Chapter 2: Description of Treatment Facilities

2.1 Introduction

This chapter defines the Milwaukee Metropolitan Sewerage District (MMSD) service area. It also describes the wastewater treatment facilities owned, operated, and maintained by MMSD; the biosolids recycling programs operated by MMSD; and gives a description of the energy facilities.

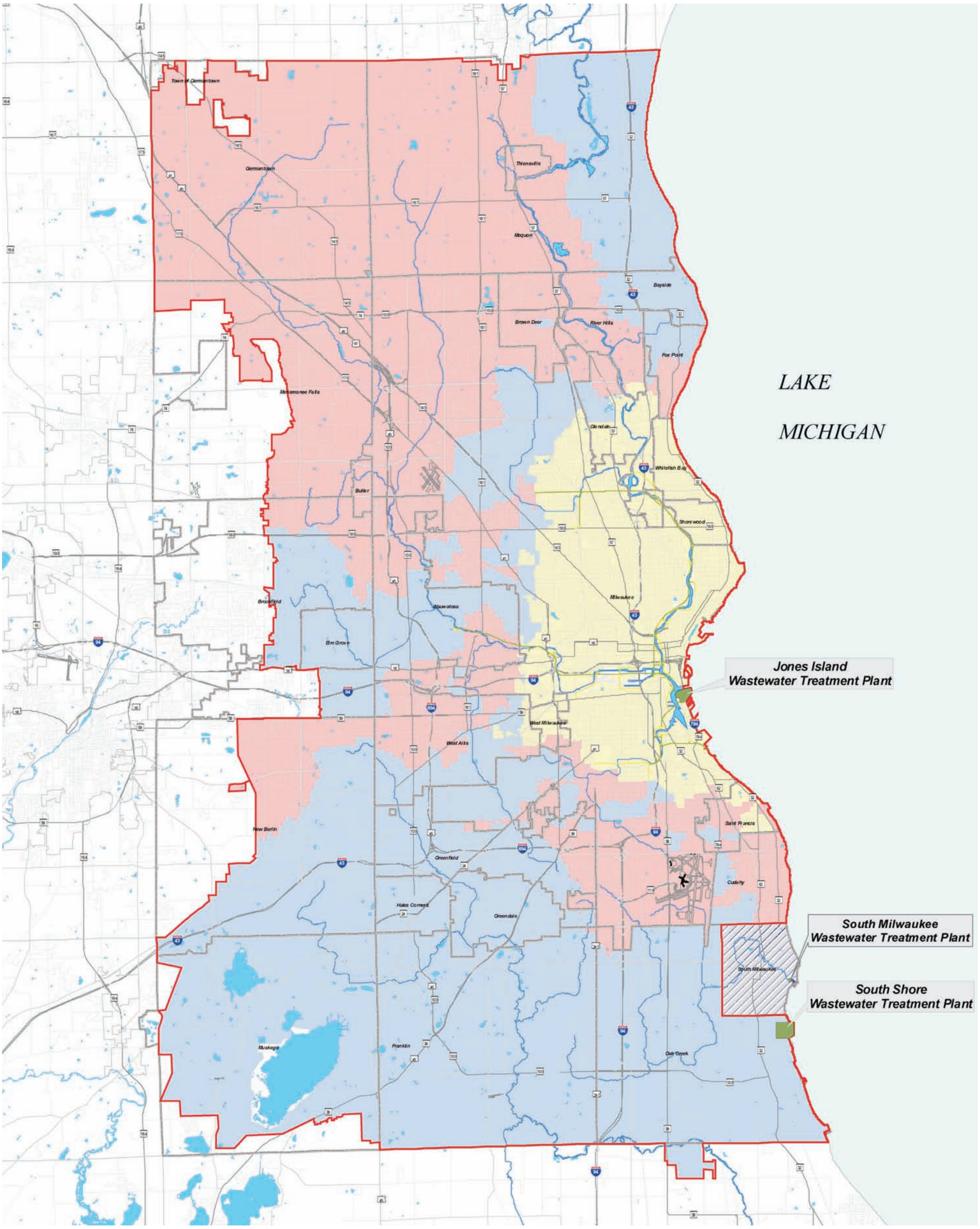
2.2 Milwaukee Metropolitan Sewerage District Service Area

The MMSD service area, shown in Figure 2.1, is divided into the areas served by Jones Island Wastewater Treatment Plant (JIWWTP), South Shore Wastewater Treatment Plant (SSWWTP), and the areas served by both treatment plants. Wastewater from areas served by both treatment plants can be diverted from one treatment plant to the other through maintenance diversions or wet weather diversions. The maintenance diversions always remain closed during normal system operations. Wet weather diversions are utilized during periods of high flow in the system. During dry weather, the wastewater flow that could be diverted by the wet weather diversions is typically treated at JIWWTP. These flows are diverted to SSWWTP during wet weather events. The conditions and means by which flow can be diverted are discussed in more detail in the *Conveyance Report* written in conjunction with this report.

The service area served by the city of South Milwaukee is also shown on Figure 2-1, because it is surrounded by the MMSD service area. The Southeastern Wisconsin Regional Planning Commission (SEWRPC) regional water quality management plan update, being written in conjunction with the *Facilities Plan Report*, includes a review of the city of South Milwaukee wastewater treatment facilities.(1)

2.3 Private Systems

No private systems have been identified within the service area; however, some private Wisconsin Pollutant Discharge Elimination System (WPDES) permit dischargers exist in the service area and are documented in Chapter 4, *Watershed Assessment – Historical and Existing Conditions* of the *Facilities Plan Report.*



LEGEND

WWTP TRIBUTARY AREA

- JONES ISLAND TREATMENT PLANT
- SOUTH SHORE TREATMENT PLANT
- EITHER TREATMENT PLANT
- WASTEWATER TREATMENT PLANTS
- MMSD PLANNING AREA

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FIGURE 2-1

TREATMENT PLANT SERVICE AREAS FOR POTENTIAL OPERATIONS

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2.4 The Milwaukee Metropolitan Sewerage District System

The wastewater treatment facilities owned by MMSD include the following:

- Inline Storage System Pump Station (ISS Pump Station)
- JIWWTP
- SSWWTP
- Biosolids Facilities (JIWWTP/SSWWTP/Interplant Solids Pipeline)
- Biosolids Recycle (Milorganite® and Agri-Life®)
- Energy Facilities

In addition, MMSD owns, operates, and maintains a network of interceptor sewers called the metropolitan interceptor sewer (MIS) system. The MIS system intercepts and conveys wastewater flows from locally-owned municipal sanitary and combined sewer systems within the service area to either JIWWTP or SSWWTP for treatment.

