental impacts sufficiently to satisfy CWA § 316(b).

### *4.3. Test Cell CWIS*

a. Existing Conditions

The Test Cell CWIS is located at the end of a 90-foot long intake canal perpendicular to the northern shore of the Saugus River, just upstream of the Power Plant CWIS (*see* Figure 1, March 2008 Cooling Water Intake Structure Information Document). As noted above in the discussion of the Power Plant CWIS, the northern portions of the river are generally deeper and do not contain salt marshes. The intake canal is approximately 28 feet wide and generally shallow with an even invert grade to the river. The depth of the canal is not maintained with dredging and siltation is an ongoing problem. During low tide, the shallow depth precludes the operation of the Test Cell CWIS.

The Test Cell CWIS is equipped with two primary pumps that provide once-through cooling water for a test turbine. A single, continuously rotating, dual-flow conventional traveling screen is located at the end of the intake canal. The seawater pumps each have a design capacity of approximately 38.2 MGD (26,500 gpm). An additional 1,500 gpm pump supplies a high pressure spray wash system that clears debris from the traveling screen, resulting in a total design capacity of 78.5 MGD at the Test Cell CWIS.

The Test Cell CWIS supplies cooling water for the aircraft engine testing that occurs intermittently throughout the year. The current permit limits the maximum daily flow of this CWIS to 45 MGD and average monthly flow to 27 MGD. However, the Test Cell typically operates with a single pump, limiting the maximum daily capacity to 40.3

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[27] In other words, EPA thinks that the estimated costs are reasonable in light of the benefits. Put differently, the Agency concludes that this option does not produce an extreme disparity in costs and benefits. More specifically, EPA thinks these costs are neither wholly disproportionate to, nor significantly greater than, the benefits to be achieved.

[28] Put differently, EPA does not think the increased costs would be reasonable in light of the margin of increased benefits that would be involved. In this case, we think such additional costs would be wholly disproportionate to and, therefore by definition, significantly greater than the additional benefits.

MGD. Additionally, average monthly flows are much lower than the current permit limit of 27 MGD because engine testing is infrequent and when it does occur, it is typically limited to a few days at a time. As a result of its intermittent operation, the Test Cell CWIS withdraws much less water annually than does the Power Plant CWIS (which operates year-round). According to the permittee, the Test Cell CWIS operated an average of 300 hours per year between September 2000 and January 2005. A review of DMRs from 1999 through 2008 indicates that average monthly flows ranged from 0 to 9.3 MGD. The average of these average monthly flows is 1.5 MGD, which accounts for less than 5% of the total annual plant flow.

According to the permittee, capacity utilization was 8% from 1996 to 1998, and ranged from 4.9% to 6.6% in 1998, 2001, 2002, 2006, and 2007. In 2008, GE Aviation installed and began operation of an auxiliary closed-loop recirculating cooling tower system to provide approximately 1,500 gpm of auxiliary cooling water. GE uses municipal water to provide water used for this cooling system. Because the auxiliary cooling water was previously diverted from the seawater pump associated with spraywash, the new auxiliary system decreases the overall cooling water demand at the Test Cell CWIS. According to the permittee, the new closed-loop system will result in a 5% capacity utilization rate for the Test Cell CWIS.

There is no entrainment data specific to this CWIS. According to the permittee, aircraft testing is most commonly scheduled during the months of September through November when entrainment potential is relatively lower. A review of entrainment data from the Power Plant CWIS biological monitoring study confirms that 97% of eggs and larvae entrained at the facility from 1994 through 1996 were captured between March and July. Eggs were prevalent from May through July, while larvae were most common between March and April with another peak in June. In late winter/early spring, grubby and sand lance larvae dominated the sample, while the June peak was dominated by Atlantic silverside, stage 3 winter flounder, Atlantic mackerel, and stage 2 and stage 3 cunner larvae. If the capacity of the Test Cell CWIS is limited between the months of March and July, the biological monitoring to date suggests that the potential for entrainment would be substantially reduced.

EPA evaluated DMRs from the Test Cell from 1999 through 2008 to determine if the capacity of the Test Cell CWIS is limited during the period of peak entrainment. Average monthly flows between March and July ranged from 0 to 9.3 MGD during this period, with an average of 1.7 MGD. Maximum daily flows could be as high as 40 MGD, but engine testing is typically limited in duration (e.g., during half of the test dates from March through July, testing appears to have occurred on only one day of the month). Still, the highest recorded average monthly flow (9.3 MGD) occurred during the peak entrainment period in April 2008. EPA's review of biological monitoring data and DMRs from the Test Cell suggest that the capacity of the CWIS could be limited sufficiently to reduce the potential for entrainment, but the Draft Permit would require seasonal flow limits to ensure that prolonged testing does not occur during entrainment season. Still, Draft Permit limits restricting average monthly flow at the Test Cell CWIS from March through July (peak entrainment period) are an available method of reducing the potential for entrainment while continuing to allow testing to be conducted commensurate with the permittee's characterization of Test Cell operations.

The permittee also evaluated the availability of additional entrainment technologies such as fine-mesh (0.5 mm) Ristroph traveling screens, fine-mesh wedgewire screens both inside and outside the canal, and closed-cycle cooling. At least one of these technologies is technically available (fine-mesh wedgewire screens outside the canal based on the same methodology as the Power Plant CWIS), but the minimum cost is $2 million. At this time, considering the lack of data and limited operation of the Test Cell CWIS, the limited potential benefits at this CWIS do not warrant the substantial cost of entrainment technologies such as fine-mesh wedgewire screens. Limiting flow into a CWIS is the most effective method to reduce entrainment, and the historic operation of this CWIS indicates that more stringent average monthly flow limits from March through July would reduce the potential for entrainment at the CWIS while still allowing some engine testing during this time.

b. Location

An alternative CWIS location on the site is not available to GE Aviation at this time. Moreover, EPA concludes that constructing a new intake would not represent the BTA for this CWIS for essentially the same reasons that the Agency rejected this option for the Power Plant CWIS. Constructing a new intake would result in adverse environmental impacts to sensitive habitat. The CWIS is already located in one of the deepest parts of the river, and moving its location downstream would disturb shallow, productive salt marsh habitat and might impact more species than the existing CWIS does at its current depth. Moving the CWIS into shallow salt marsh habitat might result in increased entrainment because the tidal flats and aquatic vegetation provide habitat for spawning fish. In light of these issues, it also uncertain at best that a proposal to construct a new CWIS would receive the necessary regulatory approvals. Thus, EPA has determined that moving the Test Cell CWIS is not the BTA at this facility.

c. Impingement Technologies

The Test Cell CWIS intake canal has a series of bar skimmers to exclude floating debris. At the end of the canal, a single dual entry-single exit traveling screen equipped with 9.5 mm (3/8-inch) mesh is oriented perpendicular to the flow from the pumps. The 9.5 mm coarse mesh screen is rotated continuously when the intake is in operation. A high-pressure (80-120 psi) spraywash system supplied by a single 1,500 gpm pump cleans the screens. No biocides or other chemicals are used at the CWIS. Any debris and organisms from the screens are deposited into a narrow (6-inch wide by 6-inch high) wooden debris return trough which exits from the north side of the traveling screen and discharges at the riprap-lined shoreline approximately 2 feet upstream of the intake canal. The discharge point at low tide is above the water line, and the wooden trough is in poor condition in some places. Both factors increase the risk of fish injury or mortality.

No impingement monitoring has been conducted at this CWIS. Inferences regarding the rate of impingement at this CWIS may be made, however, based on impingement data collected at the Power Plant CWIS. Impingement occurs year-round at the Power Plant CWIS, occasionally in very high numbers (e.g., October 1996). It is likely that the Test Cell CWIS also has the potential to impinge fish and invertebrates during its operation. Moreover, because this CWIS is not operated on a regular basis, aquatic organisms may take up residence in the intake canal during downtime. Any organism residing in the intake canal would be subject to impingement when the CWIS begins operating.

According to the permittee, the facility currently operates a single seawater pump and the spray wash pump, for a total operating capacity of 40.3 MGD. As discussed above, a low TSV tends to minimize impingement because it allows adult and juvenile fish to swim away from the screens, whereas a strong TSV tends to trap fish. EPA generally accepts a TSV no greater than 0.5 fps as protective for most fish. In its Cooling Water Intake Structure Information Document submitted March 2008, GE Aviation calculated the through-screen velocity at the Test Cell CWIS based on this operational capacity at 0.85 fps. A TSV higher than the protective level of 0.5 fps might be acceptable if coupled with a fish return system well designed to safely transport fish back to the receiving water. The fish return system presently in place at the Test Cell CWIS does not, however, meet this standard.

Like the technologies in use at the Power Plant CWIS, the intake screens at the Test Cell CWIS, installed in 1947, are primarily designed to exclude debris and are ineffective for reducing impingement mortality. EPA's assessment of the Power Plant intake screens is also applicable to the Test Cell intake due to similar design features (e.g., 9.5 mm mesh, intake through-screen velocity greater than 0.5 fps, debris and organisms comingled in a single fish/debris return trough). In addition, the poor condition of the Test Cell CWIS fish/debris return trough subjects organisms to additional hazards from rough edges or other irregularities, and then deposits organisms directly onto the rip rap above the tide line at low tides. Furthermore, the return location is only 2 feet upstream from the mouth of the intake canal, which is a poor location due to the potential for re-impingement. EPA concludes that the existing technology at the Test Cell CWIS is not the BTA to minimize the adverse impacts from impingement.

*i. Coarse-Mesh Traveling Screens*

To date, impingement at the Test Cell CWIS has not been studied. However, given the poor condition of the Test Cell's fish return system and because it discharges above the water level at low tide, survival from impingement at this CWIS is unlikely to be as high as the initial impingement survival observed in the 1994-1996 studies at the Power Plant CWIS. A redesigned fish return system, proposed by the permittee, would return organisms to the river a suitable distance away from the CWIS to prevent re-impingement, replace the single high-pressure spray wash system with a low pressure spray to more gently wash organisms into the fish return system, and improve the fish return and support structure design. According to the permittee, replacing the fish return system (including a low pressure spraywash) would cost approximately $105,000. Because the TSV of the CWIS at the permitted intake is greater than 0.5 fps, it is imperative that the fish return system be designed to safely transport adult and juvenile fish to the receiving water in a manner that maximizes their survival. Upgrading the existing fish return system would not require any process changes, and this upgrade would have no feasibility issues or non-water quality impacts.

According to the permittee, the basket frames on the existing traveling screens do not provide a secure way to safely transport fish from the screen well to the fish return system and the metallic frames may cause injury such as descaling. Fiberglass fish buckets are available on Ristroph-style screens and have been successfully used at other facilities and in laboratory studies to improve survival of juvenile and adult fish (EPRI 2007). According to the permittee, replacing the metallic frames with fiberglass fish buckets would cost about $75,000. Upgrading the fish buckets is not likely to require any process changes, and would have no feasibility issues or non-water quality impacts. In combination, fiberglass fish buckets and a new fish return system would likely increase survival of impinged organisms compared to the existing screens at relatively minimal cost to the permittee (approximately $180,000).

Alternatively, the permittee also evaluated the feasibility of replacing the existing coarse-mesh traveling screens at the Test Cell CWIS with new Ristroph-style screens. The upgrade would include installing non-metallic fish buckets, improved seals, and smooth-textured screen material consistent with Ristroph screens to improve the survival of impinged fish by reducing stress and physical injury. The capital cost of replacing the existing screens in this manner would be approximately $1,743,000, with an additional $124,000 for annual operation and maintenance costs. According to the permittee, these improvements would require more frequent maintenance than the existing screens, and might require the facility to recirculate a portion of thermal effluent in winter to prevent icing on the screens. There are no other process changes, non-water quality impacts, or feasibility issues with replacing the existing screens.

Based on the information provided by the permittee, EPA has determined that all of the improvements to the existing traveling screen discussed above are available technologies for reducing impingement mortality at GE Aviation's Test Cell CWIS. In order to reduce impingement at the Test Cell CWIS, the permittee would have to reduce the through-screen velocity to less than 0.85 fps. According to the permittee, at the current capacity (40.3 MGD) and using traveling screens, the TSV cannot be lowered without increasing the size of the CWIS to accommodate an additional screen. Additionally, upgrading the existing screens consistent with Ristroph traveling screens would likely reduce impingement mortality substantially. At this time, EPA does not believe that adding an additional traveling screen to reduce the TSV would be preferred because the cost would be substantially more than any of the improvements already discussed in this section, without additional benefit.

