GOLDER

September 20, 2019 19-125665

Mr. Robert Stafford
Duke Energy Florida
299 1st Avenue North
St. Petersburg, FL 33701

RE: REVISED COAL COMBUSTION PRODUCT AND SOLID WASTE MATERIAL MANAGEMENT PLAN CRYSTAL RIVER ENERGY COMPLEX CRYSTAL RIVER, FLORIDA

Dear Mr. Stafford:

In conjunction with Duke Energy Florida, Inc., Golder Associates Inc. has prepared this revised Coal Combustion Product (CCP) and Solid Waste Material Management Plan for the Crystal River Energy Complex (CREC). This revised CCP and Solid Waste Material Management Plan is intended to comply with the applicable requirements from Section B, Condition 1.E. Solid Wastes Management Plan of the Conditions of Certification for CREC (PA 77-09S) issued by the Florida Department of Environmental Protection on November 6, 2017.

Should you have any questions or comments, please contact me at (904) 363-3430 or by email at sstafford@golder.com.

Sincerely,

Golder Associates Inc.

SAMUEL F. STAFFORD LICENSE No. 78648 STATE OF FLORIDA PROFESSIONAL ENGINEER

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COAL COMBUSTION PRODUCT (CCP)/
SOLID WASTE MATERIALS MANAGEMENT PLAN

DUKE ENERGY FLORIDA

CRYSTAL RIVER ENERGY COMPLEX

CRYSTAL RIVER, FLORIDA

SEPTEMBER 2019

(REVISION 0 – DECEMBER 2008)
(REVISION 1 – MAY 2009)
(REVISION 2 – DECEMBER 2009)
(REVISION 3 – APRIL 2010)
(REVISION 4 – SEPTEMBER 2010)
(REVISION 5 – NOVEMBER 2012)
(REVISION 6 – DECEMBER 2013)
(REVISION 7 – AUGUST 2019)
(REVISION 8 – SEPTEMBER 2019)

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Coal Combustion Product (CCP) and Solid Waste Material Management Plan is to describe the procedures for management of CCPs and other (non-CCP) waste material generated at the Crystal River Energy Complex (CREC) operated by Duke Energy Florida, Inc. (DEF) and complies with applicable sections of rule Chapter 62-701, Florida Administrative Code (F.A.C.). The fossil plant is located near Crystal River in Citrus County, Florida. This plan is designed to assist the facility in maintaining compliance with applicable permits and environmental regulations, preventing release of products to the environment. The requirements for a CCP and Solid Waste Material Management Plan are detailed in the Conditions of Certification (PA77-09S) which states:

> *No later than December 31, 2008 or 180 days prior to the initial operation of Unit 4 and 5 FGD scrubbers (whichever occurs first), the licensee shall submit a site-wide Coal Combustion By-Product (CCP)/Solid Waste Materials Management Plan that addresses operations of the fossil generating units to the Department's SWD Office and Siting Office for review and approval. The plan shall, at a minimum, include the following information:*
>
> 1. *Descriptions and procedures for all applicable processes for on-site storage practices and management of CCPs, solid wastes and industrial by-products at the site.*
> 2. *Plans or methods to minimize waste streams, and maximize beneficial use opportunities of CCPs;*
> 3. *Methods for preventing or minimizing the release of contaminants to the environment, including (as applicable) leachate collection and control methods that meet the requirements of Chapter 62-701, F.A.C.;*
> 4. *Certification for the above information, as appropriate, by a Professional Engineer registered in the state of Florida.*

According to rule Chapter 62-701, F.A.C., Solid Waste Management Facilities, industrial byproducts are exempt from solid waste disposal regulation provided the industrial byproducts definition is met. Industrial byproducts are exempt from Chapter 62-701 F.A.C. if:

1. A majority of the industrial byproducts are demonstrated to be sold, used, or re-used with one year;
2. The industrial byproducts are not discharged, deposited, injected, dumped, spilled, leaked, or placed into or upon any land or be emitted into the air or discharged into any waters including groundwater, or otherwise enter the environment such that a threat of contamination in excess of water quality standards and criteria or air quality standards is caused; and
3. The industrial byproducts are not hazardous waste.

1.2 Facility

1.2.1 Location

The CREC is located near the Gulf of Mexico in Citrus County, Florida. The CREC encompasses approximately 4,750 acres and is situated in portions of Sections 28 through 36, Township 17 South, Range 16 East and Sections 3, 4, 5, 9, and 10, Township 18 South, Range 16 East (Golder, April 2007). The center of the CREC is at approximately 28°57’50” latitude, and 82°41’41” west longitude.

1.2.2 Operations

The Florida Siting Board issued the Site Certification (PA77-09) for Duke Energy Florida’s Crystal River Units 4 and 5 on November 21, 1978. This certification authorized the construction and operation of two coal-fired power plant units (Units 4 and 5) and ancillary facilities. Crystal River nuclear Unit 3 was certified on August 28, 2008. The Conditions of Certification also covers Units 1 and 2 of the adjacent Citrus Combined Cycle (CCC) Plant. The Department of Environmental Protection (Department or FDEP) has modified the Conditions of Certification by Final Order on several other occasions as changes to the facility occur.

The CREC consists of two active generating units. Units 4 and 5 are active coal-fired steam units located on the northern portion of the plant site. Units 1 and 2 are retired coal-fired steam units located on the southern portion of the plant site. Unit 3 is a retired nuclear power plant located on the south side of the complex and is excluded from this plan.

Units 1 and 2 were removed from service in December 2018. Decommissioning of the units will continue until the decommissioning process has been accomplished according to DEF’s plan. Coal combustion products are no longer generated from Units 1 and 2, however, there may be coal combustion products removed from equipment during demolition activities that may be stored or disposed in the ash storage/disposal area or transported off-site similar to legacy operations.

1.2.3 Permits

CREC is governed by the Department issued Conditions of Certification (COC). The COC contains requirements for the operation of the facility and its ancillary equipment. The certified site includes but is not limited to the following major associated facilities:

- Unit 4 & 5 coal storage area, coal storage area runoff treatment ponds and coal conveyor system;
- Unit 4 & 5 ash storage area;
- Unit 4 & 5 industrial wastewater (IWW) percolation pond;
- Units 1, 2, and 3 and FGD IWW disposal pond system; and
- FGD Wastewater Treatment Plant.

Attachment H of the latest revision to the COC (MOD S) addresses groundwater monitoring, and, operation and maintenance requirements for the certified site. These groundwater monitoring, operation and monitoring requirements (GWMOMR) were developed by DEF and FDEP’s industrial wastewater and solid waste section to incorporate the groundwater monitoring requirements of former industrial wastewater permit, FLA016960 into the facility's COC. The current GWMOMR incorporates Units 4 and 5 IWW percolation pond, Units 1, 2 and 3 percolation pond system, Units 4 and 5 coal storage area, ash landfill, the former (closed) flue gas desulfurization (FGD) blowdown treatment pond area, and south coal storage area.

The wastewater sources include plant equipment drains, laboratory drains, floor drains, neutralized wastes from demineralizer resin beds, water treatment process wastewater, boiler blowdown, boiler drains, pre-heater wash drains, sewage treatment plant effluents, transformer area storm water drainage, wastewater treatment plant treated effluent water, precipitator washes, boiler washes, cooling water blowdown, and filtration concentrate.

Two separate industrial wastewater permits (IWWPs) pertain to surface water discharges for Unit 1, 2 and 3 (plus Citrus Combined Cycle), and Units 4 and 5, and constitute authorization to discharge to Waters of the State under the National Pollutant Discharge Elimination System (NPDES).