To optimize the MIS system and wastewater treatment plant capacities during wet weather events, flow can be diverted through active and passive diversions to the inline storage system (ISS), also referred to as the deep tunnel. The ISS consists of several tunnels located 300 feet below ground that have a combined capacity of 405 million gallons. The MMSD system will also have an additional 89 MG of storage in the Northwest Side Relief Sewer when it is put into service. These tunnels store wastewater until the wastewater treatment plants have available treatment capacity, at which time the tunnels are emptied at the ISS Pump Station located at JIWWTP.

A detailed discussion of the MIS and ISS systems is presented in the *Conveyance Report.*

2.4.1 Inline Storage System Pump Station

The ISS Pump Station has a designed pumping capacity of 150 million gallons per day (MGD). At the ISS Pump Station, the wastewater collected in the ISS passes through a stationary bar screen before being pumped by three 50 MGD pumps to two head tanks for distribution to either JIWWTP or SSWWTP.

The ISS Pump Station process also includes an inline solids handling facility (ISHF) to process wastewater pumped out of the ISS that contains a high concentration of suspended solids. Operators have found that the suspended solids concentration of the wastewater in the tunnel is low enough that it is more practical to treat the flow with conventional methods. Therefore, ISHF has almost never been operated.

2.4.2 Jones Island Wastewater Treatment Plant

Most of the central portions of Milwaukee County and the city of Milwaukee are served by JIWWTP, as indicated in Figure 2-1. Located on Lake Michigan just south of downtown Milwaukee, JIWWTP receives both combined and separate sewer wastewater flows through two double-barreled siphons under the harbor entrance. The JIWWTP has been designated a National Historic Civil Engineering Landmark because the activated sludge wastewater treatment process, put into operation in 1925, was the first large scale application in the United States. Some of the original facilities exist today as the West Plant aeration basins and clarifiers.

JIWWTP has a design capacity to treat a maximum daily flow of 300 MGD and a peak hourly flow of 330 MGD. The wastewater treatment units at JIWWTP include influent flow measurement, influent pumping, mechanical bar screens, vortex type grit removal, primary clarifiers, aeration basins, secondary clarifiers, disinfection/dechlorination and effluent pumping. The site plan and a schematic of the treatment process at JIWWTP are shown in Figures 2-2 and 2-3 respectively.

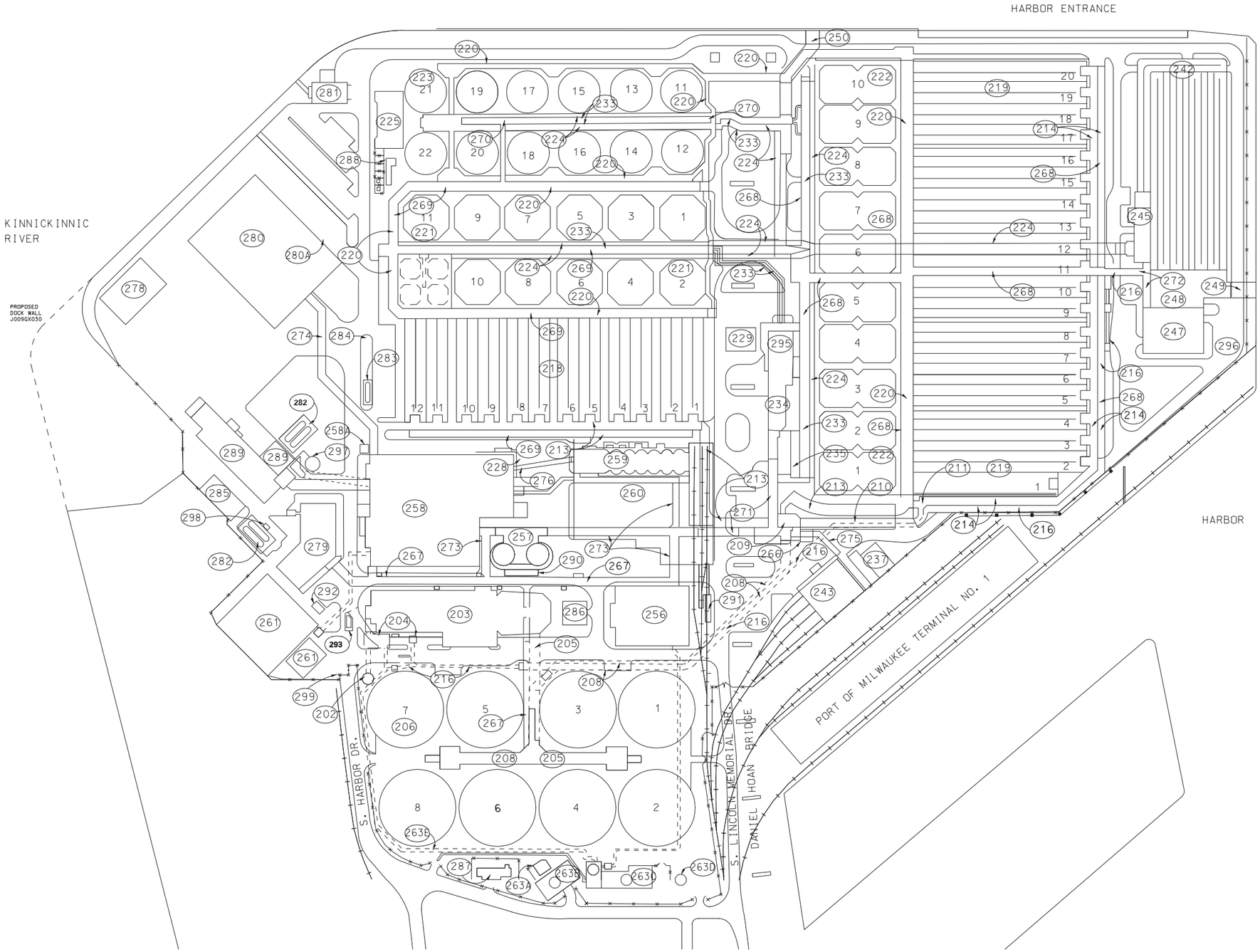

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FIGURE 2-2 SHEET 1 OF 2

JIWWTP SITE PLAN

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BUILDING AND STRUCTURE INDEX