*ii. Coarse-mesh Wedgewire Screens*

As described above in the discussion of wedgewire screens for the Power Plant CWIS, this technology can potentially reduce both impingement and entrainment, depending on the slot size used, through physical exclusion and hydrodynamics and by using the flushing action of currents present in the source waterbody. Wedgewire screens maintain a low TSV, although a sufficient ambient current must be present in the source waterbody to aid organisms in moving by the structure and to remove debris from the screen face (See EPA Technical Development Document for the Final Section 316(b) Phase II Rule, Feb. 12, 2004, p. A-13).

The permittee evaluated the feasibility of coarse-mesh cylindrical and flat plate screens with a design TSV of 0.5 fps positioned in the intake canal. Designed for mean low water (typical for this technology), the diameter of a cylindrical wedgewire screen would be limited to 3 feet due to the shallow depth of the canal. At this diameter and a slot size of 1.75 mm, 16 cylindrical screens would be required with a total length of 95 feet. An array of cylindrical screens this large would not be feasible in the 90-foot long canal. According to the permittee, a 1.75 mm-slot flat plate screen could be installed in the canal in front of the existing traveling screen at a certain horizontal to vertical ratio and an invert elevation of -9.5 feet, which would require dredging within the canal. Additional, frequent dredging might also be required to maintain the required depth for both screen designs in the intake canal.

In addition, siltation could result in heavy clogging, which might interfere with performance of the screens. While wedgewire screens can be equipped with an airburst mechanism that discharges a pulse of compressed air through the screen to clear any accumulated debris, the flow in the intake canal for the Test Cell CWIS is predominantly influenced by the pumps and is unlikely to provide a sweeping current sufficient to clear the screens of debris following an "airburst" cleaning. Such clearing of debris is necessary to maintain screen performance. Given the space limitations and lack of sweeping flow in the intake canal, EPA has determined that 1.75 mm-slot cylindrical and flat plate wedgewire screens are not available at this location to reduce impingement at the Test Cell CWIS.

According to the permittee, both the coarse-mesh flat plate and cylindrical screen configurations could be located at or outside the entrance to the intake canal, where the river provides sufficient ambient flow to clear debris and organisms from the screen face, except at slack tide. The river is large enough with sufficient depth to accommodate the required number of cylindrical screens for the Test Cell CWIS (three 4-foot diameter screens) or flat plate screen area (287 square feet). EPA considered whether the installation of both coarse-mesh flat plate and cylindrical screens in the Saugus River could potentially impact navigation, resulting in an adverse non-water quality impact. The policies of the Army Corps of Engineers, the agency that maintains the navigation channel, do not permit structures in navigational channels or setback areas (U.S. ACOE, July 1996), and under 310 CMR 9.35(2)(a), the state further restricts impediments to navigational channels. However, based on ACOE maps of the navigation channel, there is more than 100 feet between the channel and the intake. In fact, the distance from the intake and the shoaling area is approximately 50 feet, which is large enough to accommodate the installation with no impact to the navigational channel. Any installation designs would have to be reviewed by the ACOE, but the agency has maintained that they would not be opposed to structures that do not impact the channel or increase shoaling (email between E. O'Donnell and D. Gaito, 11/23/09).

The existing conventional screens at the Test Cell CWIS are outdated and coarse-mesh wedgewire screens are an available technology (in use at other facilities) that would reduce mortality to aquatic organisms from impingement. GE Aviation estimated the cost of a 1.75 mm-slot flat plate wedgewire screening system at $582,000 (capital) plus $72,000 (annual operation and maintenance), and a 1.75 mm-slot cylindrical wedgewire screening system at $613,000 (capital) plus $72,000 (annual operation and maintenance). Both the coarse-mesh flat plate and cylindrical wedgewire screens would reduce impingement with a design TSV equal to 0.5 fps and, if selected as the BTA, would not require replacement of the existing coarse mesh traveling screens.

EPA has determined that either 1.75 mm-slot flat plate or cylindrical wedgewire screens outside the intake canal are available technologies for substantially reducing impingement from the Test Cell CWIS as compared to the existing traveling screen.

d. Determination of BTA for the Test Cell CWIS

In the text above, EPA has, among other things, evaluated technological options for reducing entrainment and impingement by the GE Aviation Test Cell CWIS. In Section 4.2.d of this Fact Sheet, EPA evaluates the benefits of achieving reductions in impingement for the Power Plant CWIS, which also apply to the Test Cell CWIS. Here, EPA considers the technologies, including their cost and capacity to reduce adverse impacts from the CWIS, and the environmental benefits they offer in order to determine the BTA.

EPA first evaluated existing operations at the facility. GE Aviation has not conducted entrainment monitoring at the Test Cell CWIS. However, compared to the Power Plant CWIS, the Test Cell CWIS likely entrains fewer organisms due to its intermittent operation and lower total volume of withdrawals on a monthly basis. Under the existing operations at the Test Cell, the average monthly flow is 1.5 MGD, which is substantially less than the average monthly flow of 27 MGD at the Power Plant CWIS. Moreover, rather than pumping at a continuous rate year-round like the Power Plant, the Test Cell's intake flow limited to a few days each month. The Test Cell CWIS is shut down when there is no testing, which can be the majority of the month. According to the permittee, the Test Cell CWIS primarily operates during colder months (see, for example, page 2-4 of March 2008 Response "aircraft engine testing is scheduled most commonly during the fall months of September through November" and page 7-5 "typically limited to colder months"). Although the actual operation of the DMRs suggest that limited operation occurs during all months, EPA sees no reason why the operation of this CWIS should not be limited during months when eggs and larvae are most prevalent and the potential for entrainment is highest. Limiting flow more than the current permit during these months is one available option to reduce entrainment that would appear to require limited expenditure by the permittee.

EPA also looked at the availability of alternative technologies to reduce entrainment and concluded, at a minimum, that fine-mesh wedgewire screens could be installed and operated outside the intake canal at a total capital cost of $2 million.[29] Fine-mesh wedgewire screens could potentially reduce entrainment more than limiting the capacity during entrainment season alone, but because there is no entrainment data for this CWIS, EPA is unable to estimate how many more eggs could be saved by implementing the additional technology. Still, given the low operating capacity at this CWIS, EPA anticipates that any incremental benefits would likely be small, in comparison to the differences in benefit that would be provided by the available BTA options at the Power Plant. Considering that the actual operating capacity of this CWIS is low and contributes minimally to the total flow at the facility, EPA has determined that the magnitude of the entrainment impacts at the Test Cell CWIS do not warrant the expenditure that would be required to install and operate any of the available technologies for reducing entrainment. EPA concludes that the BTA to minimize entrainment at the Test Cell CWIS is to restrict the capacity during peak entrainment season. GE is, of course, free to install fine-mesh wedgewire screens if it prefers, as doing so would also reduce entrainment sufficiently to satisfy CWA § 316(b).

GE Aviation has not conducted impingement monitoring at the Test Cell CWIS. Assuming that impingement at the Test Cell CWIS is equivalent to the rate of impingement at the Power Plant CWIS, [30] EPA estimates that this CWIS could impinge more than 4,000 adult and juvenile fish per year. Moreover, impingement rates are highest in the fall when, according to the permittee, the Test Cell operates most frequently. EPA concludes that this CWIS has the potential to result in adverse impacts associated with impingement mortality based on impingement rates at the Power Plant CWIS, operation of the Test Cell during fall when impingement can be high, a TSV greater than 0.5 fps, and the poor condition of the existing fish return system.

In determining the BTA for the Test Cell CWIS, 3 available technology options to reduce impingement mortality stood out for consideration: (1) upgrade existing coarse-mesh traveling screens with new fish buckets and return system, (2) replace existing coarse-mesh traveling screens with new Ristroph screens, and (3) install and operate 1.75-mm slot flat plate or cylindrical wedgewire screens. While all of these options are capable of

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[29] Due to the similar physical and biological environments, technological improvements to reduce entrainment at the Test Cell CWIS are likely to have the same constraints as those at the Power Plant CWIS. However, because the annual flow at the Test Cell is substantially less than at the Power Plant, any reductions in entrainment will be relatively lower at the Test Cell. See analysis of entrainment technologies for the Power Plant CWIS in Section 4.2.c.

[30] Impingement rate of 1.58 fish per million gallons withdrawn based on estimate from MRI 1997.

reducing impingement mortality, their estimated capacity to reduce impingement and their estimated costs varied significantly.

Upgrading the existing technology with fiberglass fish buckets and a new fish return system would reduce impingement mortality at a total cost of about $180,000 with little additional operation and maintenance required. Similarly, replacing the existing screens with coarse-mesh Ristroph screens would reduce impingement mortality at a total capital cost of $1.7 million and annual operation and maintenance cost of $124,000. Although neither technology would reduce impingement – impingement is thought to be reduced only at TSVs no greater than 0.5 fps and these technologies would not alter the existing TSV of 0.85 fps -- mortality from impingement would be expected to be reduced by use of smooth fish buckets that protect fish from injury, coupled with a new fish return system that better protects fish during transport and reduces the potential for re-impingement. It is difficult, at this time, to estimate the survival of impinged fish at this facility, but laboratory studies suggest that survival with Ristroph screens is generally high (greater than 95%) and fish injury and scale loss was lowest at TSVs similar to the existing TSV at the Test Cell (EPRI 2006). In this case, EPA conservatively assumes that improving the existing coarse-mesh technology would reduce impingement mortality by 80% based on a review of this technology conducted for the suspended Phase II Rule (EPA 2004). In contrast, 1.75-mm flat plate or cylindrical wedgewire screens could potentially reduce impingement by 96% at a total capital cost of $420,000 to $592,000 and annual maintenance cost of $109,000.

EPA has discussed the benefits of reducing impingement in Section 4.2.d. Generally, EPA considers that the greater the reduction in adverse impacts, the greater the benefits that will be achieved. EPA concludes that all three technology options would reduce impingement mortality substantially. Specifically, upgrading or replacing the screens would reduce impingement mortality by 80% or more and potentially save more than 3,200 fish, while installing wedgewire screens would likely reduce impingement by 96% and potentially save more than 3,800 fish. The potential for impingement at the Test Cell CWIS represents unnecessary mortality in a productive estuary of public importance that is subject to cumulative stresses from, among other sources, municipal stormwater runoff, industrial discharges, and flow alterations. As a result, EPA has determined that some expenditure is necessary to reduce impingement at the Test Cell CWIS. Replacing the existing screens with new Ristroph screens is unlikely to reduce impingement mortality much more than replacing the fish buckets and improving the fish return, at nearly 10 times the cost. For this reason, EPA concludes that replacing the existing coarse-mesh screens is not the BTA to minimize impingement at the Test Cell. Wedgewire screens could potentially reduce impingement by an additional 16% compared to improving the existing coarse-mesh screens, but because of the overall limited flow, this improvement only saves about 600 more fish per year, at nearly 12 times the cost. In this case, EPA does not think the additional costs are warranted by the benefits. As a result, EPA has determined that improving the existing coarse-mesh traveling screen with new fiberglass fish buckets and a new fish return system constitutes the BTA for minimizing adverse impacts from impingement for the GE Aviation's Test Cell CWIS. GE is, of course, free to replace the existing screens or install wedgewire screens if it prefers, as doing so would also reduce impingement sufficiently to satisfy CWA § 316(b).

### *4.4. Permit Requirements Based on BTA Determinations*

For this permit, EPA is making a 316(b) determination for this facility on a BPJ basis. EPA has considered the design, construction, and capacity of the existing CWISs, improvements proposed by GE, available technologies, and potential adverse environmental impacts and determined that the following measures represent BTA.

a. Power Plant CWIS

To minimize impingement mortality, the permittee shall reduce the through-screen velocity at any new or existing screening system to a level no greater than 0.5 fps.

To minimize entrainment, the permittee shall either:

(i) maintain a year-round monthly average intake flow of 28.7 MGD, commensurate with a 20% reduction in average monthly flow from the current permit; *and* install and operate a fine mesh wedgewire screen with a slot or mesh size no greater than 0.5 mm and a pressurized system to clear debris from the screens; *or*

(ii) maintain a year-round maximum daily intake flow commensurate with the operation of a closed-cycle cooling system.

b. Test Cell CWIS

To minimize impingement the permittee shall improve the existing coarse mesh traveling screen with new fiberglass fish lifting buckets, a low pressure spraywash, separate fish and debris return troughs, and a new return trough that avoids high elevation drops and 90-degree turns, and that returns fish to a location that minimizes potential for re-impingement and is submerged at all tidal stages.