NPDES IWWP FL0000159 - Units 1, 2 and 3

Industrial Wastewater Facility Permit Number FL0000159 was issued by FDEP for Units 1, 2, 3 and Citrus Combined Cycle. The permit expired on April 6, 2019 and it is currently under renewal. The current permit authorizes the following discharges to State waters under NPDES: once-through condenser cooling water, treated nuclear auxiliary cooling water, treated coal pile rainfall runoff, intake screen wash water, and treated non-radioactive waste/radiation waste. This permit authorizes and requires select monitoring of 12 surface water discharge locations and four internal discharge locations. Please note that with the retirement of Units 1,2 & 3, the renewed permit is expected to have different authorizations and conditions.

NPDES IWWP FL0036366 - Units 4 and 5

Industrial Wastewater Facility Permit Number FL0036366 was issued July 18, 2011 by FDEP for Units 4 and 5 and authorizes discharge to State waters under NPDES. The permit expired on July 17, 2016 and it is currently under renewal. Wastewater at the facility consists of non-contact recirculating cooling tower blowdown (CTBD) and runoff from coal and ash storage and handling areas. CTBD discharges to the site discharge canal after being chlorinated in the cooling towers. Rainfall runoff from the coal yard, ash storage area, ash sluice/dewatering system, and transport truck rinse water is treated in the collection areas by sedimentation. Runoff overflow occasionally discharges to the runoff collection system which in turn discharges to the site discharge canal covered under permit FL0000159. This current permit authorizes and requires select monitoring of two surface water discharge locations (CTBD) and one storm water discharge location which includes internal outfall from the coal storage area and ash storage area. Please note that with the permit renewed permit may have different authorizations and conditions.

2.0 COAL COMBUSTION PRODUCT AND NON-COAL COMBUSTION PRODUCT – MATERIALS

Product materials currently generated at CREC are grouped into the following categories:

Coal Combustion Products (CCPs)

- Fly Ash
- Bottom Ash
- Flue Gas Desulfurization Products (Gypsum)

Non-Coal Combustion Products (Non-CCPs)

- Cooling Tower Solids (Units 4 and 5, Helper Cooling Towers)
- Dredge Materials (intake/discharge canals, ditch cleanings, IWW ponds)
- Truck Wash Solids

Miscellaneous Solid Wastes

- Impacted Soils (site-wide)

This section provides product process descriptions, material characteristics, estimated generation rates, and transport destinations for waste products generated at CREC. A site plan showing identified areas is presented on Figure 1. Process flow diagrams for the above coal combustion products and non-coal combustion products are provided on Figures 2 and 3. A summary of coal combustion products and non-coal combustion products is provided in Table 1.

2.1 FLY ASH

Fly ash is an industrial byproduct produced during the coal combustion process in each unit and is captured from furnace flue gas and collected by electrostatic precipitators (ESPs). Units 4 and 5 fly ash is transferred from the ESPs to individual storage silos. Fly ash from storage silos is loaded into pressure-differential trucks or conditioned by a pug mill prior to being loaded into dump trucks for off-site beneficial use or on-site storage.

A primary CCP contractor supports DEF with the management and final disposition of fly ash. To the extent that the primary CCP contractor is unable to use or sell these materials, it transfers temporarily unsalable fly ash to the existing on-site ash storage area located east of Units 4 and 5 (see Figure 1). The primary CCP contractor supports CREC with the transportation, spreading, compacting and pile maintenance operations for the ash storage/disposal area (AS/DA). Fly ash may be removed for off-site beneficial use from the storage area by a secondary CCP contractor. The secondary CCP contractor supports DEF with ash reclamation and beneficial use opportunities.

Fly ash is typically gray in color with a particle size that ranges from a very fine ash to pebble sized spent cinders. In November 2007, statistically representative samples were collected from the fly ash storage area for synthetic precipitation leaching procedure (SPLP) analysis. Based on mean concentrations of the sample results, SPLP exceedances of Primary Drinking Water Standards (Chapter 62-550, FAC) (PDWS), Secondary Drinking Water Standards (Chapter 62-550, FAC) (SDWS) and Groundwater Guidance Concentrations (Chapter 62-777, FAC) (GGC) were reported for the following: aluminum (SDWS), antimony (PDWS), arsenic (PDWS), boron (GGC), molybdenum (GGC), selenium (PDWS) and vanadium (GGC).

Table 2 provides production, beneficial use and disposal rates of fly ash.

2.2 BOTTOM ASH

Units 4 and 5 use wet systems for bottom ash handling. Bottom ash from each boiler falls into a hopper and is transported with water into a transfer tank. An ash slurry pump transfers the bottom ash/water mixture to a dewatering bin where solids are allowed to settle. The wet bottom ash (about 20% moisture) from each dewatering bin is then transported in trucks for either off-site beneficial use or on-site storage at the AS/DA.

Water from the dewatering bins overflows into an ash settling tank. Solids which are carried over with the water settle and are pumped back into the dewatering bin. Water overflows the ash settling tank into a surge tank where it is pumped back to the bottom ash hopper to sluice more bottom ash. Overflow water is sent to the FGD filtrate tanks at the wastewater treatment plant. Under emergency conditions, overflow water may be discharged to IWW percolation ponds. A pit below the bottom ash hopper catches any leakage from the bottom ash hopper and a sump pump sends this water to the dewatering bin. Make-up water to the system comes from service water and is introduced at either the ash settling tank or directly to the surge tank.

A primary CCP contractor supports DEF with management and final disposition of bottom ash. The primary CCP contractor supports CREC with the transport, spreading, compacting, and pile maintenance operation for the bottom ash that it determines not to be salable. Bottom ash deposited in the AS/DA may be removed for off-site beneficial use by a secondary CCP contractor who support CREC with ash reclamation and beneficial use opportunities.

Units 4 and 5 bottom ash typically ranges from very fine to gravel sized ash and is brownish gray in color. In November 2007, statistically representative samples were collected from the Units 4 and 5 bottom ash storage pile for SPLP analysis. The mean SPLP values of the Units 4 and 5 bottom ash exceeded the PDWS for arsenic and the SDWS for aluminum and iron.

Table 2 provides production, beneficial use and disposal rates of bottom ash.

2.3 FLUE GAS DESULFURIZATION PRODUCTS

The flue gas desulfurization (FGD) system constructed for Units 4 and 5, became operational in December 2009, and began scrubbing up to 5 lbs. SO_2 per million Btu coal in April 2011. The FGD system produces synthetic gypsum (calcium sulfate). FGD system operations include a gypsum dewatering facility, a wastewater treatment system, a conveyor, and a storage pad. The synthetic gypsum produced by the FGD system is transported via conveyor to an adjacent gypsum marketer for beneficial use, temporarily stored at the gypsum storage pad, or placed in the AS/DA for disposal or later reclamation. The wastewater treatment plant produces a FGD blowdown filter cake. Table 2 provides production, beneficial use and storage/disposal rates of Units 4 and 5 gypsum.

In March 2010, samples were collected from the temporary gypsum stockpile for SPLP analysis (Golder, April 2010). The mean SPLP values of the gypsum stockpile samples exceeded the respective PDWS and/or SDWS of the following constituents: aluminum (SDWS), fluoride (PDWS and SDWS), sulfate (SDWS), and total dissolved solids (SDWS).