NO.	NAME
201	GENERAL SITE
202	SIPHONS AND SIPHON SHAFT
203	PRELIMINARY TREATMENT FACILITY (J32G21)
204	INFLUENT FLOW METER VAULT & HIGH LEVEL/INLINE JUNCTION BOX
205	PRIMARY INFLUENT CONDUITS OR CHANNELS
206	PRIMARY CLARIFIERS (J33G31)
207	(NOT USED)
208	PRIMARY EFFLUENT CONDUITS OR CHANNELS
209	FLOW CONTROL STRUCTURE
210	MIX CHANNEL
211	MIXED LIQUOR STRUCTURE
212	(NOT USED)
213	WEST PLANT MIXED LIQUOR CHANNELS
214	EAST PLANT MIXED LIQUOR CHANNELS
215	(NOT USED)
216	INLINE FLOW SYSTEM
217	(NOT USED)
218	WEST PLANT AERATION BASINS
219	EAST PLANT AERATION BASINS
220	AERATED EFFLUENT CONDUITS OR CHANNELS
221	WEST PLANT SECONDARY CLARIFIERS
222	EAST PLANT SECONDARY CLARIFIERS
223	NEW EAST PLANT SECONDARY CLARIFIERS
224	SECONDARY EFFLUENT CONDUITS OR CHANNELS
225	PROCESS AIR COMPRESSOR BUILDING
226	(NOT USED)
227	(NOT USED)
228	SALT & GRAVEL STORAGE BIN (J009GX010)(O&M2650-1)
229	MILORGANITE CHAFF DUMPING STATION (J009GX010)
230	(NOT USED)
231	(NOT USED)
232	(NOT USED)
233	RAS PIPES, CONDUITS OR CHANNELS
234	RAS PUMP STATION
235	WAS PUMP STATION
236	(NOT USED)
237	PICKLE LIQUOR FACILITY
238	(NOT USED)
239	(NOT USED)
240	(NOT USED)
241	(NOT USED)
242	CHLORINE CONTACT BASIN
243	CHEMICAL UNLOADING FACILITY (J61G11)
244	(NOT USED)
245	DISINFECTION BUILDING
246	(NOT USED)
247	EFFLUENT PUMP STATION
248	PLANT EFFLUENT CHANNELS
249	PLANT EFFLUENT OUTFALL
250	INTERIM OUTFALL
251	(NOT USED)
252	(NOT USED)
253	(NOT USED)
254	(NOT USED)
255	(NOT USED)
256	THICKENING FACILITY (J51G21)
257	EQUALIZATION AND BLEND FACILITY
258	DEWATERING AND DRYING FACILITY (J51G31)
258A	STORM WATER PUMP STATION (J26-MS-100)
259	MILORGANITE STORAGE FACILITY (J51G71)
260	MILORGANITE PACKAGING FACILITY (NOT BUILT)
261	INLINE SOLIDS HANDLING FACILITY (I37G21 // 87-499 TO 541)
262	INTRIM TRUCK LOADING FACILITY (DEMO. J007GX020)
263	INLINE PUMP STATION
263A	TUNNEL VENTILATION FAN BUILDING
263B	SOLIDS HANDLING AREA
263C	INLINE PUMP STATION SURFACE STRUCTURE
263D	EQUIPMENT SHAFT
263E	INLINE PUMP-OUT
264	(NOT USED)
265	(NOT USED)
266	GALLERY ACCESS ('BUS STOP')
267	PRIMARY TREATMENT GALLERIES
268	EAST PLANT GALLERIES
269	WEST PLANT GALLERIES
270	NEW EAST PLANT CLARIFIER GALLERIES
271	WAS GALLERY
272	DISINFECTION GALLERY
273	SOLIDS GALLERY
274	NONPROCESS GALLERIES
275	CHEMICAL FEED PIPE TRENCH
276	MILORGANITE PIPE TRENCH
277	(NOT USED)
278	BUILDING & GROUNDS FACILITY (J73G41)
279	OPERATIONS BUILDING (J72G11)
280	MAINTENANCE FACILITY (J73G21)
280A	COMPRESSED GAS STORAGE (J009GX020)(construction 2000)
281	NORTH UTILITY PUMP STATION (J63G11)
282	FUEL OIL STORAGE TANKS (J007GX020 // 289-MA-93)
283	LP GAS FACILITY
284	VEHICLE FUEL STATION (J009GX020)(construction 2000)
285	GARAGE
286	PRIMARY SWITCHING STATION
287	ELECTRICAL SUBSTATION
288	SECONDARY MOTOR CONTROL BUILDING
289	POWER HOUSE
289A	POWER HOUSE - BOILER ROOM ADDITION (J007GX020)
290	TRUCK WEIGH STATION
291	RAIL WEIGH STATION
292	GAS METER
293	GATE HOUSE (NOT BUILT)
294	(NOT USED)
295	LABORATORY
296	LAKEFILL
297	STACK
298	FOAM BUILDING (J72G11 // 279-AS-1)
299	MAIN GATE - AUTOMATED (201CF1.dgn)

