

3 D Dredger™ Autonomous Sediment Management System

PROMETHEUS INNOVATIONS, LLC



Advanced Dredging Technology Presentation for WEDA Webinar

PROMETHEUS INNOVATIONS, LLC – US agent-partner for Hydro Maintenance Service

May 2021

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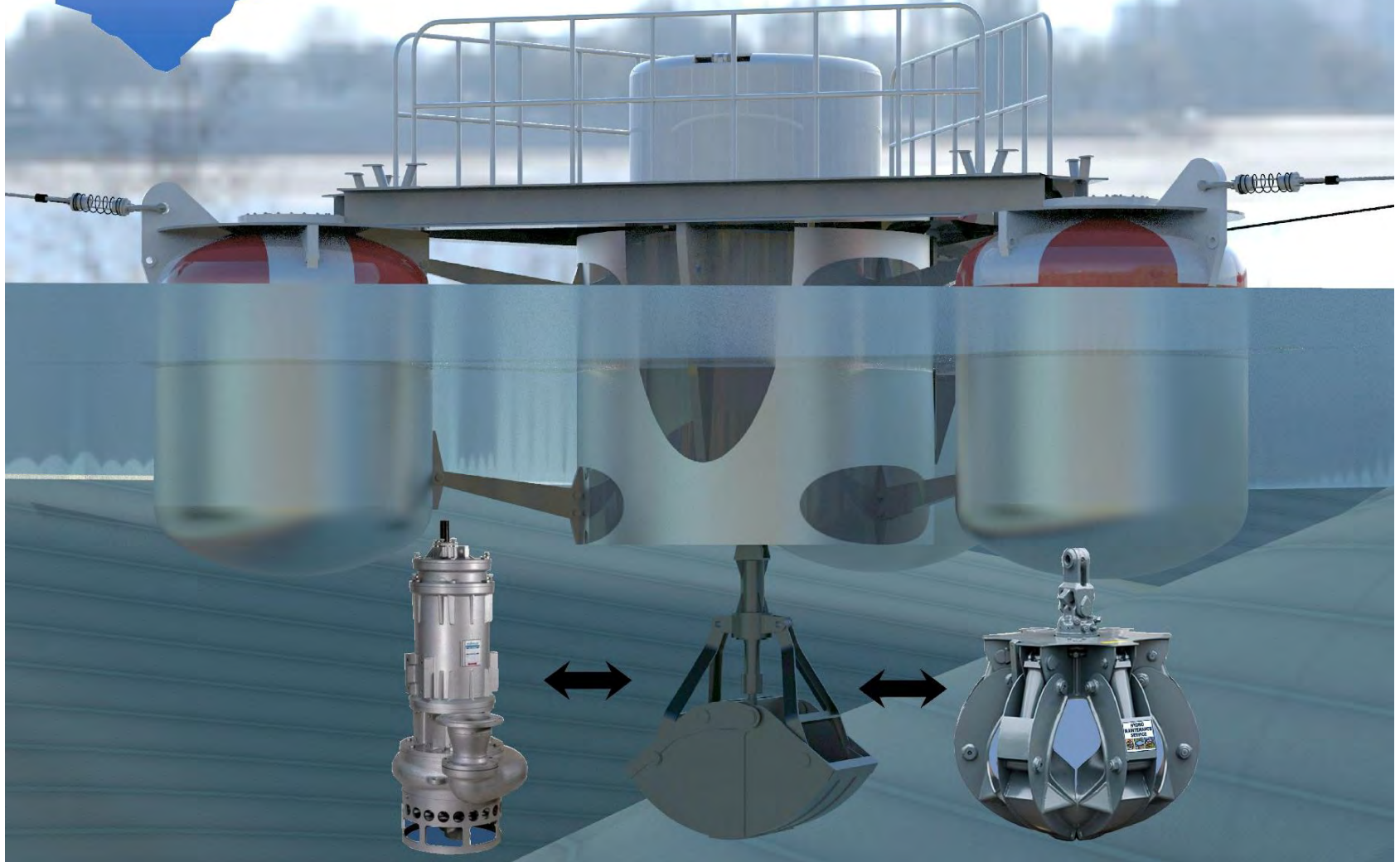
Dredging system:

- **Autonomous**
- **Unmanned floating system**
- **High precision positioning**
- **For the majority of sediment compositions**
- **Rapid deployment and movement**





The 3 D Dredger™ system utilizes a hydraulic dredging pump, hydraulically operated bucket, or a hydraulically operated grapple to dredge in all environments.