The Former North Ash Pond was converted to the FGD Blowdown Pond System which became operational in February 2010 and was taken out of service in February 2019 when the wastewater treatment system was put into operation. During the operation and closure of the FGD Blowdown System, pond solids were removed from the ponds and transported to the AS/DA for beneficial use or disposal. In March 2010, solids samples were collected from influent blowdown waste stream for SPLP analysis (Golder, April 2010). The mean SPLP values of the FGD Blowdown Pond System solids exceeded the respective PDWS, SDWS or GGC of the following constituents: boron (GGC), manganese (SDWS), fluoride (PDWS and SDWS), sulfate (SDWS) and total dissolved solids (SDWS). The FGD blowdown filter cake generated by the wastewater treatment system was sampled and analyzed in accordance with Test Method 1311 – Toxicity Characteristic Leaching Procedure (TCLP). Data confirmed the material is not hazardous and may be disposed in the AS/DA. Characterization of the filter cake will be developed after the wastewater treatment plant reaches steady operations which is expected to by October 31, 2019.

2.4 COOLING TOWER SOLIDS

Units 4 and 5 employ natural draft hyperbolic cooling towers for water cooling. The discharge canal employs a series of auxiliary mechanical draft cooling towers to cool discharge canal water in order to meet the point of compliance temperature requirements.

Beneficial use options for cooling tower solids may be explored with local landfills for use as daily cover. If beneficial use is not viable, the solids will be disposed in the AS/DA as mentioned in the COC Mod S Attachment H or transported off-site for disposal. The auxiliary cooling tower solids have, in the past, been put to beneficial use on site as road material.

On January 14, 2009, DEF submitted via email a request to FDEP to authorize on-site use of cooling tower solids as “fill-material”. The request included a proposed sampling plan for the Department’s review and approval. On February 4, 2009, the Department submitted an email approving DEF’s proposed sampling parameters with the following changes: include SPLP for nickel, sodium, chlorides, vanadium, antimony, and boron. The following parameters were sampled and analyzed in accordance with EPA Method 1312 Synthetic Precipitation Leaching Procedure which is designed to determine the leachability of analytes:

Parameter	TCLP (RCRA Limits)	SPLP (Drinking Water Standards)	Other
Antimony		X	
Arsenic	X	X	
Barium	X	X	
Boron		X	
$CaCO_3$			Totals
Cadmium	X	X	
Chloride		X	Totals
Chromium	X	X	
Lead	X	X	
$MgSO_4$			Totals
Mercury	X	X	
Selenium	X	X	
Silver	X	X	
Sodium		X	Totals
Nickel		X	
pH			pH Units
Vanadium		X	
Zinc		X	

The sampling plan was based on the constituents expected to be seen in the cooling tower solids primarily due to the intake water quality and chemical usage such as algaecides and acid. Some potential constituents include inorganic salts (e.g. $CaCO_3$, $MgSO_4$), which are generated as a result of natural deposition from the intake cooling water and metals, were included in the laboratory analyses.

The analytical results did not exceed respective primary and secondary drinking water standards and guidance concentrations with the following exceptions: Sodium (PDWS) was exceeded and chloride (SDWS) was exceeded. Because the plant is considered an "existing facility", secondary drinking water standards do not apply for this location. While sodium was the only constituent of concern, DEF is pursuing an exemption for sodium because of its natural presence in this coastal environment.

As previously described, cooling tower solids from Units 4 and 5 are generated over an approximate 6-year period. When the solids are generated, DEF will explore beneficial use of the material prior to disposal. The analytical results from the parameters sampled in 2009 were favorable and thus beneficial use as on-site road material or on-site fill material is preferred instead of disposal.

DEF will submit to the Department for review and approval proposed future beneficial use opportunities such as on-site road material or on-site fill material. To evaluate any such beneficial use opportunities, DEF will refer to the 2009 sampling plan that was reviewed and approved by the Department unless the Department requires an amendment to the sampling approach.

On July 9, 2019, DEF and FDEP-Tallahassee Solid Waste Section discussed disposal of cooling tower solids from the Citrus Combined Cycle Plant. The Department had previously provided DEF with a one-time authorization to dispose cooling tower solids in the AS/DA based on the analytical data that revealed the material is not a hazardous waste. DEF had conducted a TCLP analysis confirming the material is not a hazardous waste. The Solid Waste Section agreed that cooling tower solids may be disposed in the AS/DA on a regular basis based on the TCLP analysis and confirmation that constituents don't exceed their respective Groundwater Cleanup Target Level contained in rule Chapter 62-777 F.A.C. This confirmation needs to occur by profiling cooling tower solids and performing an analysis via EPA Test Method 1312 – Synthetic Precipitation Leaching Procedure (SPLP) which is designed to determine the mobility of analytes.

2.5 DREDGE MATERIALS

As part of ongoing maintenance to ensure proper function of the plant's water bodies, excavation or dredging of deposited solids is necessary. Generally, this is performed on an as-needed basis; however, based on past experience, some locations may be subject to a scheduled frequency for the removal work. The following are the dredging subject areas:

- Ash storage area ponds and canal;
- Industrial wastewater percolation ponds;
- Ditches and canals;
- FGD blowdown settling ponds;
- Units 4 and 5 coal yard storm water ponds; and
- Units 1 and 2 coal yard storm water ponds.

The AS/DA stormwater basins and ditches are excavated on an as-needed basis. Portions of the stormwater basins receiving direct runoff from active operations areas are cleaned out approximately every six months. In the past, fly ash was the primary material recovered and was returned to the AS/DA.

The plant has five (5) IWW percolation ponds which are part of the industrial wastewater management system. Dredge spoils from the percolation ponds will either be transported off-site for disposal or disposed on-site in the AS/DA in accordance with the PA77-09.

Within the CREC there are numerous ditches and canals. The drainage ditches are typically 5 to 10 feet wide with an average depth of 3 feet. They exist north of Units 4 and 5, east and south of the mill reject pile, south of the Units 1 and 2 coal yard, north and east of the Units 4 and 5 coal yard. The intake canal is dredged approximately every 5 years, producing approximately 6,000 CY of dredged material for potential beneficial reuse off-site as landfill cover. Ditches and canals within the plant are excavated/dredged on an as-needed basis; no estimate of quantity is made.

The FGD blowdown settling ponds decommissioning is scheduled to be completed by the end of October 2019 (see Section 3.5).

Two lined storm water collection ponds receive runoff from the Units 4 and 5 coal yard. The ponds are located on the east side of the coal yard and are designed to manage storm water runoff from the lined Units 4 and 5 coal yard. Additionally, two (2) coal pile runoff treatment ponds treat the discharge from the runoff collection ponds and discharge to the north percolation pond or coal pile runoff ditch. Excavated/dredged spoils from these ponds will consist of coal fines that can be returned to the coal pile, transported off-site for beneficial re-use (with Department approval), or disposed of by other appropriate means. Storm water from Units 1 and 2 coal yard is collected and conveyed to an adjacent percolation pond via drainage ditches located on the east and south sides of the coal yard. Periodically, the ditches and pond are excavated and the solids (coal fines) are returned to the coal pile. These Unit 1 and 2 stormwater management features will be removed as part of the Unit 1 and 2 decommissioning.

Prior to off-site disposal, analytical testing will be conducted as necessary. Prior to on-site disposal in the ash landfill, characterization of dredge material is unnecessary as the landfill which includes dredge material in the commingled pile have been characterized and results are contained in the ECT report dated March 2008.