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FIGURE 2-2 SHEET 2 OF 2
JIWWTP SITE PLAN
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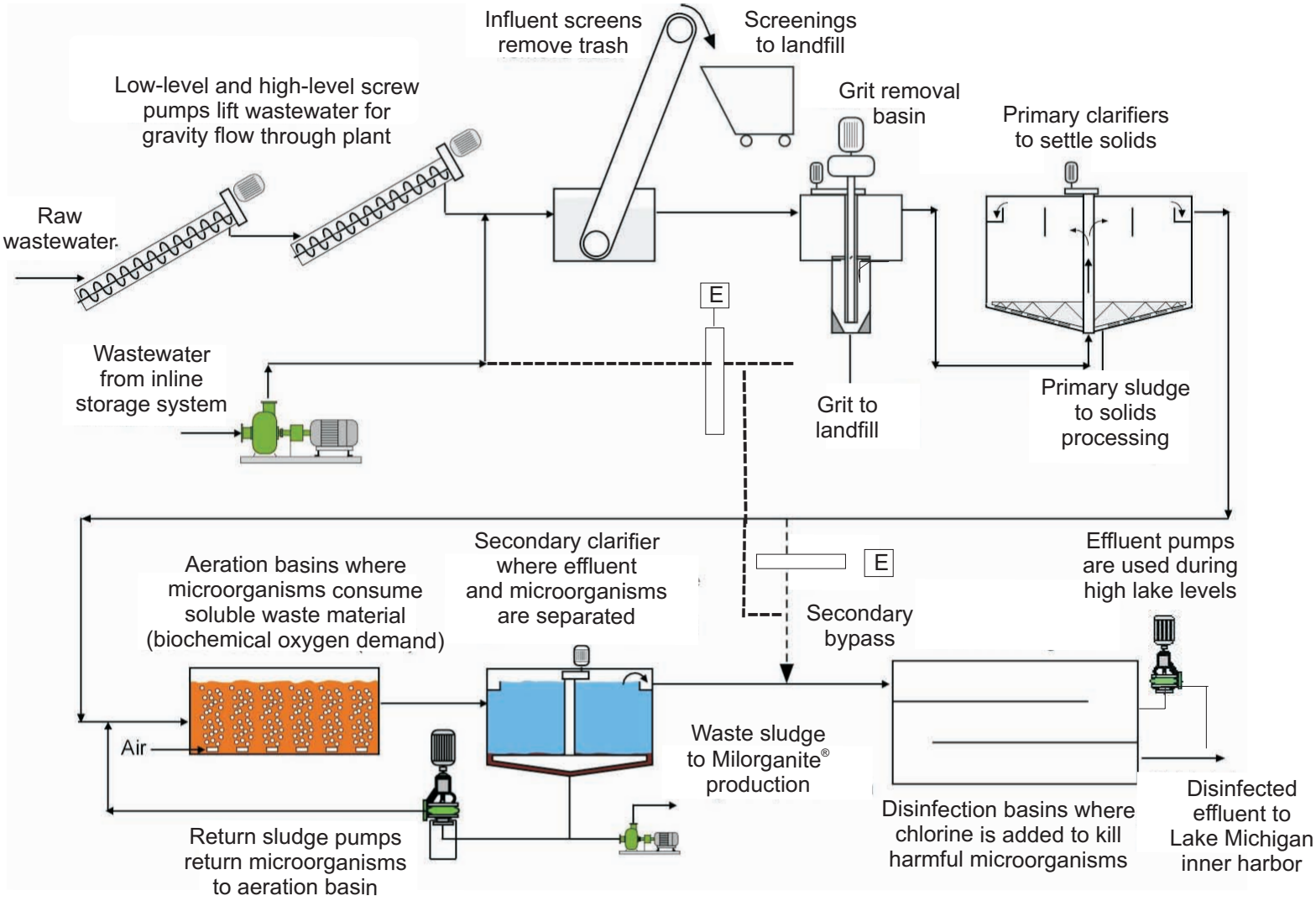

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FIGURE 2-3
JIWWTP
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2.4.3 South Shore Wastewater Treatment Plant

Most of the wastewater generated from the southern, far western, and far northern portions of the MMSD service area as well as wastewater from the areas that can be diverted from JIWWTP are treated at SSWWTP, as shown in Figure 2-1. This facility, first completed in 1968, originally provided only primary treatment with a maximum daily capacity of 60 MGD. In 1974, SSWWTP was expanded to 120 MGD and upgraded to provide secondary treatment with the activated sludge process.

Due to additional expansions, SSWWTP currently has the capacity to treat a maximum daily flow of 250 MGD and a peak hourly flow of 300 MGD. A control gate at SSWWTP can limit the flow entering the plant during wet weather. The wastewater treatment units at SSWWTP include influent flow monitoring, mechanical bar screens, grit chambers, primary clarifiers, aeration basins, secondary clarifiers, disinfection/dechlorination, and effluent pumping. The site plan and a schematic of the treatment process at SSWWTP are shown in Figures 2-4 and 2-5, respectively. Other systems needed for treatment include waste pickle liquor storage and feed systems for phosphorus removal.

2.4.4 Biosolids Facilities

Different processes are used at JIWWTP and SSWWTP for treatment of biosolids. To allow greater flexibility in solids processing, biosolids from each plant can be pumped to the other via an approximately 11-mile long interplant solids pipeline. From SSWWTP, waste activated sludge (WAS) and digested sludge can be pumped to JIWWTP where it is incorporated into the Milorganite® production process. From JIWWTP, primary sludge is pumped to SSWWTP where it is anaerobically digested.

The solids treatment facilities at JIWWTP include gravity belt thickening, sludge equalization and blending, belt filter press dewatering, and rotary drum drying, as shown in Figure 2-6. These treatment processes typically handle raw (or undigested) waste activated sludge from JIWWTP and SSWWTP and a portion of the digested sludge from SSWWTP, though raw primary sludge from JIWWTP can also be processed. The end product is Milorganite®, a marketable fertilizer product that has been sold since 1926.

The solids handling facilities at SSWWTP include anaerobic digestion, centrifuge sludge thickening, filter press sludge dewatering, and liquid sludge storage, as shown in Figure 2-7. These facilities typically handle raw primary sludge from both JIWWTP and SSWWTP, along with a portion of SSWWTP raw waste activated sludge. If SSWWTP raw waste activated sludge is to be added to the anaerobic digesters, it must first be thickened using a dissolved air flotation thickening process. The digested sludge is sent either to JIWWTP as one component of the Milorganite® production or is thickened in the centrifuges and stored on-site. The stored thickened sludge is used as Agri-Life®, a product that is land-applied to farm fields as a liquid or as filter cake.

Milorganite® that does not meet a quality specification and excess filter cake is occasionally landfilled.