DIMENSIONS AND COMPONENTS

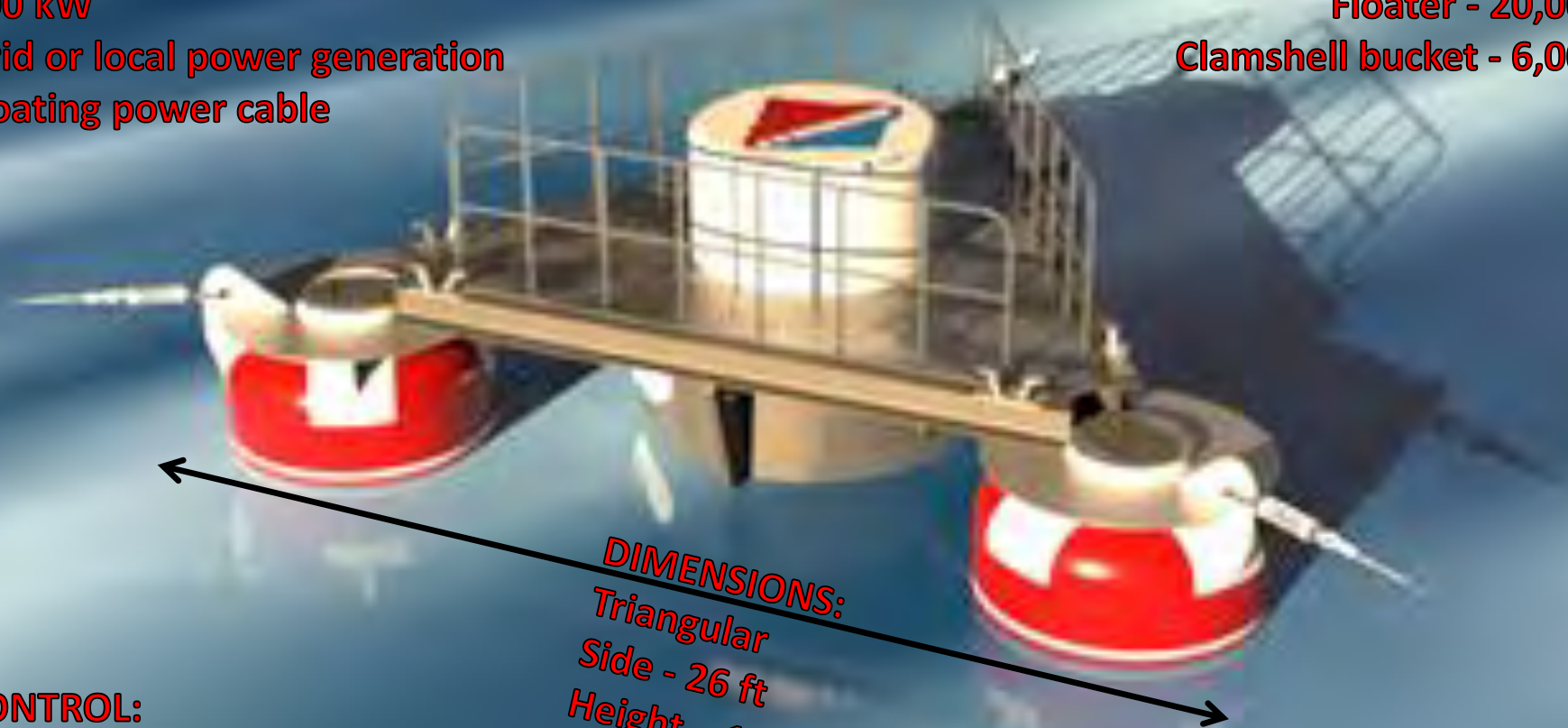


POWER SOURCE:

100 kW
Grid or local power generation
Floating power cable

WEIGHT:

Floater - 20,000 lb
Clamshell bucket - 6,000 lb



DIMENSIONS:
Triangular
Side - 26 ft
Height - 16 ft
Draft - 6 ft

CONTROL:

Remotely controlled
No on-board operators
600 ft range from control center

POSITIONING :

Autonomous
Movable mooring system

DIMENSIONS AND COMPONENTS



WINCH ANCHORS:
Dredger movement

FLOATS:
7 ft X 8 ft Cylindrical pontoons

LIFTING WINCH:
Bucket depth control

CLAMSHELL BUCKET:
Hydraulic Capacity - 68 ft³



TRANSPORTABILITY



ISO CONTAINER TRANSPORTABLE:

The 3 D Dredger™ can be loaded in five 20 ft containers

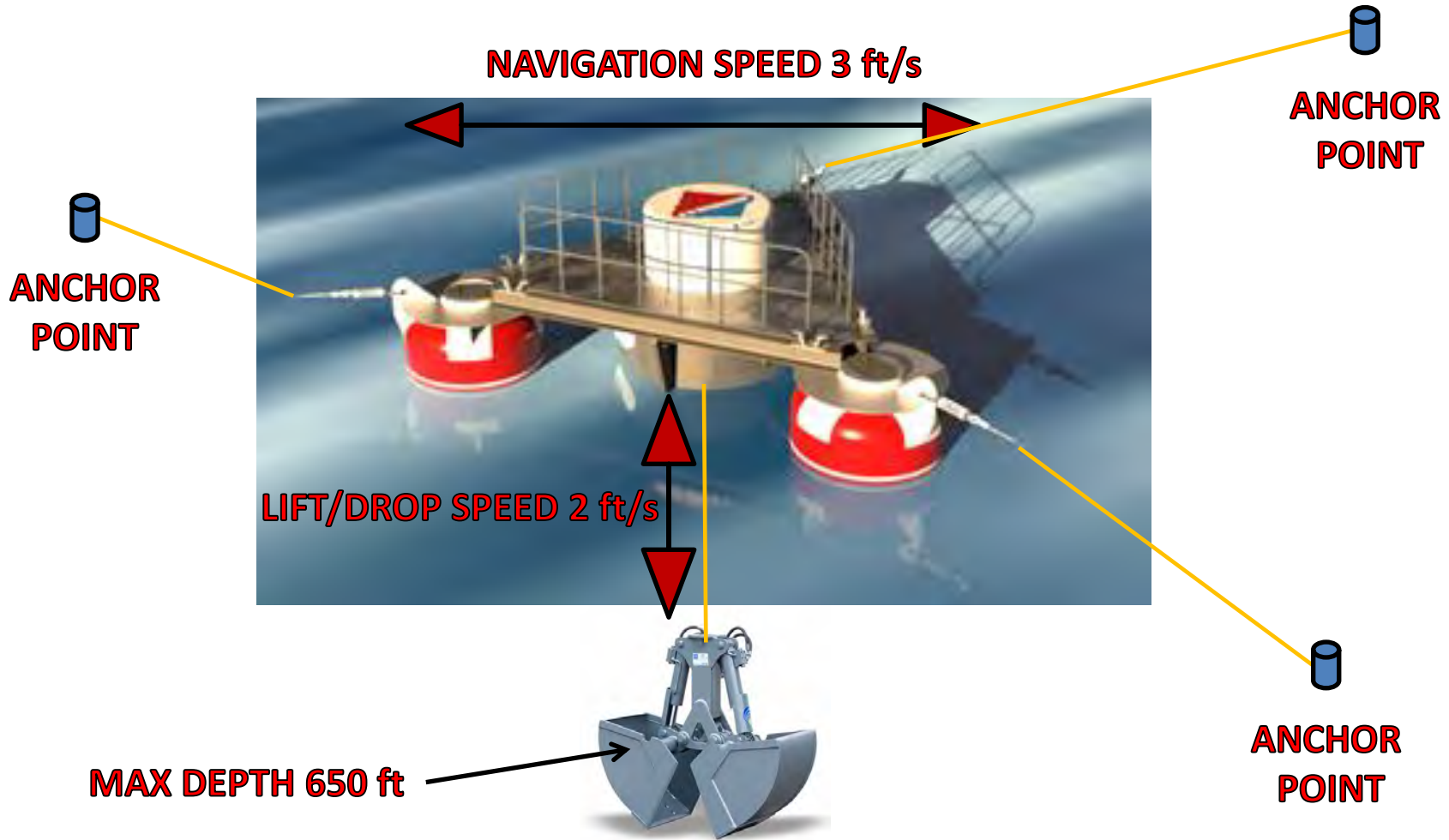
3 – floats with accessories

1 – upper structure

1 – clamshell with accessories



OPERATIONAL FEATURES