2.6 TRUCK WASH SOLIDS

The truck wash located on the south side of the ash storage area is used primarily to wash the ash and gypsum transport trucks after they have been loaded on-site and prior to them leaving site. Trucks wash within a contained area which has an underground drain system flowing into an excavated catch basin. The catch basin has adequate size, which promotes settling of the washed materials. The recovered solids resulting from the washing operation will be disposed of in AS/DA providing the solids are typical of CCPs that are already approved for disposal in the AS/DA or, in an off-site landfill, as appropriate. Liquids from the washing operations flow into a percolation basin. Overflow from the percolation basin flows into a drain which feeds into the perimeter ditch on the east side of the ash storage area.

Characterization of these recovered solids has not been made but generally should be consistent with the materials referenced in Sections 2.1, 2.2, 2.3, and 2.4 as that is where they are derived from.

2.7 IMPACTED SOIL

During plant operations, it is possible that soils could be impacted on occasion. If necessary, notification of impacted soils would be made to the FDEP and local county program prior to remediation and/or off-site disposal. Non-petroleum contaminated soil may be disposed of within the AS/DA in accordance with Attachment H of COC Mod S.

3.0 PRODUCT MANAGEMENT UNITS

The following product management units have been identified at the Crystal River Energy Complex:

- Ash storage/disposal area;
- Ash storage silos; and
- Gypsum storage pad.

This section provides descriptions of these management units, including types of materials, potential release points, and existing management practices. A summary of product management units is provided in Table 3.

3.1 ASH STORAGE/DISPOSAL AREA

The original footprint of the AS/DA covered approximately 95 acres and was permitted (PA 77-09) to reach a maximum height of 80 feet above grade with 4 horizontal: 1 vertical (4H:1V) side-slopes (FDEP letter dated March 28, 1988 from Mr. Hamilton Owen). The original footprint of approximately 95 acres was reduced to approximately 60 acres after installation of a limestone storage area and gypsum storage pad for Units 4 and 5. A portion of the un-used ash storage area was used to accommodate the installation of these air pollution control systems and infrastructure.

On February 8, 2012, the FDEP's Siting Office issued a final order amending the COC that allowed for a vertical expansion and redesign of the side slopes of the existing ash storage/disposal area. The approved vertical expansion allows the facility to increase the stacking height from 80 feet to 120 feet (no greater than +220 ft. NGVD) along with increased side slopes of 4H:1V to 3H:1V. The details of the authorized vertical expansion are contained in Post Certification Amendment (PA77-09) – Mod Q, OGC Case Number 11-0486.

A primary CCP contractor supports CREC with the transportation, spreading, compacting, and pile maintenance operations of fly and bottom ash that presently is deemed unsalable. A secondary CCP contractor support CREC with the reclamation of CCPs from the AS/DA for offsite beneficial use. The ash storage area is graded to manage storm water runoff into the ash storage area and associated ditches.

3.1.1 Unit Description and Operation

The AS/DA, which is located in the northeast corner of the Crystal River Energy Complex, was originally certified under the Units 4 and 5 Conditions of Certifications for the disposal of unsalable fly ash and bottom ash from Units 4 and 5 and was subsequently modified to include disposal of unsalable fly ash and bottom ash from Units 1 and 2.

With Department approval, solid wastes other than CCP materials (fly ash, bottom ash, and gypsum) have been disposed in the AS/DA. Examples of other solid wastes that have been placed in the AS/DA following receipt of Department approval include, but are not limited to, the following:

- Non-hazardous sand blast grit;
- Sediment/sludge from on-site domestic wastewater infiltration basin;
- Sediment/sludge from on-site industrial wastewater infiltration basin;

- Intake screenings and sediment from cooling towers;
- Non-petroleum contaminated soil;
- Percolation pond dredge material;
- Cooling tower solids;
- Mill scale; and
- FGD blowdown pond solids (see Section 3.5).

All future requests for approval to dispose of solid wastes other than the ash materials described in paragraph #1 (above) and the solid wastes described in paragraph #2 of this section shall be submitted to the FDEP Southwest District Office Solid Waste program for review and approval, with copies to the Siting Office, in accordance with Section B, Condition I. Department of Environmental Protection, E. Solid Waste Management Plan, of the Conditions of Certification.

3.1.1.1 Fly Ash Storage within the AS/DA

A primary CCP contractor supports DEF with the transportation, spreading, compacting and maintenance of fly ash material. Conditioned fly ash (moisture content approximately 20 percent) is transported to the AS/DA and deposited in the active disposal area and made available for the secondary CCP contractor for reclamation. Fly ash is compacted and graded to control runoff and infiltration. Fly ash can be reclaimed from the AS/DA by a secondary CCP contractor for off-site beneficial use.

3.1.1.2 Bottom Ash Storage in the AS/DA

A primary CCP contractor supports CREC with the transportation, spreading, compacting, and pile maintenance operations for bottom ash that may presently be deemed unsalable. The primary CCP contractor transports bottom ash with a moisture content of approximately 20% from Units 4 and 5 bottom ash silos in dump trucks and deposits the material in the active disposal area to make it available to the secondary CCP contractor for reclamation. The active disposal area is graded to manage storm water runoff into the ash storage area perimeter ponds and associated ditches. Bottom ash can be reclaimed from the pile for off-site beneficial use by a secondary CCP management contractor.

3.1.1.3 Gypsum Storage in the AS/DA

Both saleable and non-saleable gypsum may be stored or disposed in the AS/DA, however, practically all of gypsum produced at CREC is transported via conveyor directly to the adjacent gypsum marketer or to the gypsum storage pad. A primary CCP contractor supports CREC with the transportation, spreading, and compacting of gypsum at the active disposal area. Gypsum can be reclaimed from the AS/DA by a secondary CCP contractor for off-site beneficial use.

3.1.2 Potential Constituents of Concern

According to SPLP analysis of the ash storage area materials sampled in November 2007, the following mean SPLP results exceeded PDWS, SDWS, or GGC: aluminum (SDWS), antimony (PDWS), arsenic (PDWS), boron (GGC), fluoride (PDWS/SDWS), iron (SDWS), molybdenum (GGC), selenium (PDWS), sulfate (SDWS), total dissolved solids (SDWS), and vanadium (GGC).

3.1.3 Potential Release Points

The ash storage area is unlined and there is potential for leaching and percolation of the stored material to the soil, groundwater, and surface water.

The ash storage area storm water retention system is designed and constructed to retain the area runoff from a 10-year, 24-hour rainfall event (KBN, December 1987). The retained runoff is designed to be disposed of by means of evaporation and percolation (KBN, December 1987). Runoff draining to the south and west would flow to the storm water retention ponds located on the south side of the storage area. Runoff from the west drains to the ponds via a drainage ditch on the west side of the storage area. On the east and north sides of the storage area runoff discharges directly to the perimeter ash storage area retention canal located on the east and north sides of the area. In the event of storm event in excess of 10-year, 24-hour rainfall total, runoff is designed to discharge to the Units 4 and 5 storm water retention ditch system via an overflow structure (KBN, December 1987).

3.1.4 Existing Management Practices

The AS/DA is to be operated in a manner that minimizes the contact between ash and water. The active areas of the AS/DA are to be sloped and compacted to minimize the potential for rainfall infiltration. The storm water from the working face is to be initially retained in a temporary retention area to allow for the settling of suspended solids prior to discharge into the ash storage area storm water system.