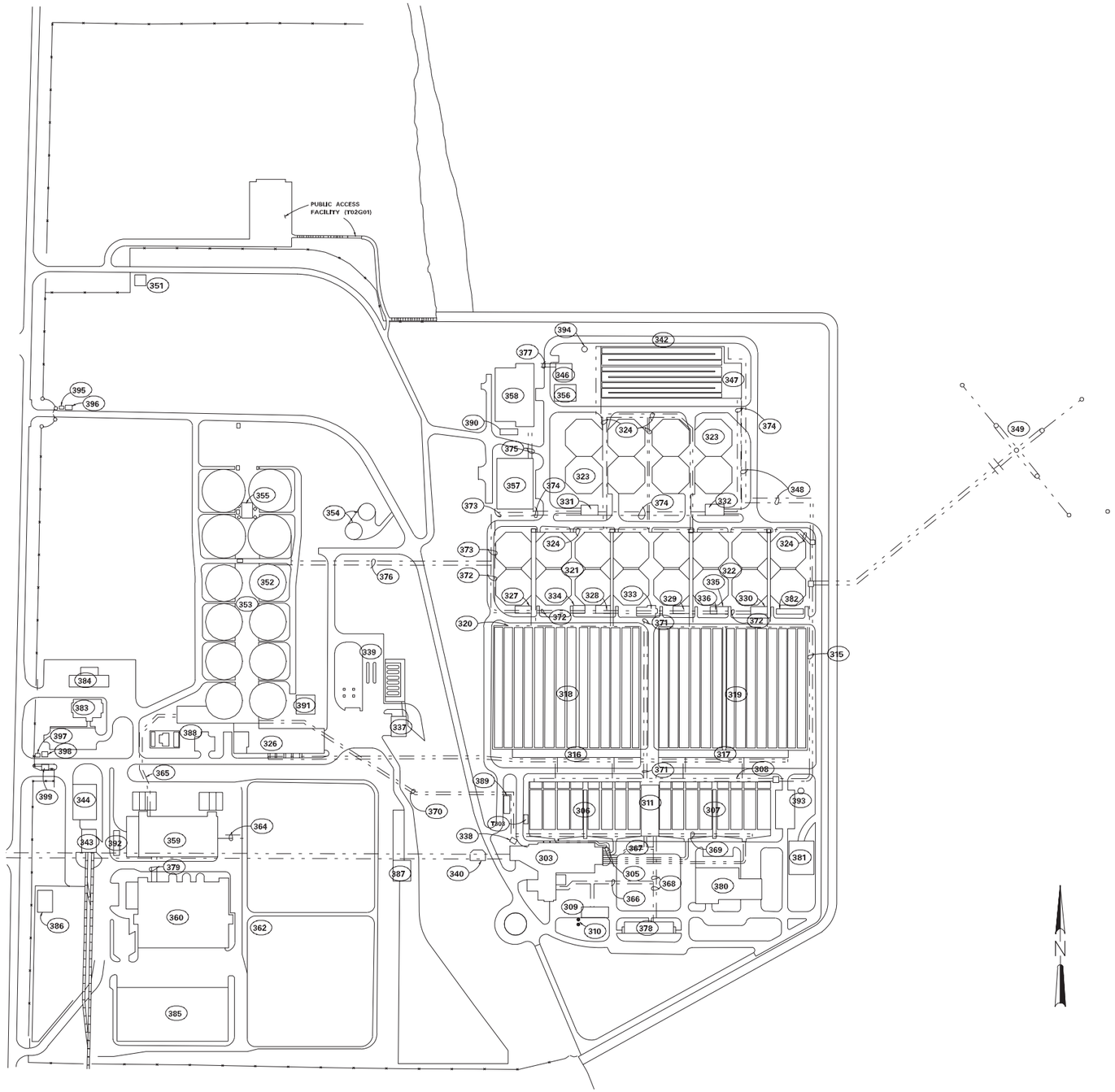

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FIGURE 2-4 SHEET 1 OF 2
SSWWTP SITE PLAN
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BUILDING & STRUCTURE # INDEX