To minimize entrainment, the permittee shall operate the CWIS with an average monthly limit of 5 MGD from March 1 to July 31 and an average monthly limit of 27 MGD from August 1 to February 28.

*4.5. References*


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**Attachment K: Thermal Analysis from Derivation of Permit Limits for Wheelabrator Saugus (NPDES Permit No. MA0028193)**

1) Fact Sheet: Determination under CWA § 316(a)

2) Response to Comment: Response to General Comment

3) Figures 2.11 to 2.15 from *Temperature Mapping and Hydrothermal Model Calibration of the Lower Saugus River Estuary* (Draft Report 04-115) prepared for Wheelabrator Saugus, Inc. by ASA (August 2004).

of the critical temperature was also seen in the benthic layer. The area exceeding 75°F dropped to 0% as the tide ebbed and then built up to 100% coverage on slack high water. There was little discernable difference between the areas of exceedance under Scenarios 1 and 6.

**October** – The model did not predict any exceedances of the critical temperatures during the October period.

#### 6.1.1.5 Determination under CWA § 316(a)

The draft permit grants a § 316(a) variance to allow WS to discharge heat to the Saugus River in a manner that will exceed the MA SWQS, but will nonetheless assure the protection and propagation of the BIP. EPA is granting the §316(a) variance based on available data indicating that no appreciable harm to the BIP has occurred from the existing thermal discharge and modeling results showing that the 30% reduction in cooling water flow, combined with a delta T limit increased to 22 °F and a maximum T limit maintained at 90°F, will only nominally affect the size, shape and magnitude of the current thermal plume, while benefiting the BIP by reducing entrainment and impingement. Consistent with this result, the amount of heat discharged by the facility to the Saugus River will change very little, if at all, under this combination of discharge limits.

Based on these modeling results, EPA has determined that the benefits of reducing impingement and entrainment of aquatic organisms at the CWIS outweigh any potential concerns about increased thermal impacts in the lower Saugus River because no significant change in the thermal plume is predicted to result from the change in intake flow.

Therefore, as discussed in more detail below in the sections addressing BTA requirements under CWA § 316(b), seasonal flow reductions have been established in this permit under CWA § 316(b). Specifically, this permit requires that WS reduce its intake flows (and corresponding effluent flows) by 28% for the period of October 1 to May 31. This is roughly consistent with Scenario 6 of the temperature modeling and reduces the flow limit from 60 MGD to 43.2 MGD. Although the modeling used a flow reduction of 30%, WS determined that the flow of 43.2 MGD, or a 28% reduction, was as close to 30% as the facility could reliably achieve, using a specific pumping rate. For the remainder of the year, June 1 through September 30, the permit will maintain the present flow limit of 60 MGD, but will require that the permittee limit intake flow consistent with specific intake temperature ranges, as shown in Section 7.6.3 below and in the permit.

With regard to thermal discharge limits, the 1991 permit states that the difference between the river intake and the NCCW discharge, the delta T, cannot exceed 20°F, and the maximum temperature of the discharge (effluent) can not exceed 90°F. In order to accommodate the permittee's operational needs while achieving the intake flow reductions discussed above, the permit's delta T limit has been increased from 20 °F to 22 °F. In addition, the maximum effluent temperature and the delta T limits will now be expressed as hourly averages, instead of as instantaneous values. The new draft permit retains the effluent temperature limit of 90°F in the permit as a year-round limit. The influent temperature is measured in the pipe leading from the pump house approximately 80 feet from the outlet of the pumps. The effluent temperature is measured at the outlet from the condenser.

For the period of October 1 through May 31, in light of colder river water temperatures that allow for lower intake flows than the currently permitted 60 MGD, the permittee is limited to an effluent flow of 43.2 MGD. For the period from June 1 through September 30, the effluent flow limits are based on the highest hourly average intake temperature recorded for each calendar day. When this temperature is below 65°F, the flow limit will be a daily maximum of 43.2 MGD. When the intake temperature is between 65 and 70°F, the flow limit will be 50 MGD and when the temperature is 70°F or higher, the flow limit will be 60 MGD.

In consideration of the reduced seasonal flow limits, the permittee's September 1, 2006, submission requested both a delta T of 22°F and elimination of the permit's maximum temperature limits. Consistent with this request, and as stated above, the draft permit changes the delta T limit to 22 °F year-round to reflect the fact that the permittee will be reducing permitted flows through most of the year. Moreover, the permittee has indicated that WS is not operated above a delta T of 22°F because it would lead to efficiency and operational problems.

In response to the permittee's request that maximum effluent temperature limits be eliminated during the period from June through September, EPA reviewed the scientific literature regarding temperature sensitivities for a number of species that utilize the Saugus River. EPA looked at winter flounder, alewives and striped bass, as these species are known to be thermally sensitive and represent a range of life histories. Collette and Klein-MacPhee (2002, AR #18) reported that winter flounder juveniles experience significant mortality at 86°F. Otto et al. (1976, AR #19) detailed some acute toxicity in juvenile alewives at 90°F. In addition, Pardue (1983, AR #20) classifies water temperatures above 90°F as completely unsuitable habitat for juvenile alewives. Finally, Collette and Klein-MacPhee (AR #18) report the temperature range for juvenile striped bass as extending up to 90°F. In light of this review, EPA does not believe that a discharge temperature in excess of 90°F would be protective of the balanced indigenous population and that a maximum temperature limit is needed because intake water temperatures are high enough that relying exclusively on a delta T of 22 °F would result in discharge temperatures in excess of 90°F and, at times, well in excess of that level.

In addition, without a maximum temperature limit, the increased delta T limit would result in an increased thermal load to the river during times of higher intake water temperatures. As explained earlier, EPA concludes that any small, temporary instream temperature increases associated with the increase in permitted delta T and the change in temperature limits to hourly averages would be more than offset by the benefits of reduced intake flows and corresponding decreases in entrainment. However, during periods of time when intake temperatures are highest – for example, from June through September, intake water temperatures approach and occasionally exceed 80°F, *see* **Figure 6** – allowing higher maximum effluent temperatures as well as higher delta T could lead to more significant increases in thermal loadings to the river as the permittee would need to take in and discharge water at a rate of 60 MGD or higher. Furthermore, at those times, there would be no benefit of entrainment reductions because there would be no decrease in permitted flows.

The draft permit also includes thermal effluent monitoring requirements, which have been established to yield data representative of the discharges under the authority of Sections 308(a) and 402(a) of the Clean Water Act, and in accordance with regulations set forth at 40 CFR §§ 122.41(j), 122.44(i) and 122.48. The approved analytical procedures are to be found in 40 CFR 136 unless other procedures are explicitly required in the permit.

### 6.1.1.6 Antibacksliding Provisions Regarding Temperature Limits

As discussed above, the CWA's anti-backsliding provisions, set forth in Section 402(o) of the CWA and 40 C.F.R. §122.44(l), bar the relaxation of prior permit limits under certain circumstances. These antibacksliding prohibitions do not, however, apply to this permit. The CWA's antibacksliding bar on relaxing permit limits explicitly applies only to the renewal, reissuance, or modification of technology-based or water quality-based effluent limitations in NPDES permits, as opposed to the revision of permit limits that were based on a § 316(a) variance. Since the thermal discharge limits in the current WS permit were based on a CWA 316(a) variance, the anti-backsliding prohibitions do not apply to these limits.

Even if the anti-backsliding provisions were applied to revisions of permit limits based on § 316(a) variances, two exceptions to the anti-backsliding bar on relaxing permit limits would apply to the thermal discharge limits set forth in this permit. First, the regulations at 40 C.F.R. §122.44(l)(2)(i)(D) offer an exception to the anti-backsliding provisions for permits that have limits or conditions developed pursuant to CWA § 316(a), as is the case in this permit. Specifically, not only were the thermal discharge limits in the currently effective permit based on a § 316(a) variance, but the limits proposed in the new draft permit are also based on a new § 316(a) variance analysis.

Second, the regulations at 40 C.F.R. §122.44(l)(2)(i)(B)(1) provide an exception to the anti-backsliding provisions where information is available that was not available at the time of the earlier permit issuance that would have justified the application of a less stringent effluent limitation. The results of the temperature modeling at WS, coupled with consideration of new intake flow restrictions, represent new information that was not available at the time of the previous permit issuance. As explained above in the discussion of permit requirements under § 316(a), and based on the new modeling information, the proposed changes in permit limits related to thermal discharges will result in only minor, inconsequential changes in the facility's overall thermal discharge and, at the same time, will allow for significantly reduced intake flow that will result in significantly reduced impingement and entrainment.

8. Part I.D.3.b. of the Final Permit has eliminated the requirement that the permittee sample impingement using ¾-inch stainless steel baskets placed in the screenwash return sluiceway. Instead, the language in the Final Permit has been changed to require the permittee to collect aquatic organisms passing through the fish return system without specifying a particular method.

9. Part I.D.3.e. of the Final Permit has been revised to require that the total number of impinged fish shall be derived from an extrapolation of observed counts. (C4)

10. Parts I.D.2.a. and I.D.3.a. have added the following language regarding the biological monitoring program "Samples shall not be taken during consecutive periods of the diurnal cycle or on consecutive days." This language was added to these Parts in order to prevent the permittee from completing sampling on a single day. EPA and MassDEP believe that spreading this sampling out over several days or a week would yield more representative results.

**A) Comments submitted by Wheelabrator Saugus:**

**General Comment**: The Draft permit includes an absolute discharge temperature of 90 °F for outfall 001. Allowing higher absolute discharge temperatures while maintaining a 22 °F Facility temperature rise (delta T) was the approach that we had proposed to maintain de-minimis thermal impacts which continue to protect the Balanced Indigenous Populations (BIP) and reduce impingement and entrainment impacts by reducing flow as much as possible without significantly impacting plant operations.

Our facility is obligated by contracts with municipalities and others to receive and process MSW (our fuel) regardless of weather conditions. As we have indicated in previous correspondence, in warm weather conditions, historically in July and August, when intake temperatures reach the high 70s(°F) and low 80s(°F) we have had to drop load and vent steam to avoid exceeding the 90 °F absolute discharge limit. This has resulted in significant wasted energy over the years. Wheelabrator has requested the increase to prevent the need to waste energy in the future, especially in the summer when power demand is typically higher.

During the permit renewal process, we recommended and conducted thermal modeling of an approach that addresses this issue as well as addressing concerns about entrainment and impingement, particularly in the late winter and spring when fish eggs and larvae are most abundant. The approach included:

Use of a variable frequency drive (VFD) on one of the pumps to allow turndown during cold water months (essentially October through May) and thereby achieving significant impingement and entrainment reduction especially in the months when eggs and larvae have been determined to be most abundant (March through May).

Use of the VFD on warm days to increase flow as required for operations during warmer periods (typically ebb tide to low tide) and operate at lower flow during relatively cooler periods (typically flood tide through high tide) while always staying within our Daily Maximum 60 MGD flow limit.

Request to eliminate, or increase the absolute discharge temperature limit above 90°F to 95 °F to allow lower flow for longer periods in the warm weather months while allowing the plant to operate at full load, and produce electricity from a renewable source during periods of high demand. Operating with lower cooling water flows for longer periods of time will further decrease potential impingement and entrainment impacts. Modeling analysis provided to EPA in presentations and in our December 15, 2005 report on modeling results (Scenario 6) has shown no meaningful or significant difference between scenarios with and without the 90°F discharge temperature limit.

The Draft Permit includes some, but not other, pieces of our proposal. We are concerned that by not taking the pieces together, as proposed, that the targeted benefits will not be achieved and our operations will be significantly impacted without providing additional environmental benefit.

**Response to General Comment:** Wheelabrator comments that the Draft Permit's maximum temperature limit (Max-T) of 90°F should either be replaced with a limit of 95°F (or higher) or be eliminated. In support of this comment, the company states that Wheelabrator Station is obligated by contract to receive and process municipal solid waste (MSW) "regardless of weather conditions." Further, the company expresses concern that the facility has at times in the past had to "drop load and vent steam" in July and August, when intake temperatures peak, in order to avoid violating the permit's maximum temperature (Max-T) limit of 90°F. Wheelabrator explains that it had proposed that the permit require reduced intake flow (to achieve entrainment and impingement reductions) but allow an attendant increase in the permit's temperature change (Delta-T) and Max-T limits (in order to avoid restricting electrical generation and in light of the company's view that increased discharge temperatures would not harm aquatic organisms).