3.1.4.1 Groundwater Monitoring, Contour Mapping and Reporting

There are eight monitoring wells that are used for groundwater monitoring of this area as shown on Figure 1. All eight wells – MWI-2R2 (down gradient), MWC-12R (up gradient), TWI-1R (down gradient), TWI-3 (down gradient), TWI-4 (down gradient) TWI-5 (down gradient), MWB-30R (background), and TWI-2R (piezometer) – are screened with the upper Floridan aquifer with a total depth of approximately 20 feet. Monitoring well, MWC-12R, is located hydraulically up gradient of the AS/DA and provides background water quality data. Monitoring wells, MWI-2R2, TWI-1R, TWI-3, TWI-4, TWI-5 are located immediately down gradient of the AS/DA and monitors the immediate effects of ash leachate on natural groundwater quality levels (KBN, December 1987). Monitoring well, MWB-30R, is the facility background well. The groundwater monitoring plan, which includes these eight wells as part of the eighteen well network, was intended to monitor the AS/DA, detect potential releases to the groundwater, and comply with the facility's Conditions of Certification, Modification S, Attachment H, and applicable groundwater quality regulations. Samples are collected on a quarterly basis for the parameters listed in Table 2, Attachment H of the COC, Mod S. (Note that the Solid Waste (SW) wells are sampled for the same parameters as the IWW wells, plus additional parameters which include sulfate, aluminum, manganese, molybdenum, silver, strontium, and vanadium). Well TWI-2R is used for water levels only. A revised groundwater monitoring plan was prepared in 2007 (Golder, April 2007) which superseded a previous plan (Dames & Moore, April 1995).

3.1.4.2 Surface Water Monitoring

Surface water monitoring for the ash storage area is conducted per discharge event at the ash storage area overflow weir (NPDES outfall I-C40) prior to discharge into the runoff collection system. The following parameters are to be reported per discharge: flow, total suspended solids, length of discharge, and total recoverable metals including arsenic, aluminum, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, thallium, vanadium (NPDES Permit Number, FL 0036366, Condition I.A.12).

3.1.4.3 Inspections and Maintenance

Weekly inspections of the AS/DA are performed pursuant to the CCR Rule[1]. Annual inspections are also performed pursuant to the CCR Rule.

As necessary, the CCP contractors support CREC by performing maintenance and repairing erosion of the soil cover materials and open ash storage area. They also repair any damage to the storm water retention system. Additionally, quarterly and/or annual inspections area conducted in accordance with the facility's Stormwater Pollution Prevent Plans (SWPPPs) (DEF, October 2010 and DEF, February 2012). The purpose of the inspections is to ensure the storm water management system is operating properly, prevent the release of pollutants and ash, observe any significant erosion, and determine if any maintenance is necessary. Routine maintenance includes mowing, sediment removal, vegetation clearing from intake and discharge structures, and repair of eroded areas.

3.3 ASH STORAGE SILOS

3.3.1 Unit Description and Operation

Ash storage silos are used for fly ash and bottom ash for Units 4 and 5 prior to transport to the AS/DA or off-site beneficial use.

Units 4 and 5 fly ash is pneumatically conveyed to respective storage silos prior to transportation by an CCP contractor to the ash storage area or off-site beneficial use. Units 4 and 5 fly ash is either loaded into pressure-differential trucks from the storage silo or it is conditioned to a moisture content of approximately 20% prior to being loaded into open trucks for transport.

In 2012, CREC completed a construction project referred to as "CRN Ash Area Drainage Improvements for Gate 10 VBS Modification". This project created a drainage sump/collection structure for ash laded water draining away from Unit 4 and 5 ash silo areas. The structure is designed to allow re-use of the water in the system while ash material settles. The settled ash is periodically moved out of the catch basin into the adjacent drying slab. The drying slab is sloped to allow drainage of residual water back into the settling basin. When this material is dry enough to transport, the on-site ash management contractor loads the fly ash into dump trucks and transports it to the on-site ash storage/disposal area.

The bottom ash from Units 4 and 5 is conveyed with water to four storage silos (aka dewatering bins) prior to loading into trucks for transport by a CCP contractor to the ash storage area or off-site beneficial use.

[1] The CCR Rule (Chapter 40 Code of Federal Regulations, Part 257, Subpart D) is a Federal rule that establishes technical requirements for CCR landfills and surface impoundments and is not associated with or governed by the CREC COC.

Water used to convey bottom ash is contained in a closed loop system and so, with the exception of about 20% moisture content of the bottom ash, there is no water disposal.

3.3.2 Potential Constituents of Concern

According to ash SPLP analysis performed in November 2007, the following mean SPLP results exceeded PDWS, SDWS, and GGC: aluminum (SDWS), antimony (PDWS), arsenic (PDWS), boron (GGC), iron (SDWS), molybdenum (GGC), selenium (PDWS), and vanadium (GGC).

3.3.3 Potential Release Points

Fly ash and bottom ash stored in silos is not considered a significant release point. Ash stored in these completely enclosed storage containers does not pose a potential release to soil, groundwater or surface water. Ash that is spilled during transfer associated with transport truck loading is promptly removed according to management practices.

3.3.4 Existing Management Practices

Management practices of the ash storage silos consists of visual inspections of the silos and removal of ash that may inadvertently been released to the ground surface. As a normal part of ash handling, during transfer of ash from the storage silos to transport trucks, ash may be inadvertently spilled on the ground, which in many instances is an impervious surface. Housekeeping activities are performed on a daily basis.

The ash storage silos are not part of the groundwater or surface water monitoring performed at the site, due to the limited potential of release to the environment. Inspections of the storage silos are performed as part of the facility-wide inspections prescribed in the Stormwater Pollution Prevention Plans (SWPPP) (DEF, October 2010 and DEF, February 2012.). Besides structural maintenance of the storage silos, BMP-related maintenance is generally limited to recovery of spilled ash.

3.4 GYPSUM HANDLING AREAS

3.4.1 Unit Description and Operation

The Units 4 and 5 FGD System gypsum handling management areas include the gypsum dewatering facility and the gypsum storage areas.

3.4.1.1 Gypsum Dewatering Facility

The gypsum slurry from the Units 4 and 5 FGD System is dewatered in vacuum filter beds. The gypsum is dewatered and washed by the FGD vacuum filters to produce a gypsum cake (approximately 90% solids content by weight). The gypsum cake is then conveyed from the dewatering facility to the adjacent gypsum marketer or temporary storage area via conveyor. Filtrate from the vacuum filter beds is pumped to FGD filtrate tanks then from there it is routed back into the process as scrubber make-up water and to aid in limestone processing.

3.4.1.2 Temporary Gypsum Storage Pad

The temporary gypsum storage area consists of a dual-truck load out tower and a lined concrete storage pad. The gypsum cake produced by the dewatering facility that is not conveyed directly to the adjacent gypsum marketer is transported either to the truck load out tower or the storage pad via the conveyor. The temporary gypsum storage area is sized to temporarily store 32,000 tons of gypsum. Off specification gypsum will be stored in a separate pile on the lined storage pad. Gypsum is transported from the temporary storage area for off-site beneficial use or to the AS/DA for additional storage prior to beneficial use or onsite/off-site disposal.

3.4.1.3 Gypsum Storage in the AS/DA

Gypsum is stored on its temporary storage pad and in the AS/DA. Both saleable and unsalable gypsum will be transported to the AS/DA where it will be stored pending beneficial use or disposal. See Section 3.1.1.5 for further information.

3.4.2 Potential Constituents of Concern

According to the SPLP analysis of samples collected from the gypsum stockpile in March 2010, the following mean SPLP results exceeded PDWS or SDWS: aluminum (SDWS), fluoride (PDWS and SDWS), sulfate (SDWS) and total dissolved solids (SDWS).