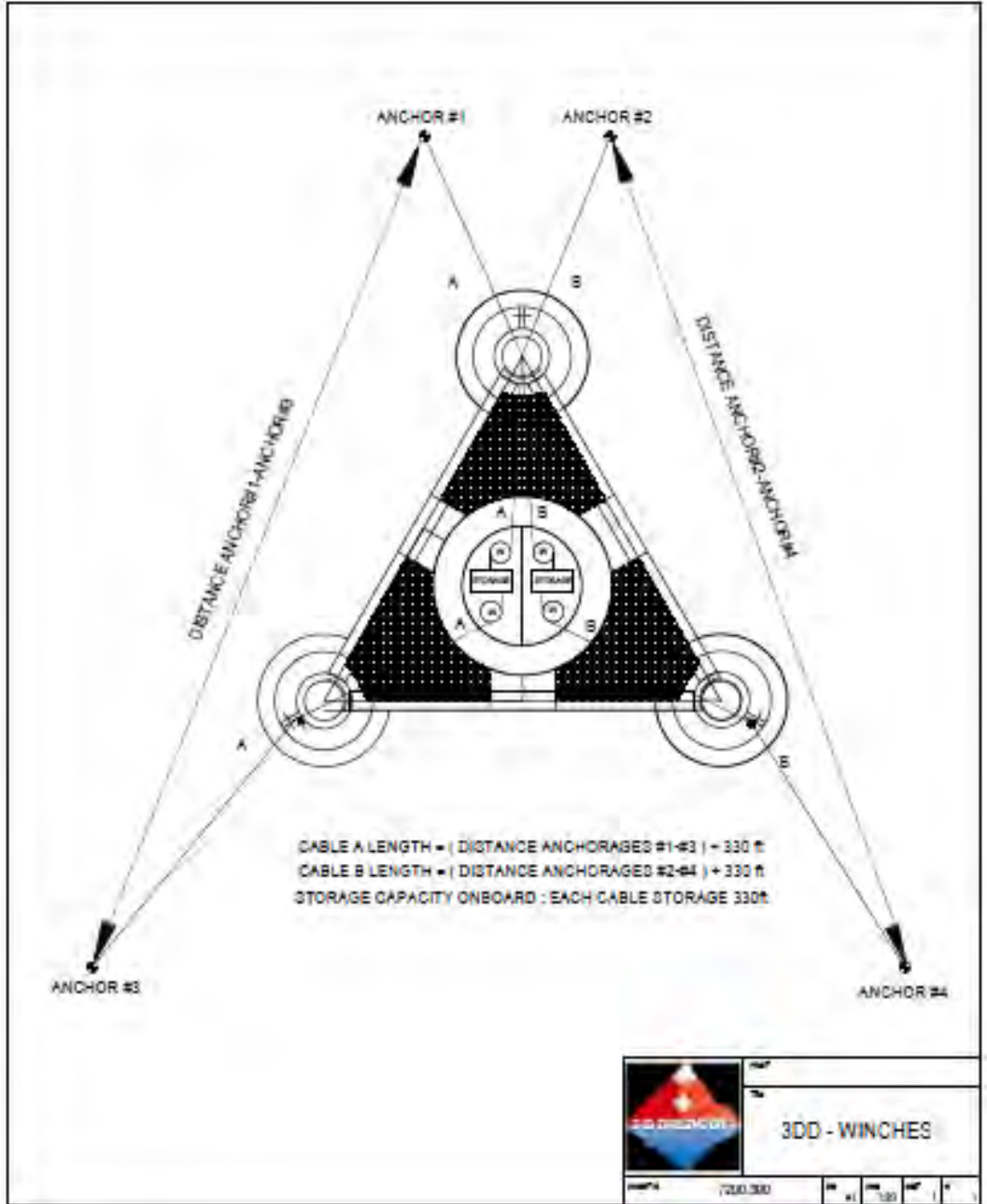


Power Requirements for the 3DD System

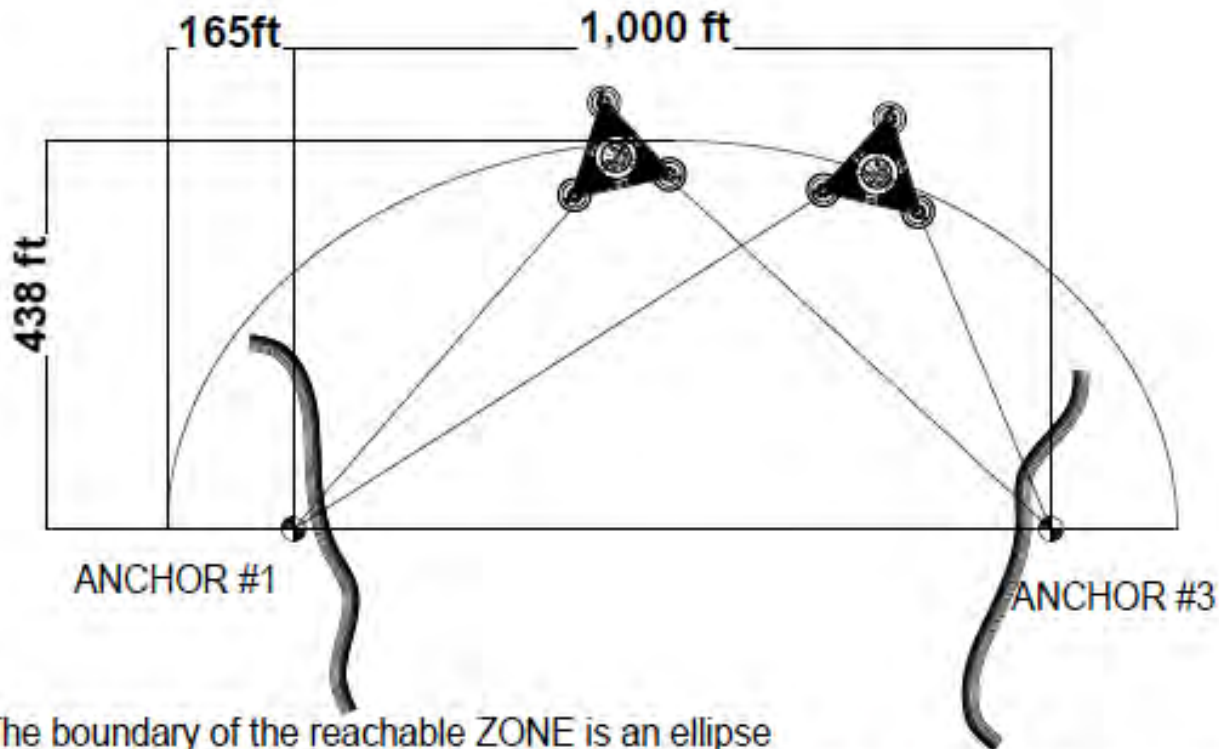
AC Voltage (V)	440 3-phase
Frequency (Hz)	50 - 60
Wattage (kW)	50 operating
Amperage (A)	125