While EPA and MassDEP have agreed to certain of the permit changes requested by Wheelabrator – notably, an increase in the Delta-T limit from 20°F to 22°F and a shift from assessing compliance based on instantaneous temperature values to using hourly averages – the agencies do not agree that the permit's current Max-T limit of 90°F should be eliminated or replaced with a limit of 95°F or higher. The reasons for the agencies' determination in this regard are set forth below.

With regard to Wheelabrator's reference to its contractual obligations, the agencies point out only that the company is, of course, obligated to comply with its NPDES permit limits. It is apparent that the company understands this given its statement that it has on occasion in the past dropped load in July and August to avoid violating its Max-T limit. The facility's original owners chose to locate the power plant on the Saugus River, a water of both the United States and the Commonwealth of Massachusetts, and a part of the Rumney Marshes Area of Critical Environmental Concern (ACEC), as later designated by the Commonwealth. Wheelabrator Station uses the river both as a source of water for cooling and as a receptacle for the facility's waste heat (and certain other pollutants). The Saugus River is an important public natural resource and Wheelabrator Station's uses of the river are subject to the requirements of the Clean Water Act (and other laws) designed to protect the Nation's waters and the organisms that inhabit them. Whether or not Wheelabrator ultimately chooses to comply with its permit limits by occasionally dropping load and venting steam, or some other method, has no bearing on the derivation of the thermal discharge limits needed to protect the river consistent with legal requirements.[1]

Wheelabrator Station's cooling system can adversely affect the Saugus River ecosystem in two primary ways. First, the facility's withdrawal of river water for cooling causes the entrainment and impingement of aquatic organisms. Second, its discharge of waste heat can raise ambient water temperatures in the river. EPA and MassDEP appreciate that Wheelabrator has explored and proposed certain changes in operation that will benefit the ecology of the Saugus River. Specifically, Wheelabrator proposes operating at lower cooling water intake flows, which will reduce current levels of entrainment and impingement. Accordingly, the new permit's limits reflect sizable reductions in flow for a large percentage of the year, and these more stringent flow limits can be achieved by operational changes using the recently installed VFDs. At the same time, however, handling the same amount of waste heat with a lower volume of cooling water produces a corresponding increase in the maximum temperature of the thermal discharge.

EPA and MassDEP must consider both sides of the equation. Weighing the environmental benefits of reducing intake flow against the drawbacks of increasing discharge temperature is a delicate balancing act. As detailed below, the agencies conclude that, for the most part, the ecological benefit of the entrainment and impingement reductions associated with reduced cooling water intake flows will more than offset the risk of harm from the resulting increase in discharge temperatures. This conclusion does not, however, extend so far as to support eliminating the permit's Max-T limit of 90°F and replacing it with a limit of 95°F (or higher) or no limit at all. Without the 90°F Max-T limit, the increased risk of adverse thermal discharge effects would threaten the protection and propagation of the Saugus River's balanced, indigenous population of fish. Moreover, this increased risk would not be offset by the marginal additional entrainment and impingement reductions that would be associated with the marginal additional intake flow reductions that would be facilitated by a higher thermal discharge limit.

Wheelabrator's comment expresses concern that load shedding could potentially be required in July and August to meet the Max-T limit of 90°F. EPA's review of ambient water temperature collected at the intake by Wheelabrator from 1997-2003 (Figure 6 in the Fact Sheet) confirms that July and August is the time of year, on average, when the

[1] While energy is lost when load is dropped and steam vented, energy is also lost when waste heat is discharged to the Saugus River. Maximizing plant efficiency and finding productive uses for the facility's waste heat would help to limit these energy losses.

discharge limit of 90°F could occasionally require Wheelabrator to curtail generation of electricity. (Obviously, in a cool summer, the quantity of time that generation might need to be curtailed would be less, and in a warm year it would be more.)

Nevertheless, EPA's biological analysis indicates that discharge temperatures above 90°F in July and August would be ecologically damaging. Permit limits for Wheelabrator Station's thermal discharge are being set under a CWA § 316(a) variance from otherwise applicable technology-based and water quality-based standards. As such, these limits must assure the protection and propagation of the balanced, indigenous population of fish, shellfish and wildlife (BIP) in and on the Saugus River. EPA's initial review of the species expected to be present in the Saugus River and their temperature sensitivities, *see* Fact Sheet at 17, suggested that, taking into account the limited temporal exposure to the thermal plume that organisms would likely experience due to the dynamic flushing of the Saugus River, water temperatures in the mid-80s to 90° F would serve as a maximum temperature threshold for multiple species (*e.g.,* winter flounder, alewives and striped bass). The scientific literature suggests that water temperatures as low as the mid-80s (F) could cause these species to suffer effects ranging from mortality, to reduced habitat suitability, to forced habitat avoidance and possibly other sublethal effects. Alewife population numbers are dramatically reduced throughout Massachusetts, resulting in the state closing both the commercial and recreational fishery for the species. Moreover, winter flounder populations have significantly deteriorated regionally, which has resulted in the National Oceanic and Atmospheric Administration (NOAA) severely restricting fishing for the species. Striped bass are a popular recreational species that generates millions of dollars of revenue per year in Massachusetts. As a result, the agencies have heightened concerns over the potential for Wheelabrator Station's cooling system to harm these species within the Saugus River.

Based on data from neighboring river systems (Charles River), and in the opinion of the state of Massachusetts anadromous fish biologist (Phillips Brady, MADMF), July through October/November would most likely be the period of juvenile alewife outmigration in the Saugus River. Juvenile winter flounder and striped bass would also certainly be present in the Saugus River during that time frame.

Additional literature review on alewives in particular, suggests that temperatures in the mid-80s to 90° F can trigger sublethal impacts and mortality within relatively short exposure times. Otto et al. (1976), Administrative Record Item (AR) #88, observed that (i) 50% of juvenile alewives acclimated to 18-20°C (64.4-68°F) and later exposed to 31°C (87.8°F) died in about an hour or less (actually, 70 minutes or less); and that (ii) 50% of juvenile alewives acclimated to 24-26°C (75.2-78.8°F) and later exposed to 33°C (91.4°F) died within 76 minutes or less. Coutant (1972), AR #89 has shown that one can arrive at an approximate NOAEL (no observed acute effect level) in thermal tests for some fish by subtracting 2° (3.6°F) from the TL50 (the temperature lethal to 50% of the test organisms). NOAELs in the two tests cited above from Otto et al. (1976) appear to be 2.5-3°C below the approximate TL50 and generally support the Coutant figure. Based on the Coutant estimate, we would expect the NOAEL from this particular exposure scenario to be about 84.2°F (29°C) to 87.8°F (31°C). The agency selected these particular values from the Otto et al. (1976) to help (roughly) estimate juvenile survival rates after about an hour of exposure time and these were a reasonably close fit.

The agency realizes that it is not possible to accurately predict acclimation temperature or exposure time for juvenile alewives in the lower Saugus River, and that we cannot be certain how closely the critical temperatures identified in either laboratory studies or *in situ* studies from other locations would be mirrored in the Saugus River. Nevertheless, the data from Otto et al. (1976) suggest that significant mortality (and/or sublethal effects) to juvenile alewives could occur at temperatures in the mid-80s to low 90s°F within exposure times (around 60 minutes) that could be experienced around the low slack tide in that system given the range of water temperatures that exist upstream of the Rt. 107 Bridge in the summertime. The Fact Sheet, at 17, also discusses scientific literature indicating that water with temperatures above 90°F (and in some cases as low as 86°F) could result in acute toxicity for juvenile winter flounder, juvenile striped bass and juvenile alewives.

Thermal modeling of the discharge plume predicts that the period of slack low tide is the period of time with the least amount of mixing and dilution. Dispersion of the facility's thermal discharge due to tidal currents is also at its minimum at slack tide. This combination of factors is expected to occur twice a day for a period of roughly one hour each time. During these periods, Wheelabrator Station's thermal plume drives water temperatures across and throughout virtually the entire water column. This is of greatest concern during the summer months from July through September, when ambient water temperatures are at their maximum and thermal discharges could cause river temperatures to approach or exceed the range determined to be protective of the BIP.

In General Comment (A) the permittee maintains that "operating at lower flows for longer periods of time will further decrease potential impingement and entrainment impacts." EPA agrees that lower flows result in reduced impingement and entrainment impacts. In general, reduced impingement and entrainment losses would be beneficial to the Saugus River. However, during the summer, EPA believes that the potential negative impacts from a higher absolute discharge temperature outweigh the potential incremental benefits of the reduced flow. In the Draft Permit, EPA increased the Delta-T limit and introduced an hourly average (as opposed to instantaneous) maximum daily temperature limit to allow the facility to reduce flows between October 1 and May 31, resulting in at least a 28% reduction in impingement and entrainment. Low intake water temperatures during these months allow the permittee to reduce intake flows and increase the Delta-T of its discharge while remaining below the Max-T limit of 90°F and ensuring protection of the BIP. Under these conditions, the amount of heat (as measured in British thermal units (BTUs)) discharged remains essentially the same; although the water is somewhat warmer, a smaller volume is discharged. When intake temperatures exceed 65°F, however, the facility must increase its intake flows to compensate for the loss of cooling capacity in the water [See Figure 5 in the 2008 308 Response, AR #3]. Indeed, when intake temperatures reach the high 70s to 80°F, which can occur periodically in August (See ASA 2004, AR #4, Figure 2.8a and b), intake flows may need to reach as high as 50,000 to 55,000 gallons per minute (gpm), which would require the facility to discharge at or approaching the maximum permitted volume of 60 MGD. Thus, under such conditions, cooling water intake volumes would not be significantly reduced even if the Max-T limit was increased above 90˚F. As a result, during these periods, raising the Max-T limit would result in increased thermal loading (i.e., more BTUs) to the river without significantly reduced entrainment and impingement.

In other words, while the permittee will likely be able to reduce cooling water withdrawal volumes during the cooler months (i.e., October through May, and most likely all or part of June and September), operational limitations associated with higher intake temperatures will likely preclude such reductions during the hottest summer months (i.e., July and August) (*see* March 2008 308 Response, AR #3, Section 6.4, page 2). Thus, increasing the maximum daily discharge temperature to 95˚F at times when ambient river temperature is high, and intake flows are approaching or equal to 60 MGD, would result in increased heat load to the river at a time when river conditions are approaching the limits of thermal tolerance for several fish species. Retaining the maximum daily discharge limit of 90˚F will protect the BIP during the hottest summer months by preventing the facility from adding even more heat to the system than is currently permitted. While EPA and MassDEP recognize that retaining the Max-T limit of 90° F may keep Wheelabrator Station from reducing its water withdrawal volumes at certain times – most likely to occur on some number of days in June and September -- and that this will result in marginally greater entrainment and impingement, the agencies have concluded, in light of our review of the scientific literature on thermal effects, that it is more important in this case to prevent the effects that could result from discharges above 90°F.

The permittee maintains that the modeling results show "no meaningful or significant difference with or without the 90˚F discharge temperature limit." For the most part, EPA agrees with this assessment. The model appears to predict average water temperatures over entire tidal cycles with reasonable accuracy and is useful in predicting the impacts of a small Delta-T increase with reduced flows. At the same time, however, a comparison of modeled and observed temperatures indicates that at stations in the vicinity of the GE discharge and upstream of the Wheelabrator discharge, the model is not accurately predicting peak temperatures around low slack tide. In some cases, observed temperatures near the low slack period were 5-7°C (9-12.6°F) higher than the model's predicted value (See ASA 2004, AR #4, Figures 5.2-5.10). The differences between observed and modeled temperatures suggest that the model may not accurately predict the impact of a 95˚F discharge at 60 MGD during low slack tide in August, which is a serious concern for EPA and MassDEP given that this time period reflects the highest natural river temperatures and the least mixing and dilution, and is the time when thermal impacts to alewife, winter flounder, and striped bass juveniles are most likely to occur. Indeed, the occurrence of very high temperatures in localized areas (i.e., near the thermal discharges) during low slack tide is one of EPA's chief concerns with regard to assuring the protection and propagation of the BIP.

In light of the above considerations, EPA and MassDEP also considered imposing a maximum discharge temperature limit even lower than 90°F. The agencies currently conclude, however, that the more conservative approach of a lower discharge temperature is not necessary at this time. This conclusion is based on the limited temporal and spatial extent of the thermal plume at temperatures above levels of concern for resident and anadromous species in light of the dynamic flushing provided by the Saugus River. After issuance of the new permit, the agencies anticipate additional evaluation of the actual behavior of the thermal plume in the Saugus River at periods of low slack tide in the summer (and during other periods) to further characterize the water temperatures that will result during that segment of the tidal cycle.