3.4.3 Potential Release Points

The gypsum dewatering facility is not considered a significant release point. The temporary storage pad is lined and designed with a three-foot perimeter wall and sumps to collect storm water and seepage thereby, limiting the potential release of water.

As mentioned in Section 3.1.3, the AS/DA is designed and constructed to retain the area runoff from a 10-year, 24-hour rainfall event. Storm water runoff draining from the south and west would flow to the storm water retention ponds located on the south side of the storage area. Runoff from the west drains to the ponds via a drainage ditch on the west side of the storage area. On the east and north sides of the storage area, runoff discharges directly to the perimeter ash storage area retention canal located on the east and north sides of the area. As described in Section 3.1.4.1, there are eight monitoring wells that are used for groundwater monitoring of this area as shown on Figure 1. These ground water monitoring wells and the parameters monitored and reported on a quarterly basis appropriately cover constituents contained in gypsum that is stored in the AS/DA.

3.4.4 Existing Management Practices

3.4.4.1 Temporary Gypsum Storage Pad

Gypsum stored on its temporary pad is watered down by an off-road water truck to create a hard outer crust for the purpose of controlling dust generation.

Stormwater and seepage from the temporary gypsum storage pad is collected and conveyed to the FGD filtrate tanks or blowdown tanks. Temporary gypsum storage is contained on a concrete pad with a geosynthetic clay liner underneath.

3.4.4.2 Gypsum Storage in the AS/DA

Gypsum stored is in the AS/DA is also watered down by an off-road water truck to create a hard outer curst for the purpose of controlling dust generation.

The existing groundwater monitoring wells dedicated to the AS/DA and the parameters analyzed for these wells should be sufficient to adequately monitor groundwater for materials stored/disposed in the AS/DA (see Section 3.1.4).

3.5 FGD BLOWDOWN POND SYSTEM

3.5.1 Unit Description and Operation

The FGD Blowdown Pond System consisted of two lined ponds, the Primary Pond and Backup Pond, which receive FGD blowdown wastewater from the Units 4 and 5 FGD units. The ponds were designed to manage wastewater from the FGD unit process and allow for the settling of suspended solids. The FGD Blowdown Pond System was taken out of service in February 2019 when the wastewater treatment system began operations. Pond solids from the Primary Pond and Backup Pond were excavated and transported to the AS/DA for disposal, with final closure to be completed by the end of 2019.

3.5.2 Potential Constituents of Concern

According to the SPLP analysis of samples collected from FGD pond solids in March 2010, the following mean SPLP results exceed PDWS, SDWS, or GGC: boron (GGC), fluoride (PDWS and SDWS), manganese (SDWS), sulfate (SDWS), and total dissolved solids (SDWS).

3.5.3 Potential Release Points

The FGD wastewater settling ponds were lined and designed with adequate freeboard for storm events thereby limiting the potential release of FGD wastewater. The remainder of the area that was the former North Ash Pond was graded such that all surface water within the former ash pond is directed to the west of the former ash pond and is designed to contain all the water from a 25-year, 24-hour storm event.

3.5.4 Existing Management Practices

The wastewater settling ponds cleanout and decommissioning will be completed by end of 2019.

3.5.4.1 Groundwater Monitoring

The facility's COC MOD P, Attachment H, includes groundwater monitoring for the site. Groundwater monitoring is conducted in accordance with groundwater monitoring plan which addresses industrial wastewater wells and solid waste wells. In part, the site groundwater monitoring requirements contained in Attachment H includes well construction requirements, IWW wells, solid waste wells, sampling frequency and analysis, sampling parameters for IWW and SW wells, water level sampling collection, and report submittal requirements. Details are provided in Attachment H.

3.5.4.2 Surface Water Monitoring

No surface water monitoring is required from this area under the NPDES permits for the site.

3.5.4.3 Inspections and Maintenance

Quarterly and annual inspections are conducted as part of the facility-wide inspections until decommissioning of the ponds is complete in accordance with the NPDES Permit and Attachment H of Mod S of the COC.

4.0 REFERENCES

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TABLE 1
SUMMARY OF COAL COMBUSTION PRODUCT AND NON-COAL COMBUSTION PRODUCT MATERIALS

Crystal River Energy Complex
Citrus County, Florida

Material	Type		Generation		Source	Storage Location	Material Type		Rationale for Material Type Designation
	CCP	Non-CCP Solid	Active	Inactive			Industrial Byproduct*	Solid Waste*	
Fly Ash	X		X		Units 4 and 5	Ash Storage/Disposal Area	X		Several potential beneficial end uses
Bottom Ash	X		X		Units 4 and 5	Ash Storage/Disposal Area	X		Potential beneficial end uses
Gypsum	X		X		Unit 4 and 5	Temporary gypsum storage pad	X		Beneficial use off-site
						Gypsum storage in AS/DA	X		Beneficial use off-site, off-site disposal, on-site disposal
FGD Pond Solids	X			X	Units 4 and 5	FGD Blowdown Ponds		X	On Site Disposal or Off-site disposal
Dredge Spoils – Fly Ash Ponds	X	X	X		Stormwater ponds (2) SW side of fly ash pile	None		X	Off-site disposal/on-site disposal
Dredge Spoils – Perc Ponds		X	X		Percolation ponds: 2 near Units 1 & 2 and 3 near Units 4 & 5	None		X	Off-site disposal/on-site disposal
Dredge Spoils – Ditches and Canals		X	X		Drainage ditches and canals throughout plant	None		X	Off-site disposal/on-site disposal
Dredge Spoils – West Pond		X	X		Pond west of Units 1 & 2 former ASTs	None		X	Off-site disposal/on-site disposal
Dredge Spoils – Stormwater Ponds		X	X		Stormwater ponds (2) near Units 4 & 5 coal yard	None		X	Beneficial use on-site, beneficial use off-site or off-site disposal
Truck Wash Solids		X	X		Truck wash	None	X		Assumed non-contaminated – beneficial use as landfill cover
Cooling Tower Sludge – 4 & 5		X	X		Cooling towers for Units 4 & 5	None		X	On-site disposal
Units 4 & 5 Coal Yard Soil		X		X	Soil excavation for coal yard liner	Units 4 and 5 coal yard	X		Beneficial use off-site
Contaminated Soil		X	X		Throughout Plant	None		X	Contaminated and would require treatment and disposal

* Term as defined in Chapter 62-701, F.A.C.