NO.	NAME
301	GENERAL SITE
302	(NOT USED)
303	PRELIMINARY TREATMENT FACILITY (S80, S81, S82, Design S008GX030)
T303	TEMPORARY ELECTRIC BUILDING (S008GX020 - FEB, 2000)
304	(NOT USED)
305	PRIMARY INFLUENT CONDUITS (SEE 303-M-5 & 301-U-15)
306	PRIMARY CLARIFIERS (WEST) (S80)
307	PRIMARY CLARIFIERS (EAST)
308	PRIMARY EFFLUENT CHANNEL (S81, S82, & SEE 306)
309	SCUM HANDLING BUILDING (Design S008GX030 - JULY, 2000)
310	LOWER SITE SANITARY PUMP STATION (Design S008GX030 - JULY, 2000)
311	CENTRAL CONTROL BUILDING
312	(NOT USED)
313	(NOT USED)
314	(NOT USED)
315	SECONDARY DIVERSION CONDUIT (S80 & SEE 349)
316	AERATION BUILDING (WEST) (S82)
317	AERATION BUILDING (EAST) (S82)
318	AERATION BASIN (WEST) (S81 & S82)
319	AERATION BASIN (EAST) (S81 & S82)
320	AERATION EFFLUENT CHANNEL (S82, & SEE 318)
321	SECONDARY CLARIFIERS (WEST) (S82)
322	SECONDARY CLARIFIERS (EAST)
323	SECONDARY CLARIFIERS (NEW) (S41)
324	SECONDARY EFFLUENT CHANNELS (S41)
325	(NOT USED)
326	BLOWER & GENERATOR BUILDING (S58 & S82)
327	SECONDARY CONTROL BUILDING #1 (S82)
328	SECONDARY CONTROL BUILDING #2
329	SECONDARY CONTROL BUILDING #3
330	SECONDARY CONTROL BUILDING #4
331	SECONDARY CONTROL BUILDING #5 (S41)
332	SECONDARY CONTROL BUILDING #6 (S41)
333	AREA CONTROL CENTER #3
334	WAS PUMP STATION #1 (S82)
335	WAS PUMP STATION #2 (S82)
336	HCL GAS CLEANING BUILDING (S82)
337	PICKLE LIQUOR STORAGE (S50 & S81)
338	PICKLE LIQUOR OXIDATION BUILDING (S80)
339	PICKLE LIQUOR FACILITY (T60G01)
340	MIS FLOW CONTROL STRUCTURE (S31G11)
341	(NOT USED)
342	CHLORINE CONTACT BASIN (S61)
343	CHLORINE UNLOADING STATION
344	CHLORINE & SULFUR DIOXIDE FEED BUILDING (S80 & S81)
345	(NOT USED)
346	DISINFECTION BUILDING (S61)
347	EFFLUENT PUMP STATION (S61)
348	PLANT EFFLUENT CONDUIT (S70 & S61)
349	PLANT EFFLUENT CONDUIT (270) & ROCK REEF
350	(NOT USED)
351	JUNCTION STRUCTURE/GUARD STATION (S72)
352	ANAEROBIC DIGESTERS (S54, S55 & S81)
353	DIGESTERS GALLERY (S54, S55, S56, S61, S80, S81 & S82)
354	DIGESTER GAS STORAGE (S80)
355	COMPRESSOR BUILDING (S54)
356	INTERPLANT SOLIDS PUMP STATION (S72)
357	SLUDGE THICKENER BUILDING (DISINFECTION PER JS249X020)
358	SLUDGE THICKENER FACILITY (S82)
359	SLUDGE DEWATERING BUILDING PHASE 1 (S50)
360	DEWATERING BUILDING PHASE II (S57)
361	(NOT USED)(WAS INCINERATOR BUILDING)(S80)(S008GX030)
362	SLUDGE LAGOONS
363	(NOT USED)(WAS PRIMARY SLUDGE SCREENING FACILITY) (S42)(S008GX030)
364	UTILITY TUNNEL #14 (S50)
365	UTILITY TUNNEL #13 (S50)
366	UTILITY TUNNEL #1 (856)(S82)(S008GX030 - JULY, 2001)
367	UTILITY TUNNEL #2 (S82)
368	UTILITY TUNNEL #3 (S82)
369	UTILITY TUNNEL #4 (S41, S81 & S82)
370	UTILITY TUNNEL #5 (S82)
371	UTILITY TUNNEL #6 (S82)
372	UTILITY TUNNEL #7 (S82)
373	UTILITY TUNNEL #8 (S82)
374	UTILITY TUNNEL #9 (S41 & S82)
375	UTILITY TUNNEL #10 (S82)
376	UTILITY TUNNEL #11 (S82)
377	UTILITY TUNNEL #12 (S82)
378	ADMINISTRATION BUILDING
379	UTILITY TUNNEL #15 (S57)
380	MAINTENANCE BUILDING A
381	MAINTENANCE BUILDING B
382	MAINTENANCE BUILDING C
383	AGRI-LIFE OPERATIONS BUILDING (S74)
384	TRUCK WASH FACILITY (S74)
385	SLUDGE CONTAINER BUILDING (S57)
386	MAINTENANCE BUILDING D (O&M PROJ# 3000-2)
387	EXPERIMENTAL SLUDGE DEWATERING BUILDING (S57)
388	ELECTRICAL SUBSTATION & LCUS # 1 (S80)
389	LCUS # 2
390	LCUS # 3
391	RESERVOIR
392	LCUS # 4
393	PRIMARY UNDERDRAIN STATION (S81-U-2A)
394	SECONDARY UNDERDRAIN STATION (S41)
395	NORTH POTABLE WATER METER MANHOLE (S82)
396	NORTH BACKFLOW PREVENTER VAULT (S82)
397	SOUTH POTABLE WATER METER MANHOLE (S82)
398	SOUTH BACKFLOW PREVENTER VAULT (S82)
399	GUARDHOUSE (S004GX020)

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FIGURE 2-4 SHEET 2 OF 2
SSWWTP SITE PLAN
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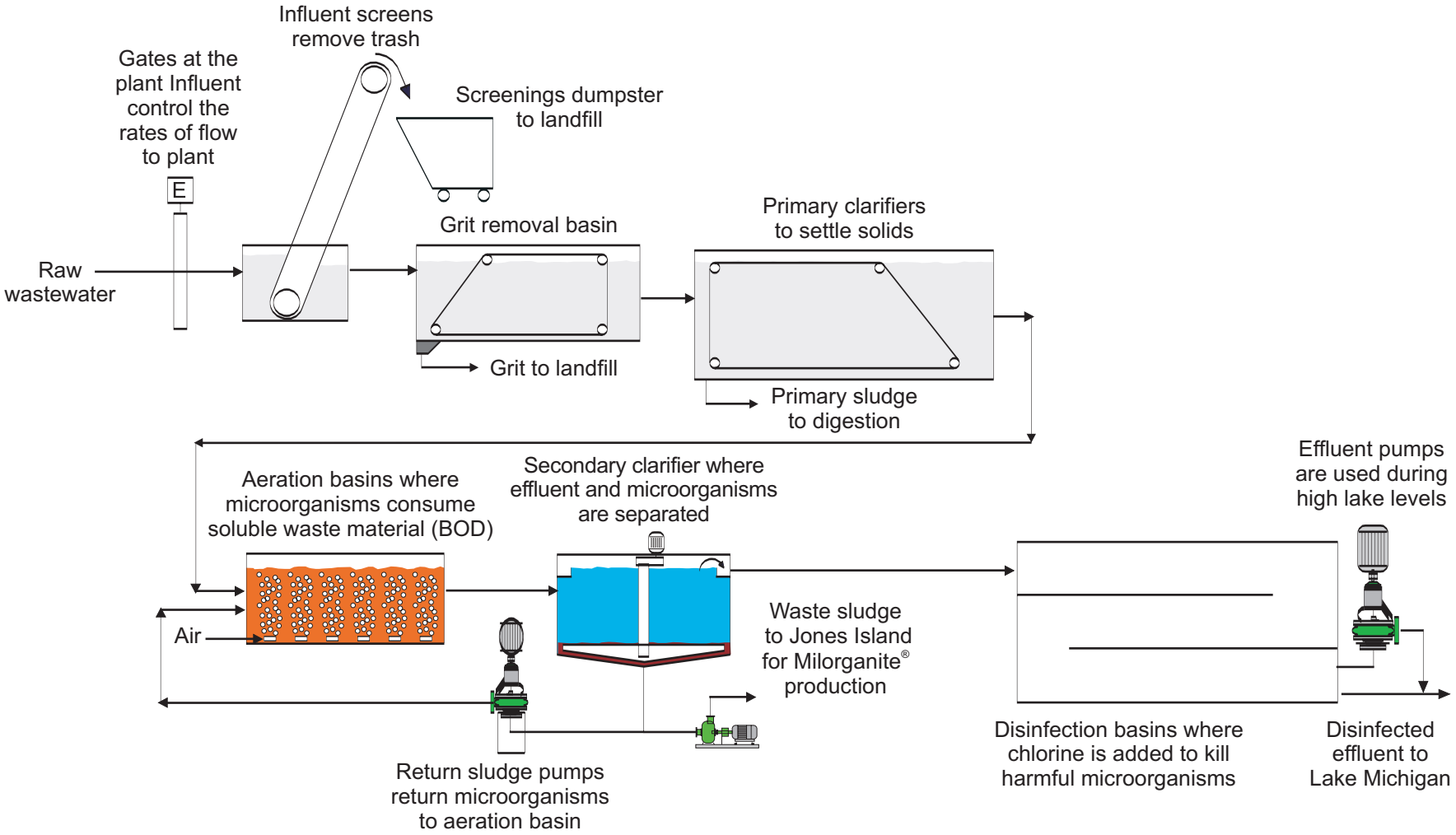