Power Source Options

- ❖ **Grid Connection – preferable long-term solution**
- ❖ **Diesel Generator – optional portable solution**
- ❖ **Fuel Cell – optional portable solution**
- ❖ **Mobile Solar + Battery + Fuel Cell – optional portable solution**
- ❖ **Hydroelectric Facility – can use excess energy from the facility at which the dredging operation is done**



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The boundary of the reachable ZONE is an ellipse

Major axis of this ellipse = distance between ANHORS + STORAGE ON BOARD = 2a

Minor axis = 2 times max distance 3DD from the line ANCHOR/ANCHOR = 2b

Focal axis = distance between anchors = 2c

$$\text{Max distance 3DD/ANCHORS AXIS} = \frac{1}{2} \sqrt{\text{STORAGE}^2 + \text{Focal axis}^2}$$

DISTANCE ANCHORS	STORAGE ONBOARD	MAX DISTANCE 3DD/ANCHORS AXIS
1000	330	438



PROJECT

NO

3DD - MOORING SCHEME - 1 CABLE

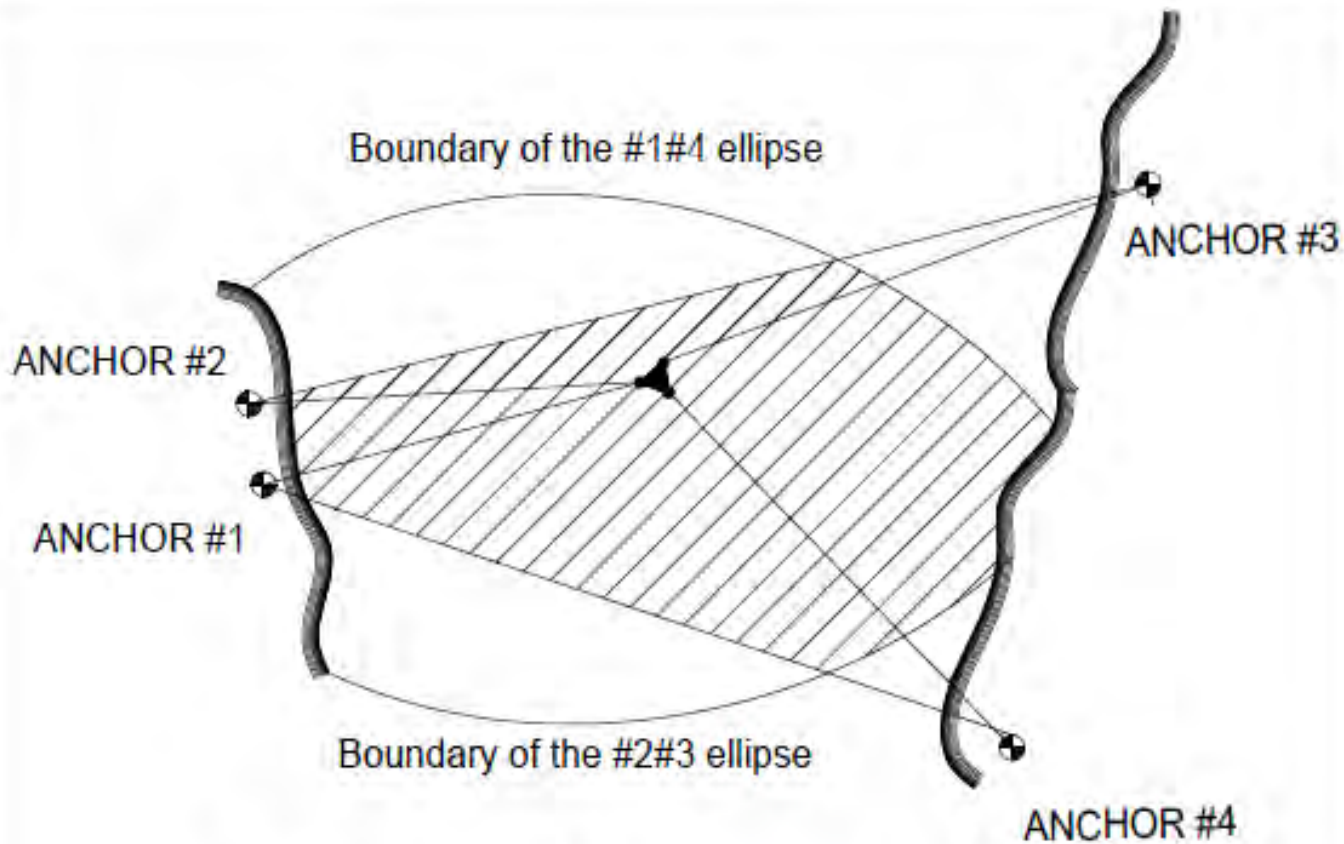
STANDARD # 7200.302 REV.2

SIZE A1

SCALE 1/20

SHEET 1

OF 1



The reachable ZONE is the overlapping of two semi ellipses



PROJECT
DESIGN
3DD - MOORING SCHEME - 2 CABLES

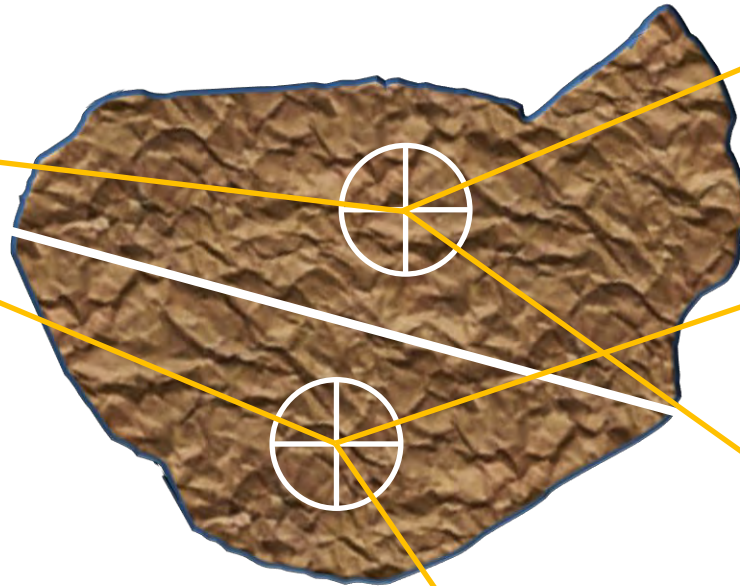
DOCUMENT NO	7200.303 REV.1	SHEET	A1	SCALE	1:20	SHEET	1	OF	1
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OPERATIONAL STRATEGY: EXTENDED DREDGING AREAS