As stated above, this discharge is being regulated under 316(a) of the Clean Water Act. As such, the discharge limits must assure the protection and propagation of the BIP. In light of the above analysis, EPA and MassDEP find that a permit with a Max-T limit of 95°F (or higher), or without any Max-T limit at all, would under certain conditions raise river temperatures to levels that would pose a risk of significant adverse thermal impacts to at least 3 important resident species in the Saugus River – namely, alewives, winter flounder and striped bass – and would as a result not reasonably assure the protection and propagation of the BIP as required by § 316(a). Moreover, EPA and MassDEP must also consider the possible cumulative effect of the Wheelabrator Station thermal discharge when coupled with the thermal discharge from the nearby General Electric facility. *See* 40 C.F.R. §§ 125.73(a) and (c)(1)(i).

Conversely, for the reasons stated above, with a maximum discharge temperature of 90°F, EPA and MassDEP find that the risk of adverse thermal impacts would be sufficiently reduced to provide reasonable assurance of the protection and propagation of the BIP. Although EPA and MassDEP have decided to grant the company's request to increase the Delta-T limit from 20°F to 22°F, and to base compliance on hourly average temperatures rather than instantaneous temperatures, the agencies have also decided to reject Wheelabrator's request to raise or eliminate the maximum temperature limit. As a result, the overall thermal load (as measured in BTUs) to the Saugus River from Wheelabrator Station's discharge will not appreciably increase because despite the increased Delta-T, the cooling water flow volume will be reduced for much of the year and the 90°F maximum temperature limit will be retained.

While the permit's thermal discharge limits are based on a CWA § 316(a) variance, rather than state water quality standards, the regulatory agencies also note that under the Massachusetts Surface Water Quality Standards (SWQS), 314 CMR Part 4.00, the Saugus River is designated as a Outstanding Resource Water (ORW) due to its designation by the state as an Area of Critical Environmental Concern (ACEC). ORWs receive a high level of protection under the state's SWQS. For example, new or increased discharges of pollutants to an ORW are prohibited unless they are determined to be for the express purpose of enhancing the resource for its designated uses. *See* 314 CMR 4.04(3).

In connection with the Rumney Marshes ACEC designation, the US Fish and Wildlife Service (USF&WS) characterized the area as "one of the most biologically significant estuaries in Massachusetts north of Boston." USF&WS commented on the proposed ACEC designation as follows:

> "Nearly 70 percent of all commercial fish and shellfish resources are dependent on estuaries for spawning and nursery grounds. Winter flounder, alewife, smelt, blueback herring, and American eel are a few of the more common finfish that occur within the nominated estuarine ecosystems.... Intertidal habitats ... support a wide variety of invertebrate resources. These include soft shelled and razor clams, mussels, snails, marine worms, and other invertebrates that are integral components of the marine food chain. Although many of the shellfish beds are too contaminated for human consumption, they represent an important food source for wildlife, attracting large numbers of wintering waterfowl to the area annually."

In the ACEC designation document for this area, the Massachusetts Secretary of Environmental Affairs found that the:

> . . . list of bird species, migratory or indigenous, is extraordinary. The Massachusetts Natural Heritage and Endangered Species Program has commented that the area contains at least 5 species listed by the Division of Fisheries and Wildlife as Endangered, Threatened, or a Species of Special Concern. Despite its proximity to the intense development of the area, there is little doubt of the productivity of the designated area. ... Given its close proximity to a major metropolitan center with a population in excess of one million, this relatively undisturbed estuary and marsh complex is indeed unique...this relatively large tract of marshland habitat, situated in an area subject to intense development pressure, provides the resource base necessary to maintain the diversity and productivity of an ecosystem which must, despite stringent regulation, accommodate the cumulative impacts arising from this development. While there may be smaller parcels of marshland which dot the urban landscape, the inventory of larger marshes capable of supporting these vital resources is dwindling and must be preserved.

Relative to the importance of this area, the Secretary further stated:

> I also hereby find that the coastal wetland resource areas included in the Rumney Marshes ACEC, the title taken from the name used during the colonial era to identify the marshes and lowlands of this region, are significant to flood control, the prevention of storm damage, the protection of land containing shellfish, and fisheries; the prevention of pollution, the protection of wildlife habitat, the protection of public and private water supplies; public interests defined in the Wetlands Protection Act (MGL c. 131, s. 40; 310 CMR 10.00).[2]

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[2] See "Designation of Portions of the Cities of Boston, Lynn, and Revere, and the Towns of Saugus and Winthrop as the Rumney Marshes Area of Critical Environmental Concern with Supporting Findings", dated 22 August 1988.

It is noteworthy that the Secretary identified "the protection of land containing shellfish, and fisheries; the prevention of pollution, [and] the protection of wildlife habitat" as issues of importance in the ACEC designation. These issues, as they pertain to the Lower Saugus River, particularly in view of its status as an ORW resource, would likewise necessitate protection under the SWQS.

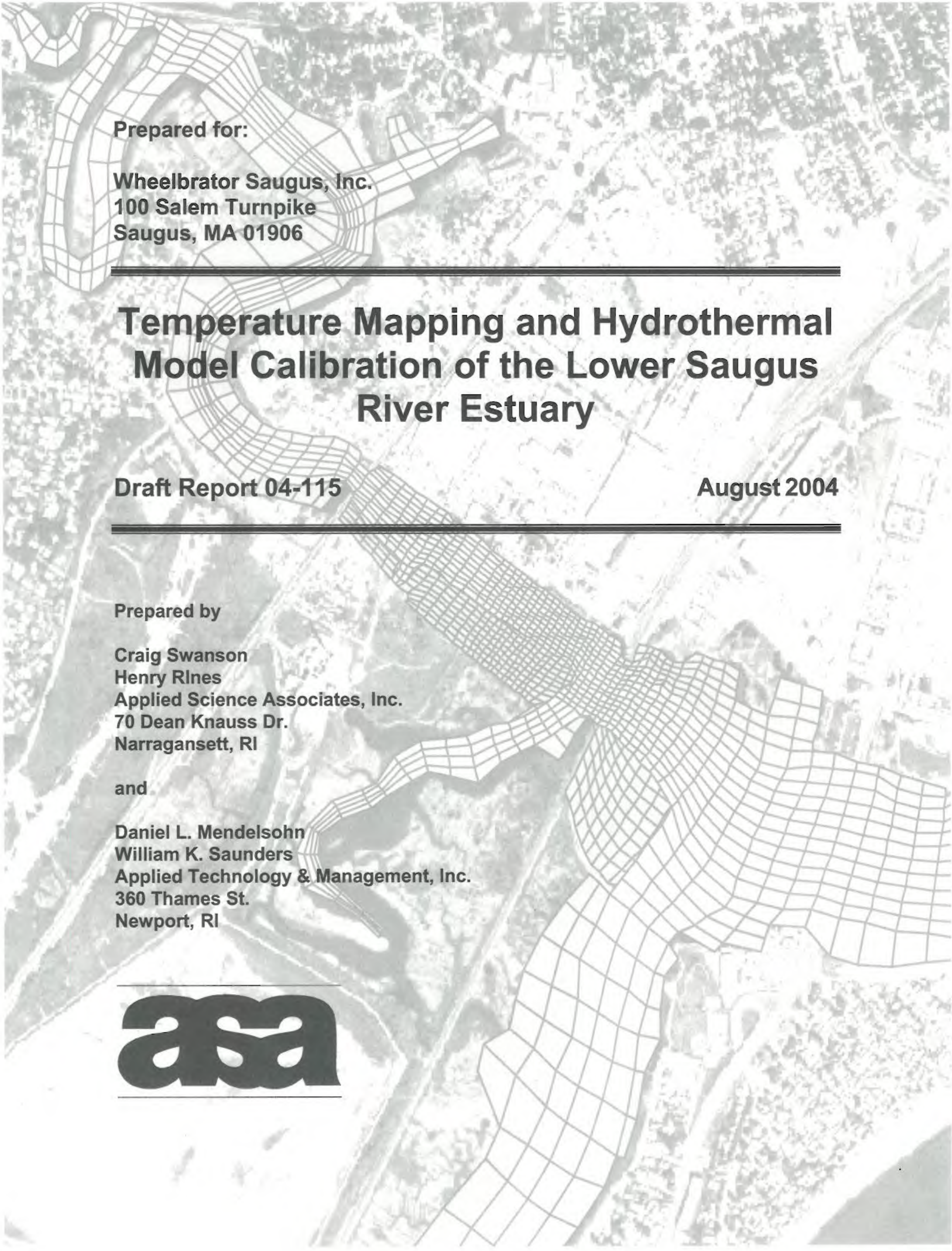
The agencies have concluded that an increase in Wheelabrator's maximum allowable discharge temperature would allow an increase in the discharge of heat, a pollutant, to the lower Saugus River. In addition, this additional discharge of heat is neither proposed for the express purpose and intent of maintaining or enhancing the resource for its designated uses (i.e., "habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation habitat for aquatic life", among other uses, *see* 314 CMR 4.05 (4)(b)), nor would it constitute such an enhancement. *See* 314 CMR 4.04(3)(b)(1). As a result, an increase in Wheelabrator Station's discharge of heat to the lower Saugus River would be inconsistent with the intent of the anti-degradation requirements of the Massachusetts SWQS, which require the maintenance and protection of the quality of ORWs. While other Wheelabrator comments (*see* Comments A15, A16 and A19 below) ask whether a mixing zone could be provided under the state water quality standards to authorize exceedances of state water quality criteria for temperature within the zone, MassDEP has determined that, independent of a 316(a) analysis, the proposed discharge will not meet the state's Mixing Zone Policy guidance under the circumstances of this case. (*See* Response A16 below; *see also* Response A15 and A19 below.)

**Comment A1**: Revise Effluent Temperature from 90 °F to 95 °F

The effluent absolute temperature limit of 90 °F does not represent a threshold of significance of impact from the thermal discharge in the river and does not allow the full entrainment/impingement withdrawal reduction benefit of the VFD. A higher absolute temperature would delay the need to increase flow (and would reduce entrainment and impingement during those periods). We have demonstrated with the modeling of Scenario 6 in the December, 2005 submittal that the thermal impacts to the river are not significant using scenarios with no absolute discharge temperature and therefore we feel very strongly that this condition:

- does not provide the available benefit to the environment of the Saugus River either with regard to impingement or entrainment, nor does it materially reduce thermal impacts;
- does not provide benefit to the environment as a whole, since when the absolute discharge temperature limit is approached, steam is vented and fuel is wasted in our plant and additional fuel must be combusted elsewhere to generate electricity (high temperature days correspond with increased electrical demand). Overall air emissions regionally therefore increase.

The absolute discharge temperature limit is presumed to be a consideration in the Mass DEP Water Quality Standards aspects of the Permit, which has not yet been available for



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# Temperature Mapping and Hydrothermal Model Calibration of the Lower Saugus River Estuary