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FIGURE 2-5
SSWWTP
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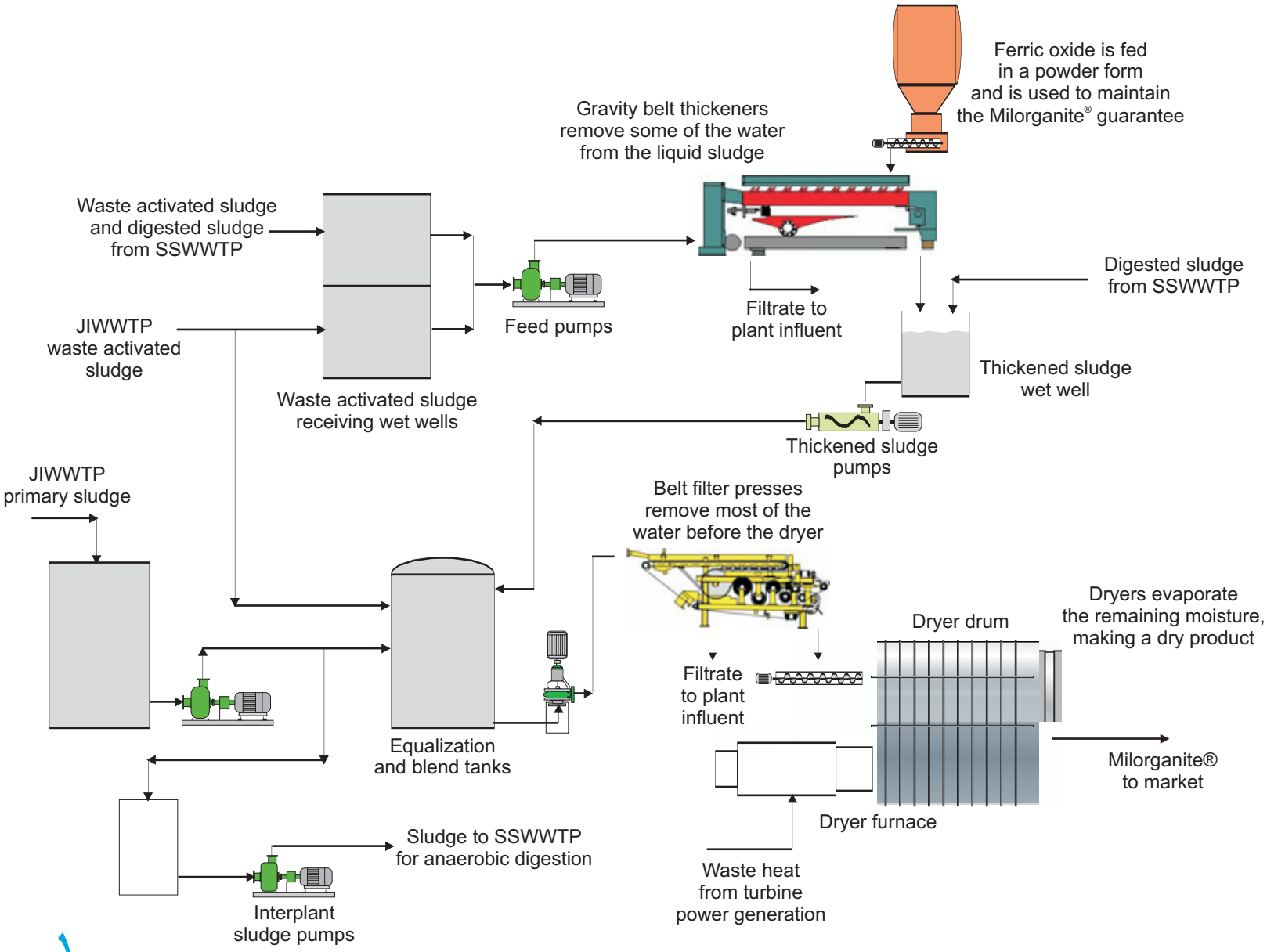