THE OPERATION OCCURS IN TWO PHASES
2nd AND 3rd ANCHORAGES ARE MOVED

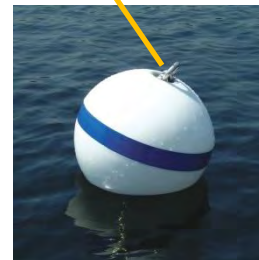
1st ANCHOR
POINT



2nd ANCHOR
POINT



ANCHORED BUOYS CAN
BE USED IF A SHORE IS
NOT AVAILABLE

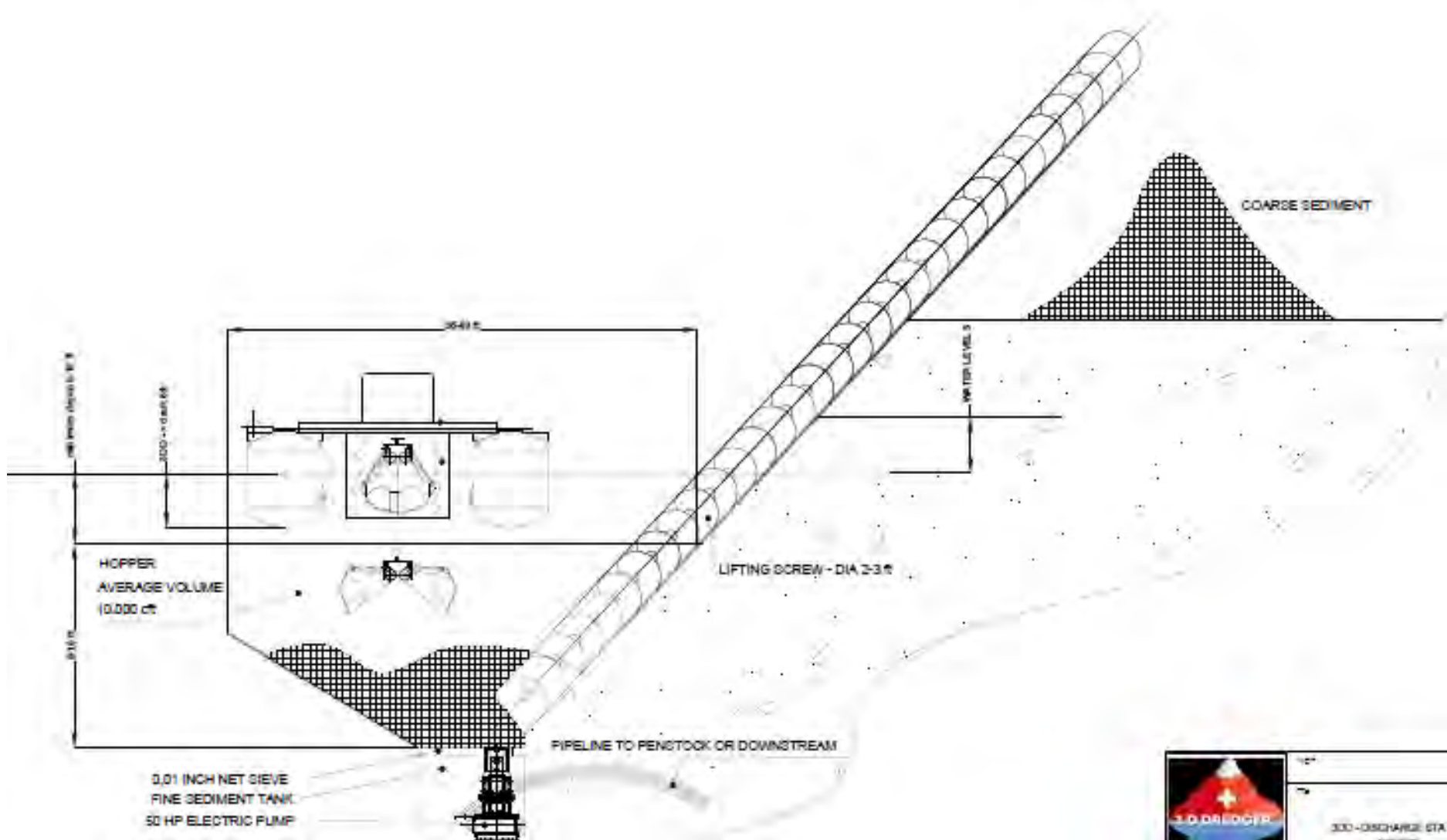


3rd ANCHOR
POINT



SEDIMENT RECOVERY METHOD