Revised by: SFS
Reviewed by: DEG

Table 2
Average Ash and Gypsum Production, Beneficial Use, and Disposal Rates

Crystal River Energy Complex
Citrus County, Florida

Coal Combustion Product	Average Production Rate (tons per day)	Average Beneficial Use Rate (tons per day)	Average Disposal/Storage Rate (tons per day)	Average Reclamation Rate (tons per day)
Fly Ash[1]	735	639	32	329
Bottom Ash[1]		64		
Gypsum[1]	1,300	1,300	0	0

NOTES:

1. Production, Beneficial Use, and Disposal data provided by DEF, January 2018 through June 2019.

Checked by: SFS
Reviewed by: DEG

TABLE 3

SUMMARY OF PRODUCT MANAGEMENT UNITS

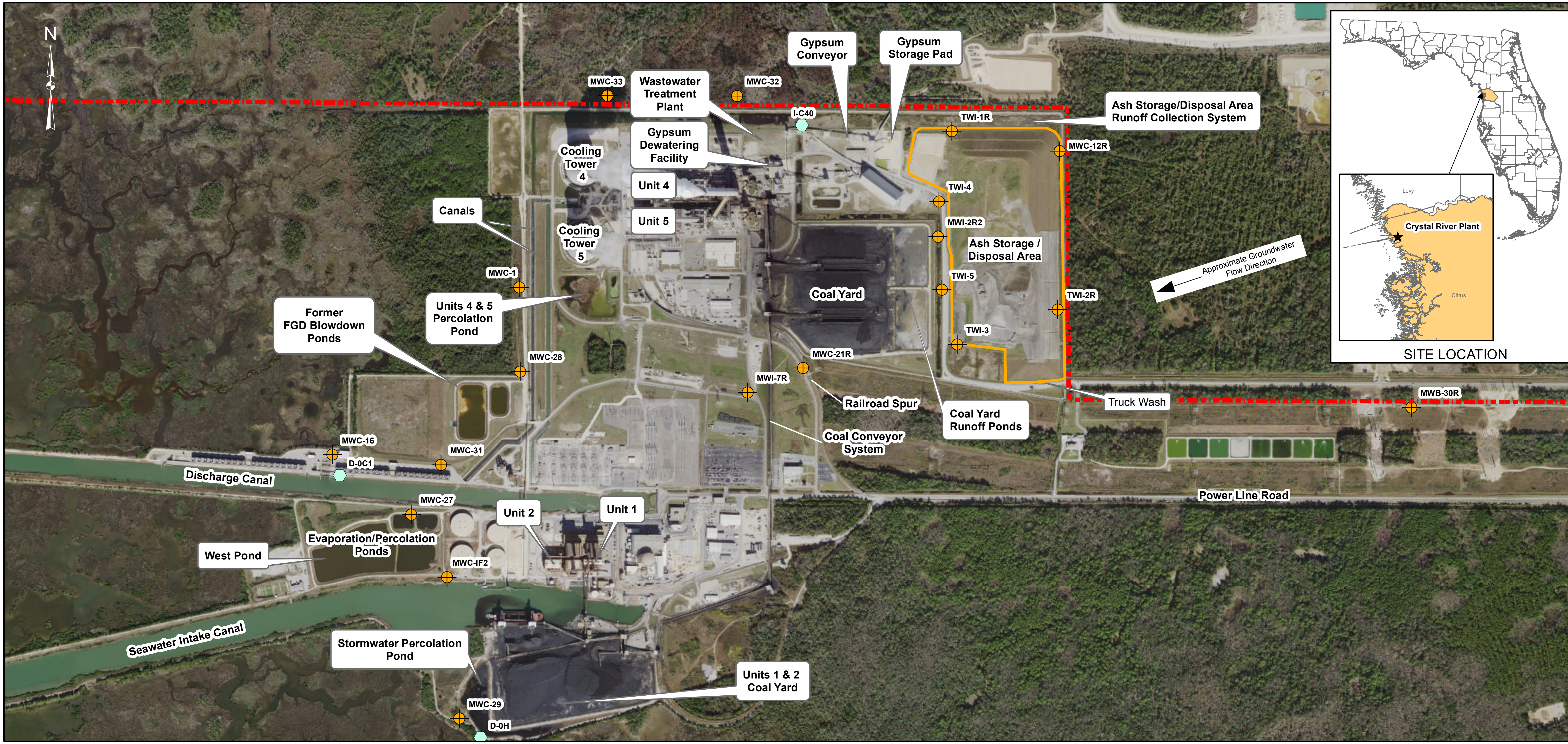
Crystal River Energy Complex
Citrus County, Florida

	Solid Type					Potential Environmental Impact		Impact Prevention and Monitoring		Ultimate Use			
					Average					Reuse		Disposal	
Management Unit	**CCP**	**Non-CCP**	**Solid**	**Hazardous**	**SPLP Exceedance**	**GW**	**SW**	**GW**	**SW**	**Onsite**	**Offsite**	**Onsite**	**Offsite**
Ash Storage/Disposal Area	X		Fly ash	No	Al, Sb, As, Bo, Mo, Se, V	X	X	X	X		X	X	
Ash Storage/Disposal Area	X		Bottom ash	No	Al, As, Fe	X	X	X	X		X	X	
Temporary Gypsum Storage Pad	X		Gypsum	No	Al, F, SO_4, TDS						X	X	X
Ash Storage/Disposal Area	X		Gypsum	No	Al, F, SO_4, TDS	X	X	X	X		X	X	
Ash Storage Silos	X		Fly ash and bottom	No	Al, Sb, As, Bo, Fe, Mo, Se, V						X		
FGD Wastewater Treatment Plant	X		FGD solids (gypsum)	No	(Note 1)	X	X	X	X		X	X	

Note 1 – FGD wastewater treatment plant filtercake characterization will be performed following steady state operations of the plant expected by October 31, 2019.

Revised by: SFS
Reviewed by: DEG

Map Document: N:\File\2019\19-125665 Duke Energy Crystal River\B - CCP-SW Management Plan\map documents\19125665B001.mxd

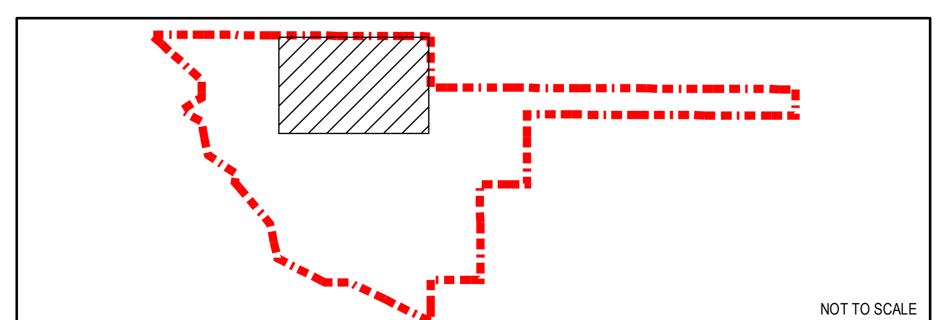


LEGEND

- Monitoring Well
- Surface Water Discharge Location
- Ash Storage / Disposal Area
- Approximate Property Boundary
- Approximate Groundwater Flow Direction

REFERENCE

1. Aerial Imagery - Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



0 500 1,000 2,000 Feet

SCALE AS SHOWN

PROJECT

DUKE ENERGY

TITLE

CRYSTAL RIVER SITE PLAN
CITRUS COUNTY, FLORIDA

DUKE ENERGY

PROJECT No. 19125665			19125665B001.mxd	REV. 0
DESIGN	SFS	3/31/2010		
GIS	JWT	06/28/2019		
CHECK	SFS	06/28/2019		
REVIEW	DEG	06/28/2019		