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FIGURE 2-6
JIWWTP BIOSOLIDS FACILITY
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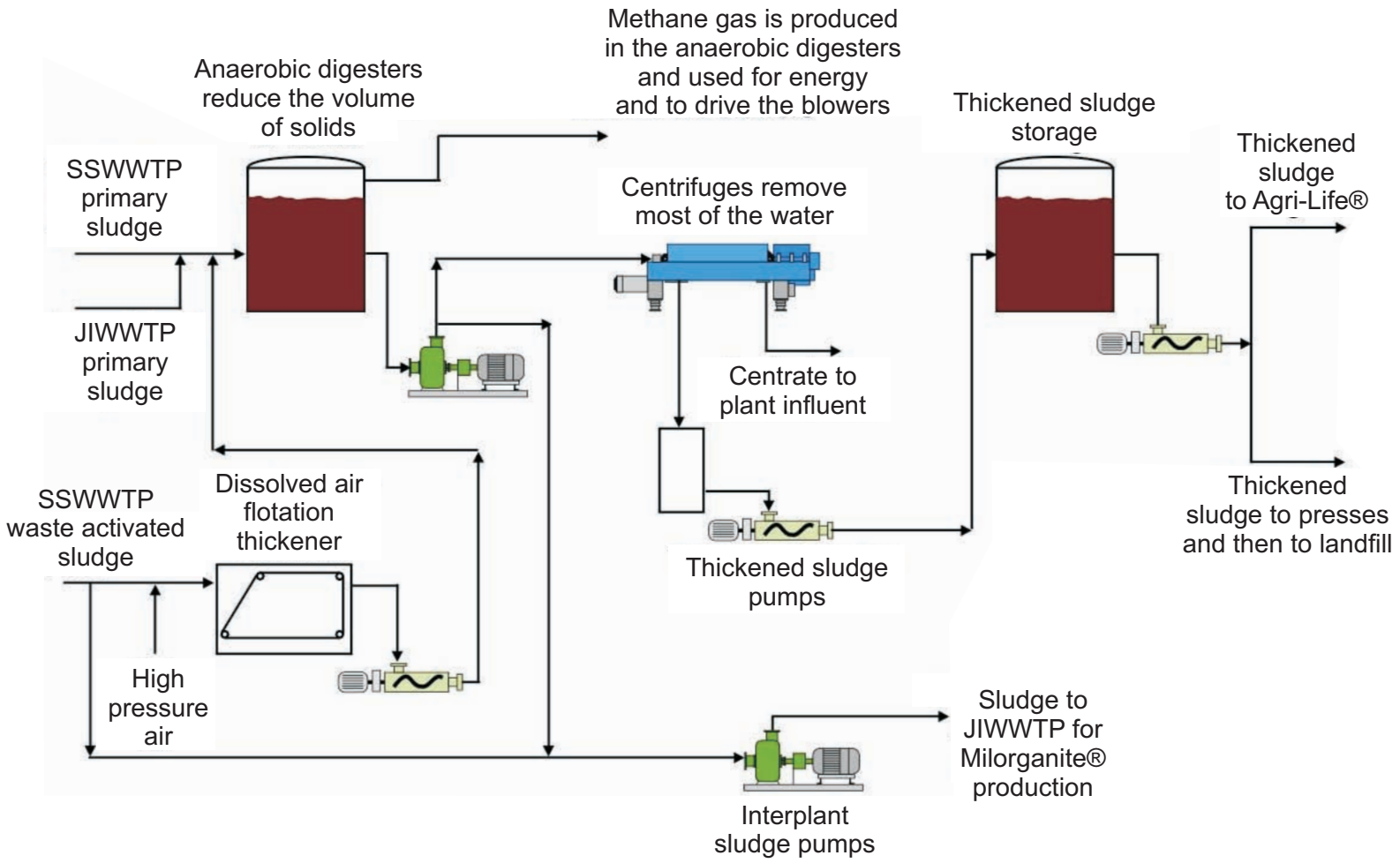

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FIGURE 2-7
SSWWTP BIOSOLIDS FACILITY
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2.4.5 Recycling Biosolids (Milorganite® and Agri-Life®)

All publicly owned treatment works must comply with Title 40 of the Code of Federal Regulations, Part 503 (also known as the EPA Part 503 Biosolids Rule), which provides requirements for the management of biosolids produced during the treatment of wastewater. The rule encourages the beneficial reuse of biosolids while regulating landfill disposal and incineration. As discussed above, heat-dried sludge produced in dryers at JIWWTP is marketed as Milorganite®, a Class A biosolid as defined by the EPA Part 503 Biosolids Rule. Milorganite® is sold as a fertilizer product to a variety of end-users and due to its Class A rating, the land application of the product is largely unregulated. Milorganite® is stored in silos located at JIWWTP to accommodate seasonal fluctuations in Milorganite® sales.

As discussed above, the digested sludge produced at SSWWTP is marketed as Agri-Life®, a product that has been land applied since 1975. Agri-Life® is considered a Class B biosolid by the EPA Part 503 Biosolids Rule, and therefore is more highly regulated. The digested sludge is stored on site until it can be applied to agricultural land in either the spring or fall seasons. The MMSD owns and maintains a fleet of vehicles that both haul and land apply Agri-Life®.

2.4.6 Energy Facilities

Most of the electricity at JIWWTP is generated through 2 General Electric Frame 5 turbine generators, each rated for 15 mega watts of power. Plant loads generally require between 10 and 12 mega watts, so only one turbine needs to operate at a single time while the other turbine remains available as a back up. The two turbines were installed in the mid-1970s and were refurbished in 1996.

Waste heat from the turbines is used in the sludge drying process. During on-peak periods the turbines are operated to avoid peak demand charges. At night, the turbines produce only enough waste heat to operate the dryers with the remaining electrical power purchased from the electric company.

Electricity from the power company can be purchased and provided through the Dewey Substation or the Harbor Substation, though the Dewey Substation serves as the primary source of power. Though the same power company provides these two sources, they operate at different phases; therefore, power cannot be coming from both sources simultaneously unless the equipment receiving power from one substation is isolated from the other substation.

Natural gas provided to the site is used primarily to generate electrical power. Natural gas can also be used for sludge drying and to provide some building heat.

At SSWWTP there are two parallel electrical power supplies, either of which can serve as the primary source of power. An automatic transfer switch monitors the primary power source and will automatically transfer to the back-up power source should the primary power fail.

In addition to electrical power, the digester gas produced from the anaerobic digesters powers one or more of the process air blowers and an electrical generator. The electrical generator is used primarily for peak shaving, as it is not sized to handle the full electrical load at the treatment plant.

Heat recovered from the blowers and the electrical generator is captured by the hot water system and used to heat the digesters and some buildings.

References

(1) Southeastern Wisconsin Regional Planning Commission, Planning Report No. 50, *A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds*, Chapter X (Draft report, January 2007)