HOPPER & AUGER – MOVING SEDIMENT AROUND THE HYDROELECTRIC PLANT



**SEDIMENT RECOVERY METHOD
HOPPER & AUGER – MOVING SEDIMENT AROUND THE
HYDROELECTRIC PLANT**

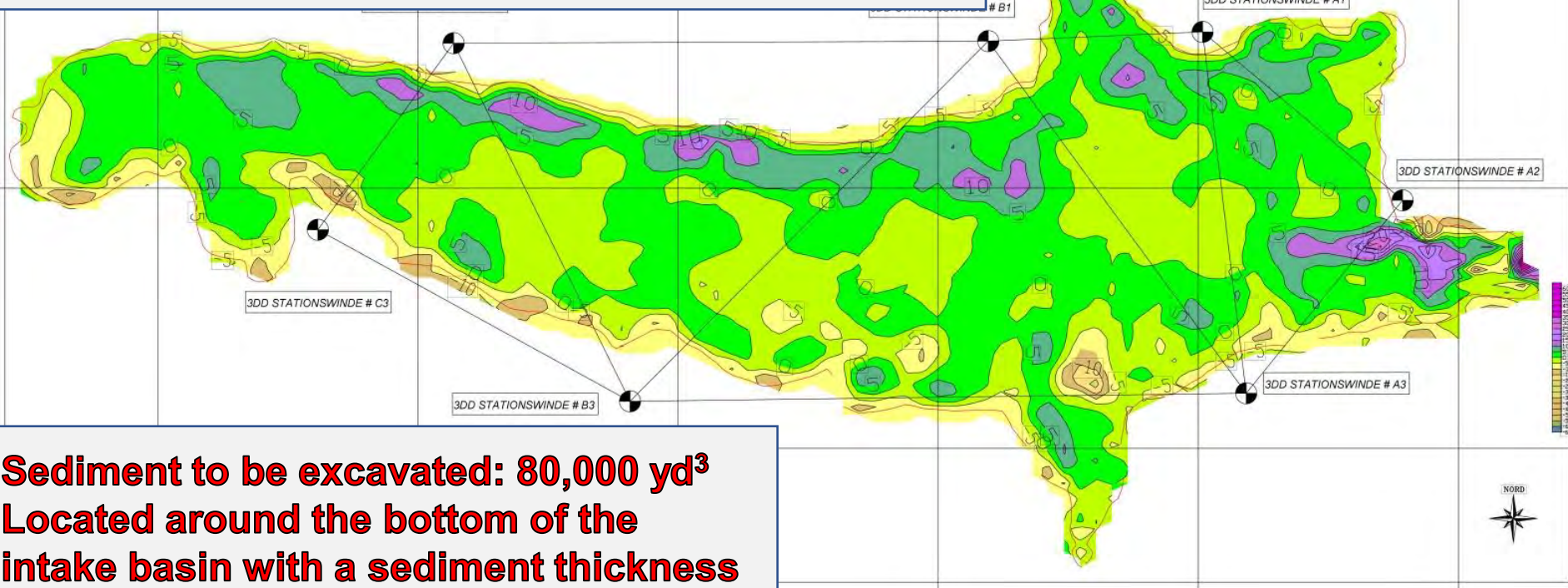




SIMULATION - TYPICAL SITE

Total amount of sediment: 250,000 yd³