Draft Report 04-115 — August 2004


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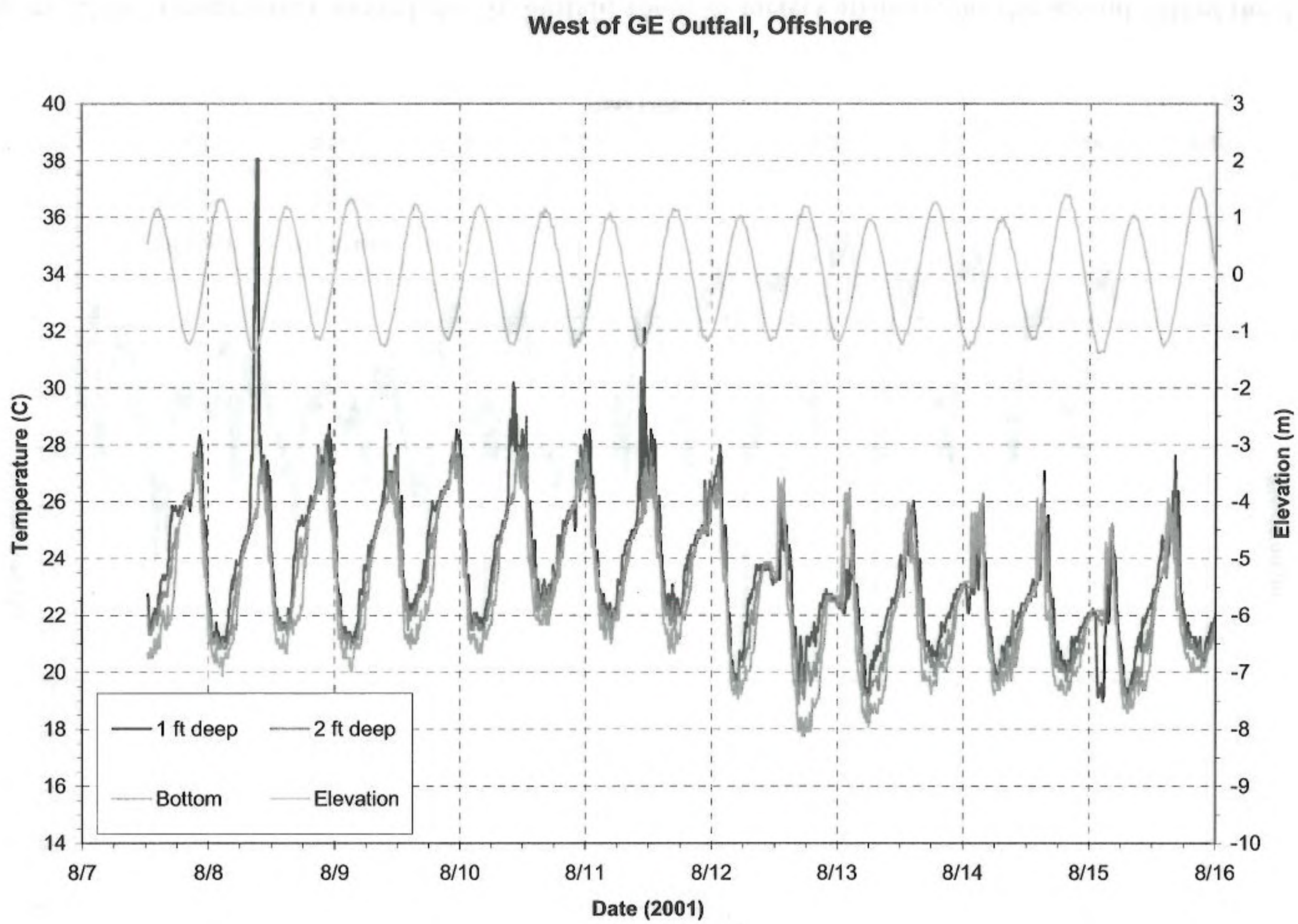