FIGURE 1

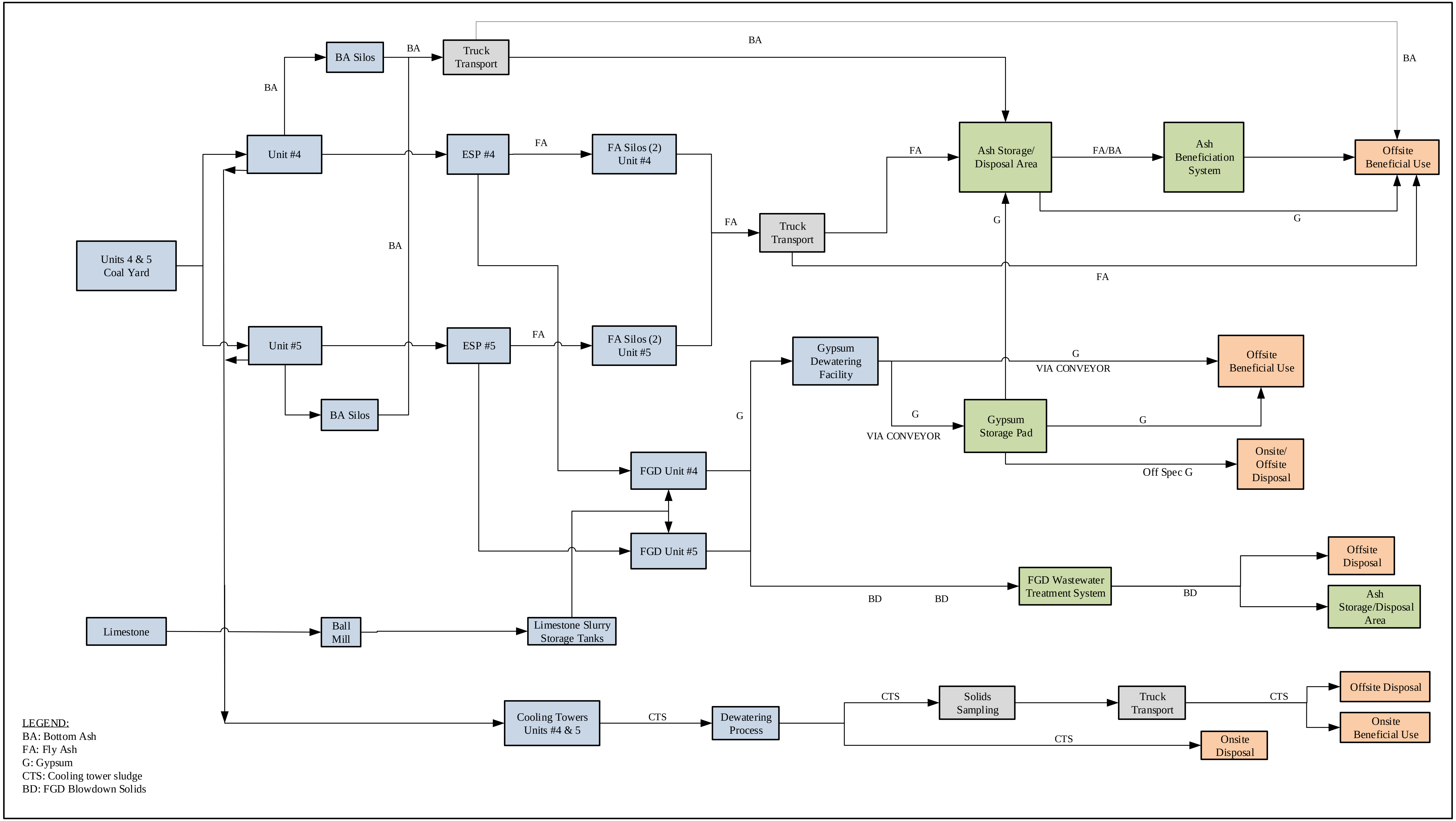


Figure 2
Process Flow Diagram for Coal Combustion Products and Non-Combustion Waste Products
Progress Energy Crystal River Energy Complex
Crystal River, Florida

REV. 3	SCALE:/ NTS	
CHECK	SFS	06/27/19
REVIEW	DEG	06/28/19

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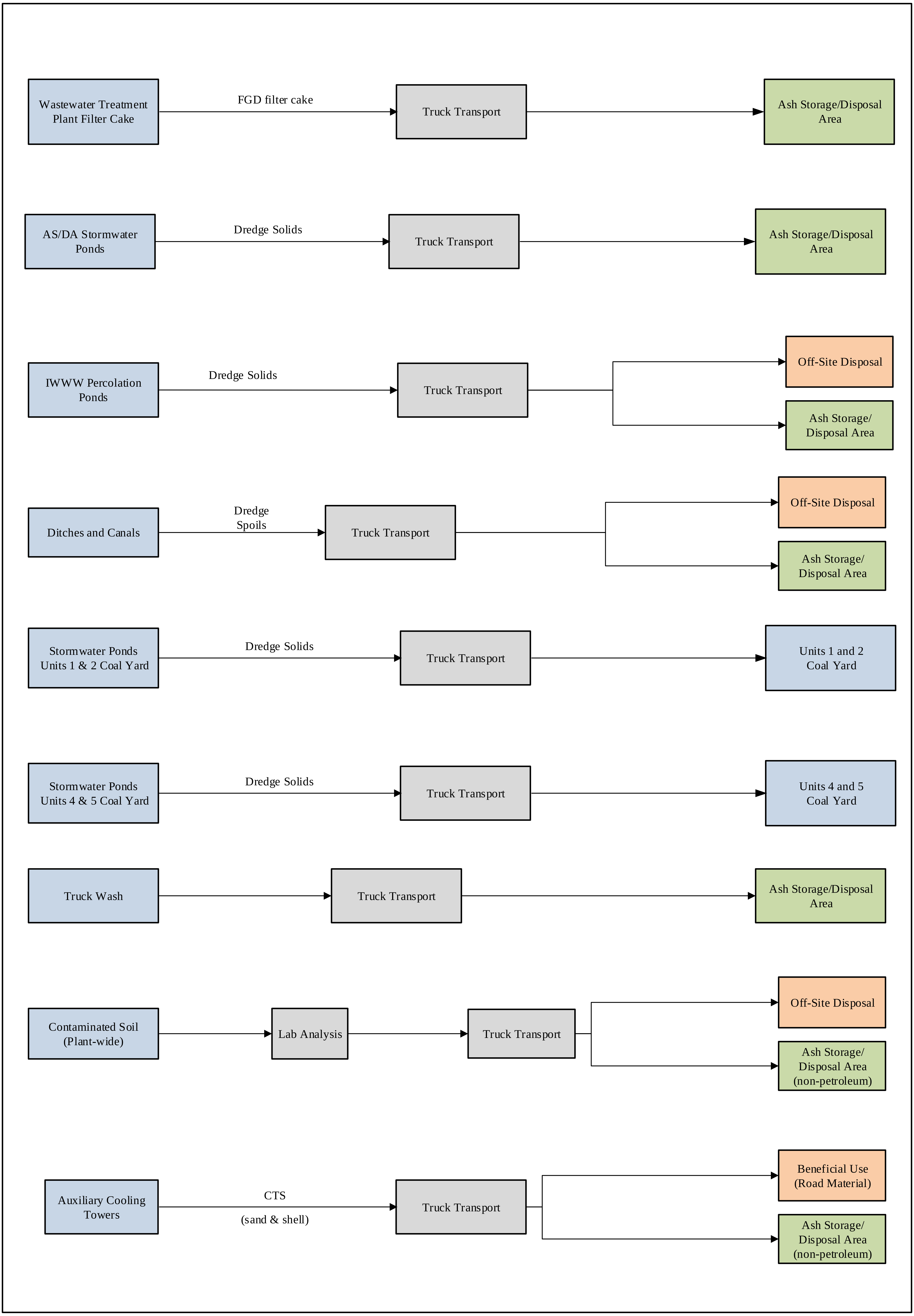

Figure 3
Process Flow Diagram for Inactive CCP Disposal Areas and Non-CCP Solids
Progress Energy Crystal River Energy Complex
Crystal River, Florida

REV. 1	SCALE: NTS	
CHECK	SFS	6/27/19
REVIEW	DEG	6/28/19

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