**Figure 2.11a Temperature west of the GE outfall, about 25 meters offshore, for the first half of the deployment.**

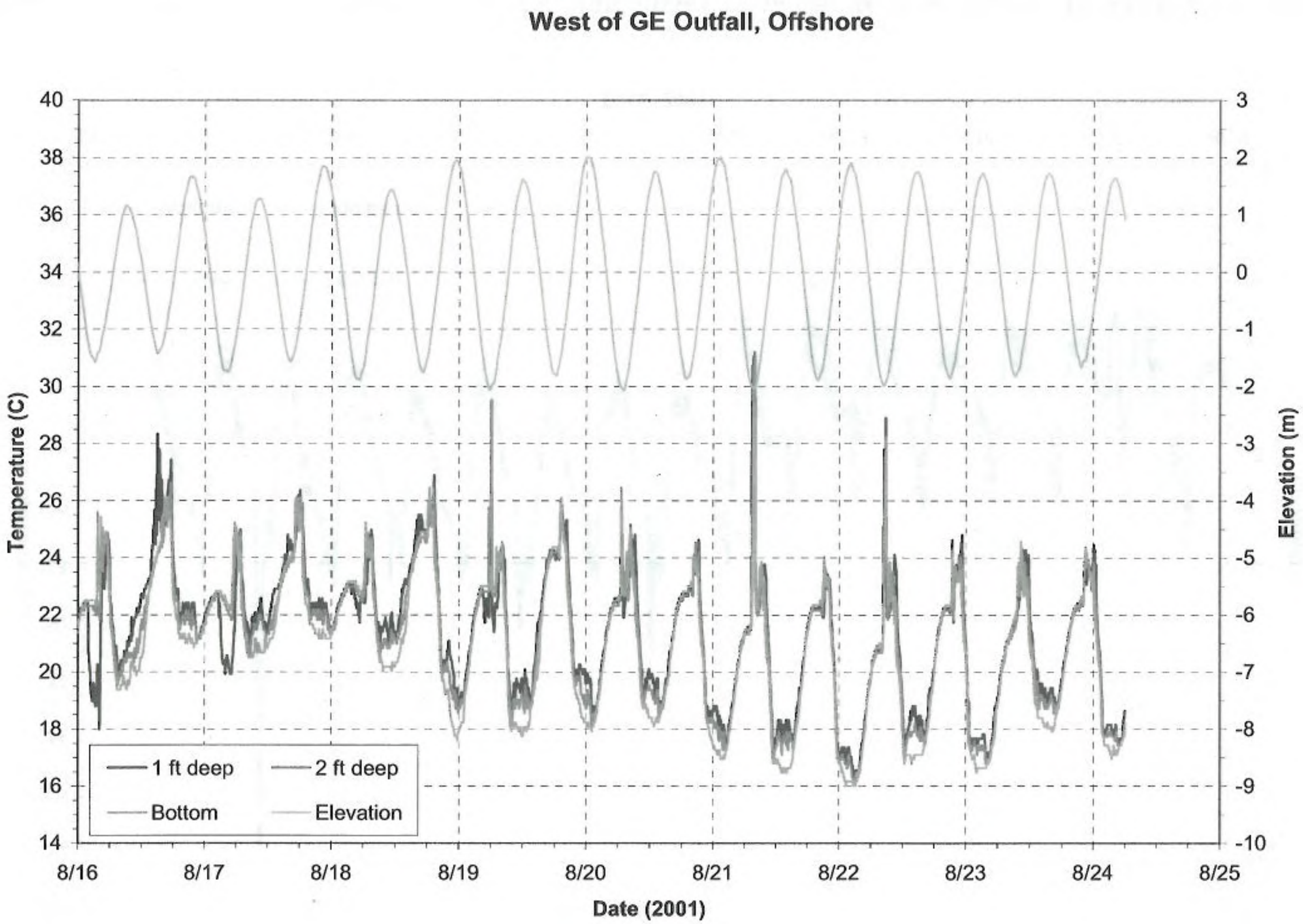


**Figure 2.11b Temperature west of the GE outfall, about 25 meters offshore, for the second half of the deployment.**

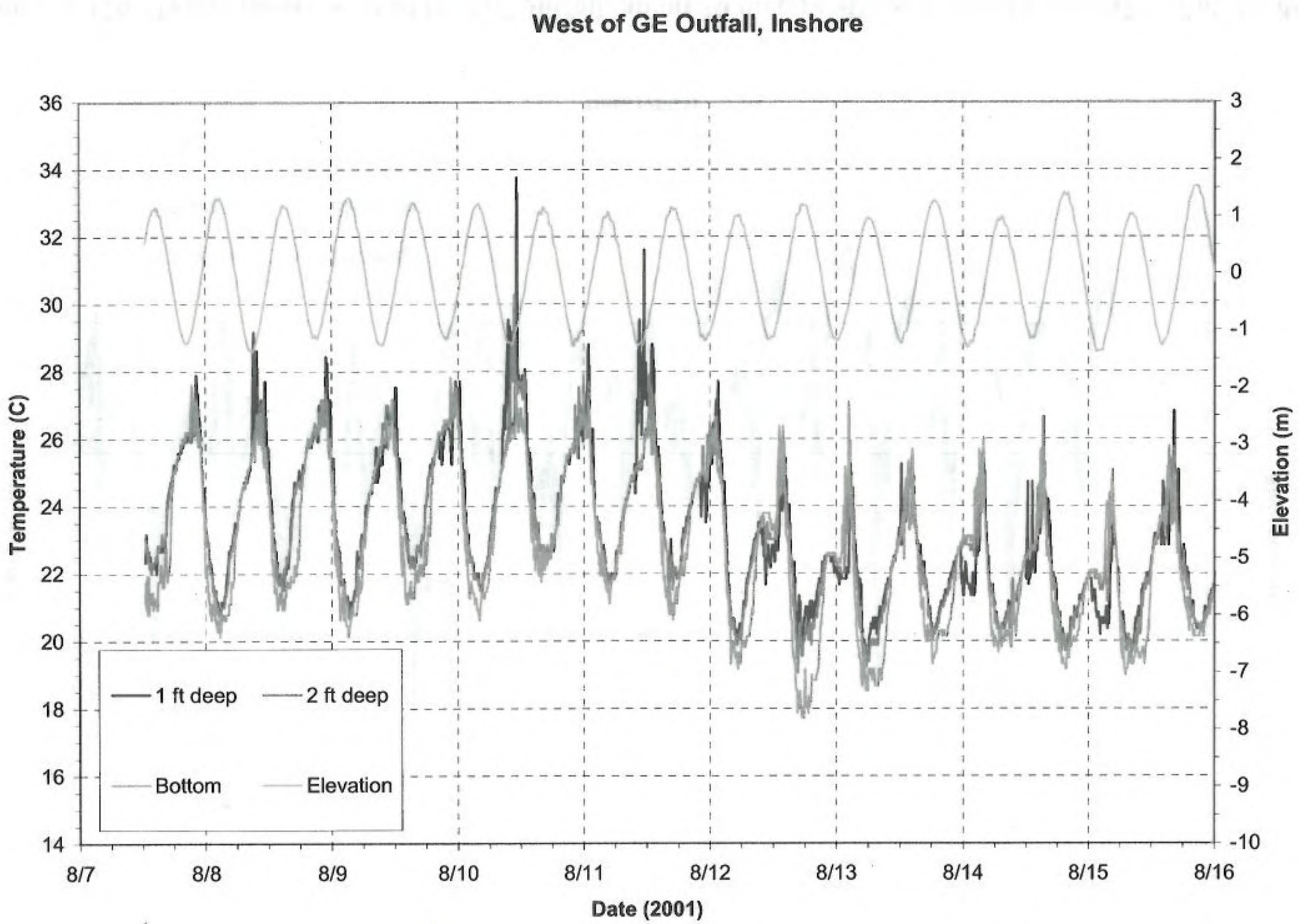


**Figure 2.12a Temperature west of the GE outfall, about 10 meters offshore, for the first half of the deployment.**

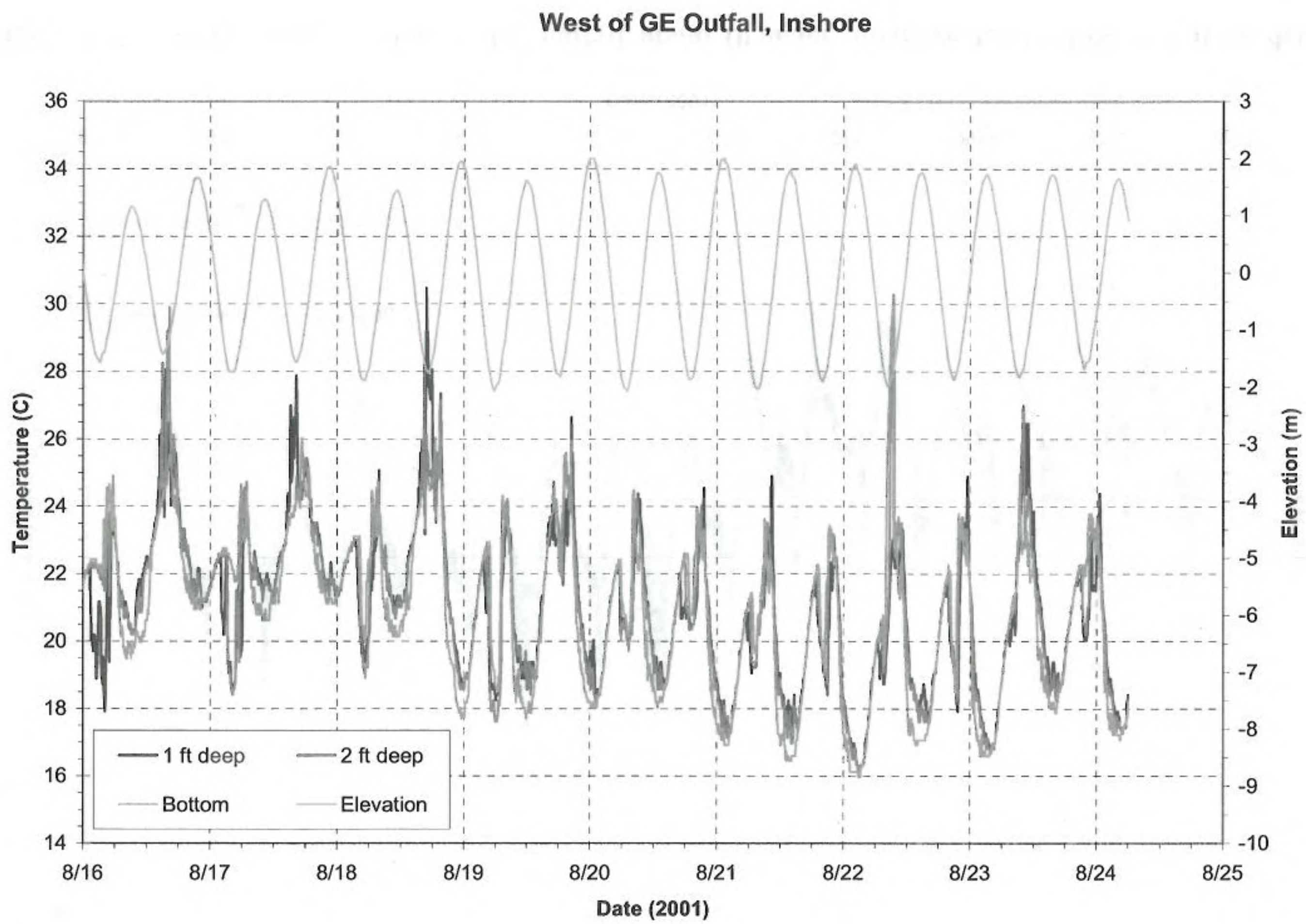


**Figure 2.12b Temperature west of the GE outfall, about 10 meters offshore, for the second half of the deployment.**

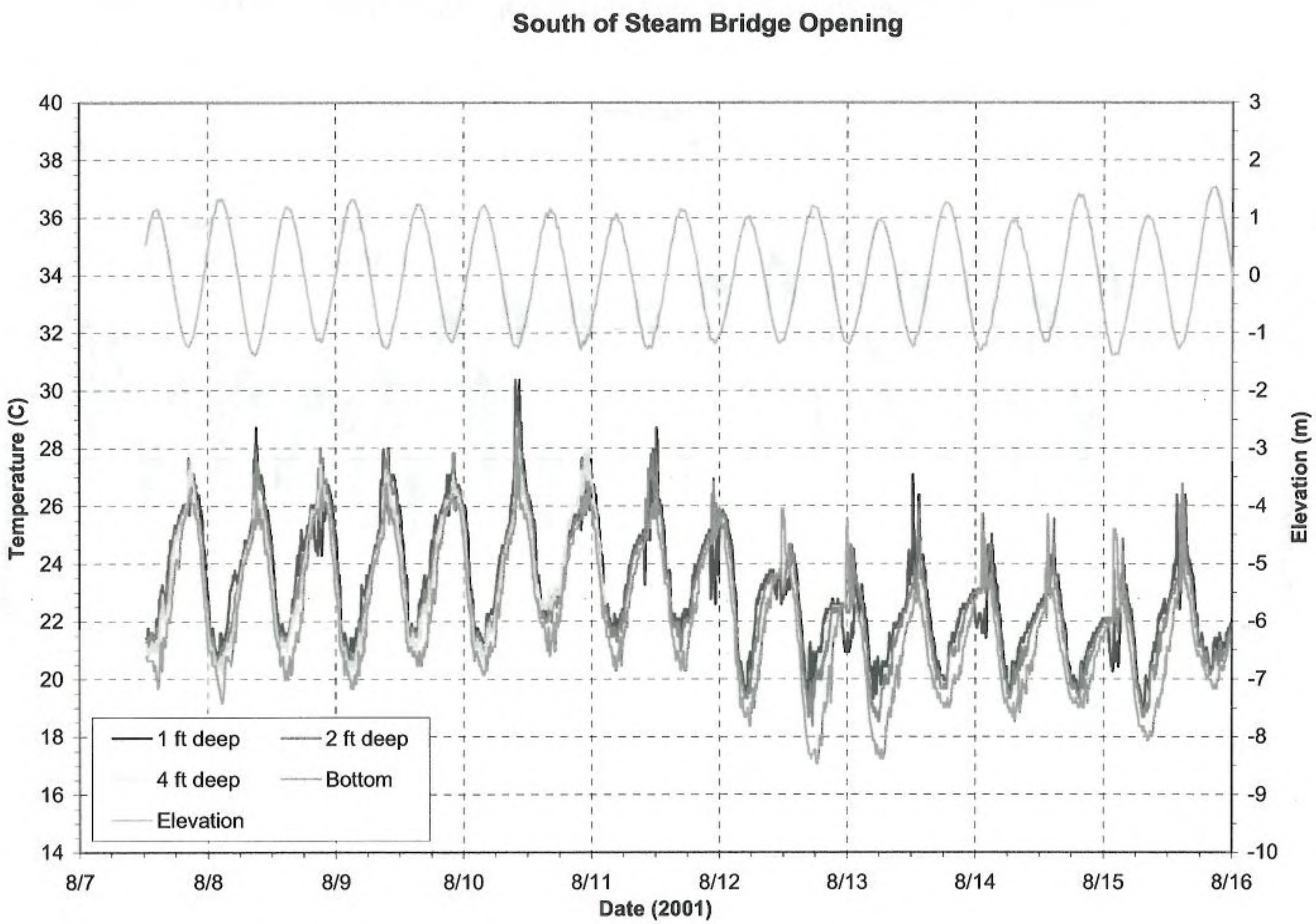


**Figure 2.13a Temperature south of the channel opening at the steam bridge for the first half of the deployment.**

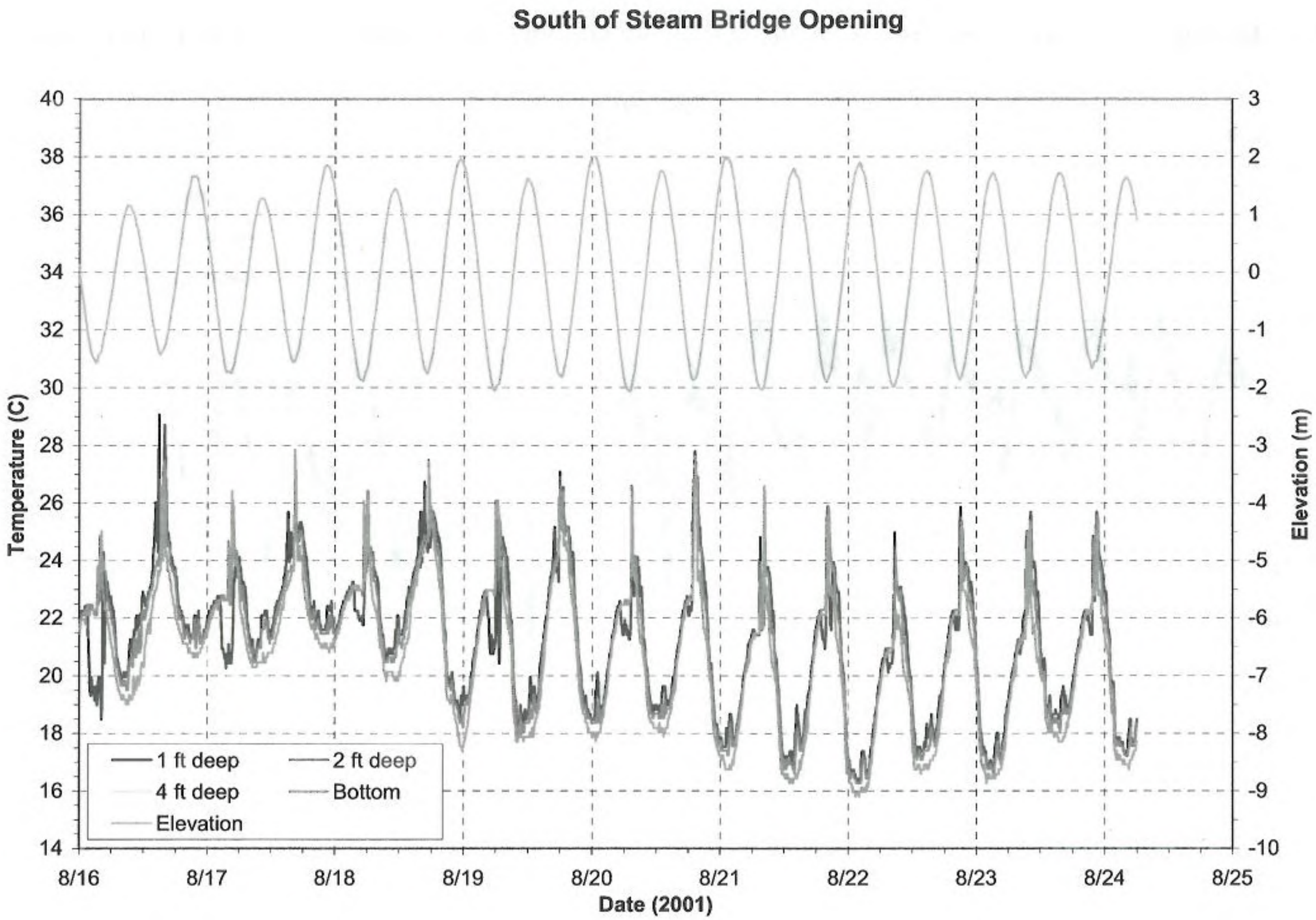


**Figure 2.13b Temperature south of the channel opening at the steam bridge for the second half of the deployment.**

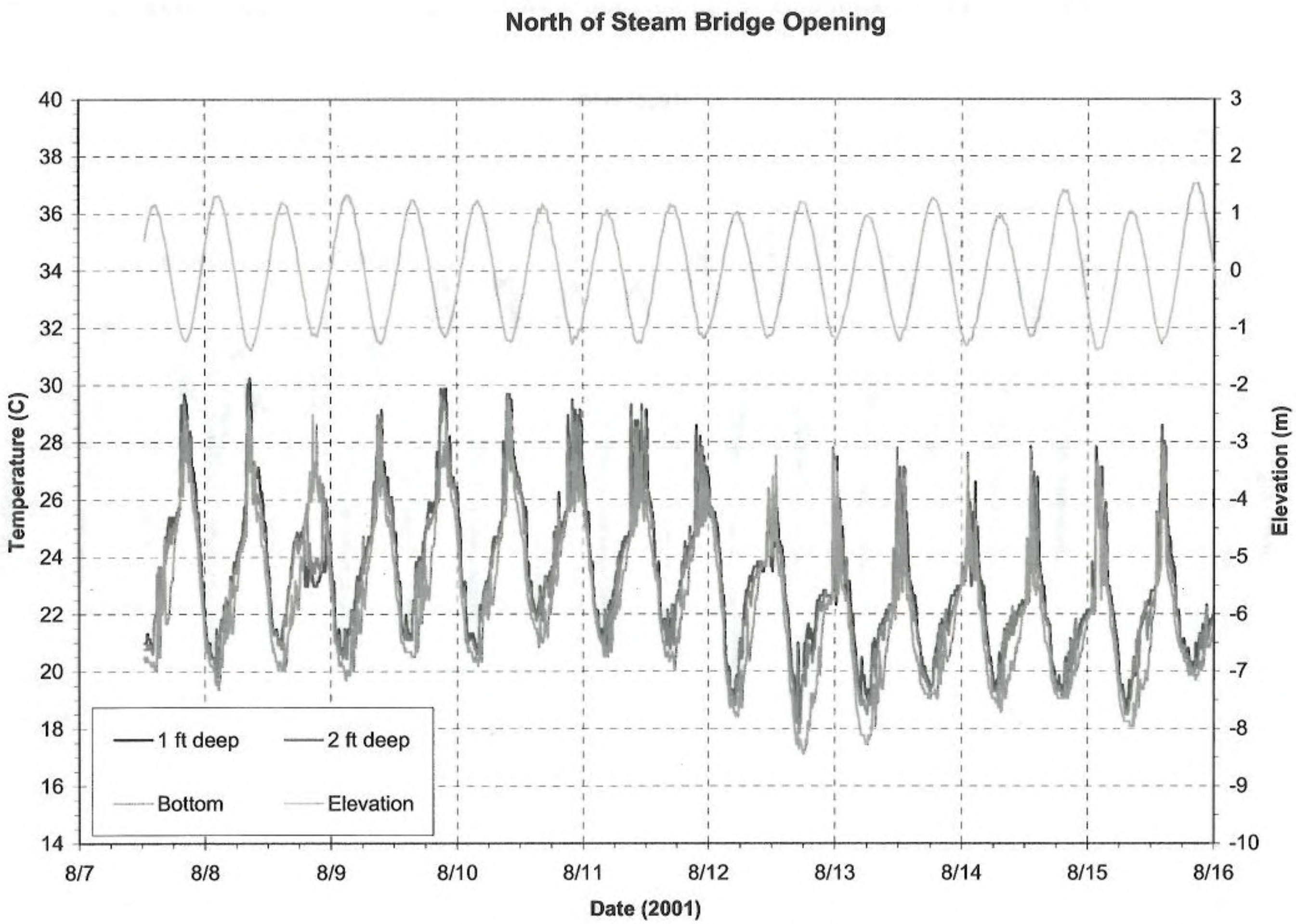


**Figure 2.14a Temperature north of the channel opening at the steam bridge for the first half of the deployment.**

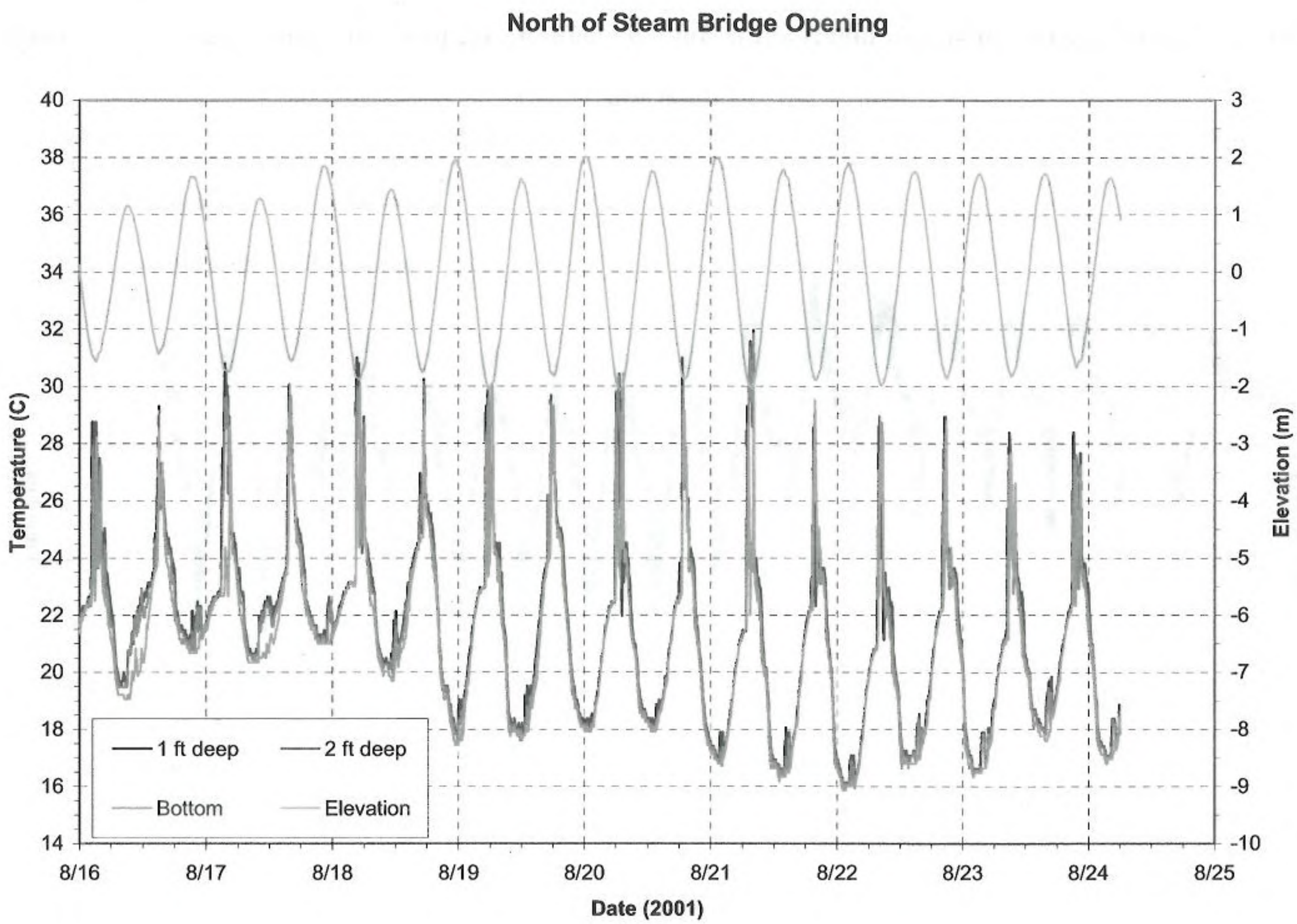


**Figure 2.14b Temperature north of the channel opening at the steam bridge for the second half of the deployment.**

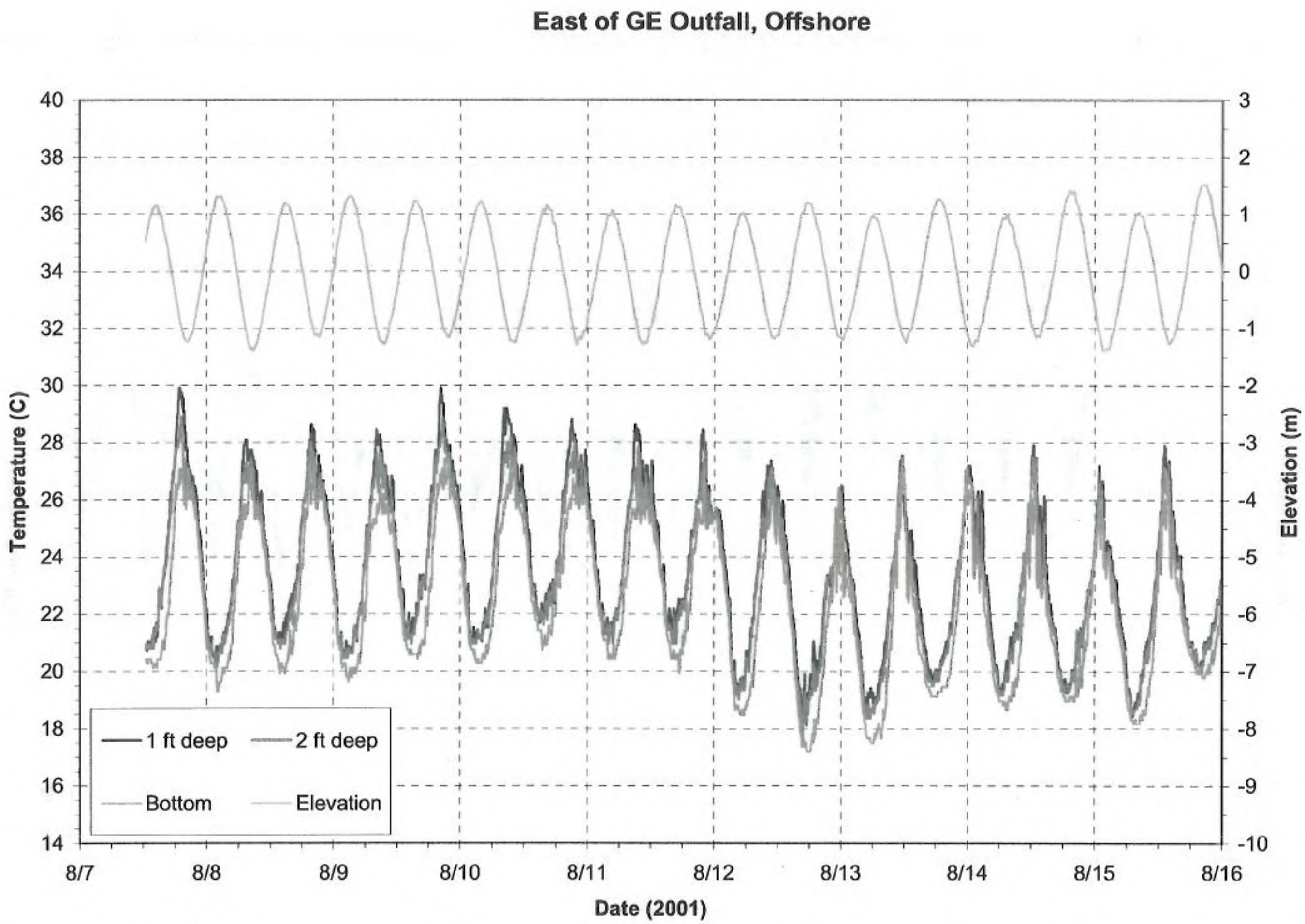


**Figure 2.15a Temperature east of the GE outfall, about 25 meters offshore, for the first half of the deployment.**

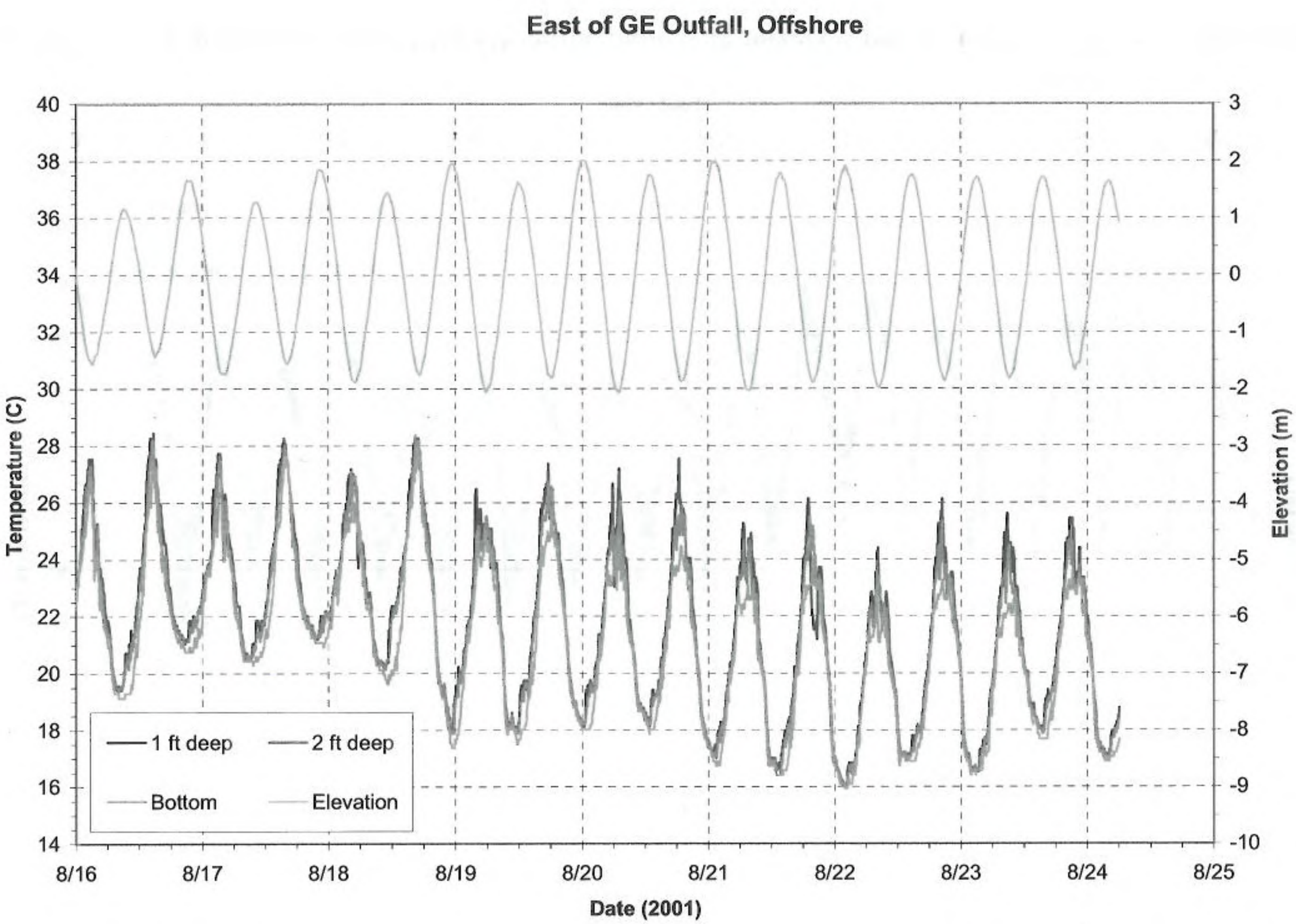


**Figure 2.15b Temperature east of the GE outfall, about 25 meters offshore, for the second half of the deployment.**