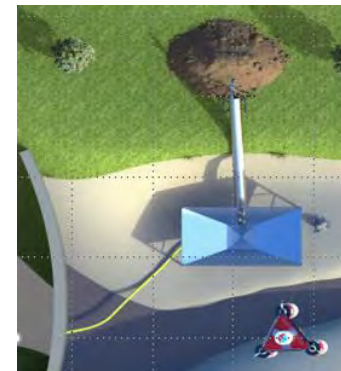
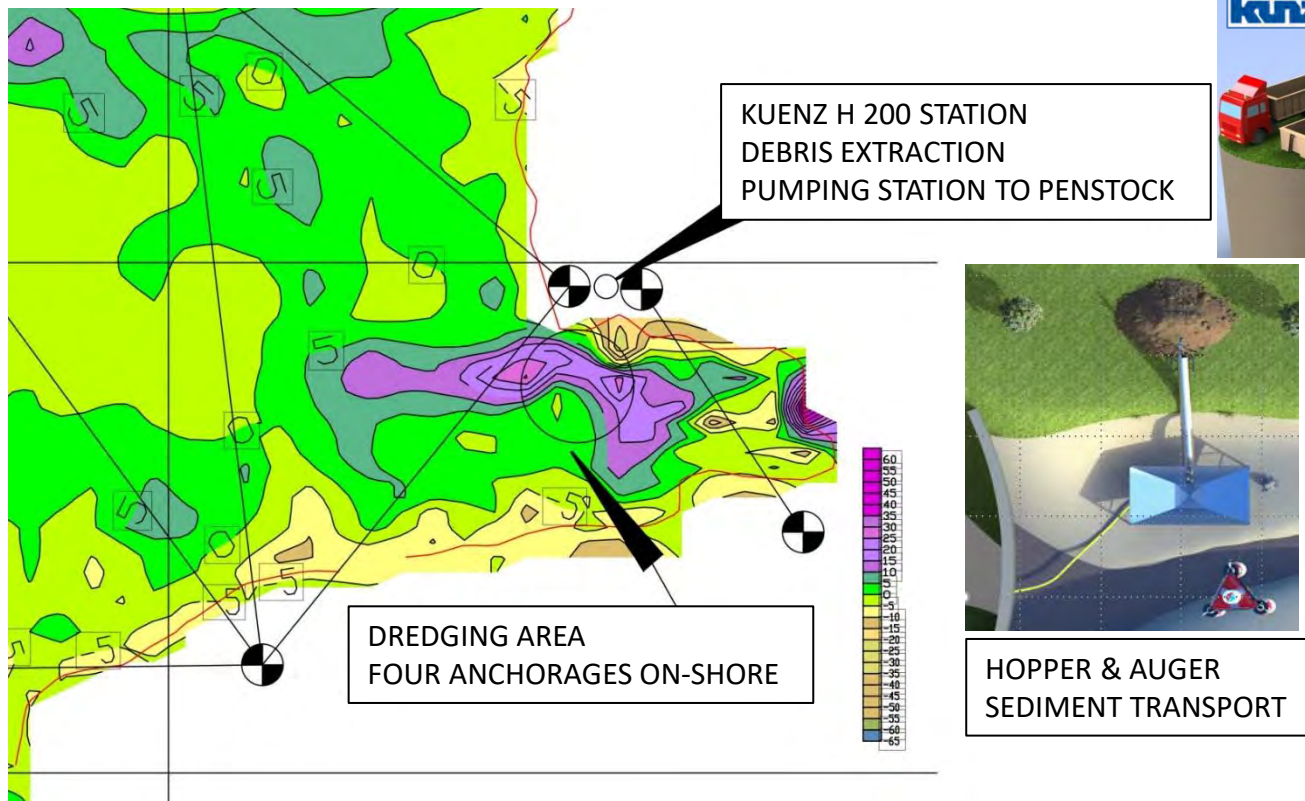
Fine sediment (95% clay) mixed with woody debris
Average intake flow: 162 ft³/s



Sediment to be excavated: 80,000 yd³
Located around the bottom of the
intake basin with a sediment thickness
of 20 ft



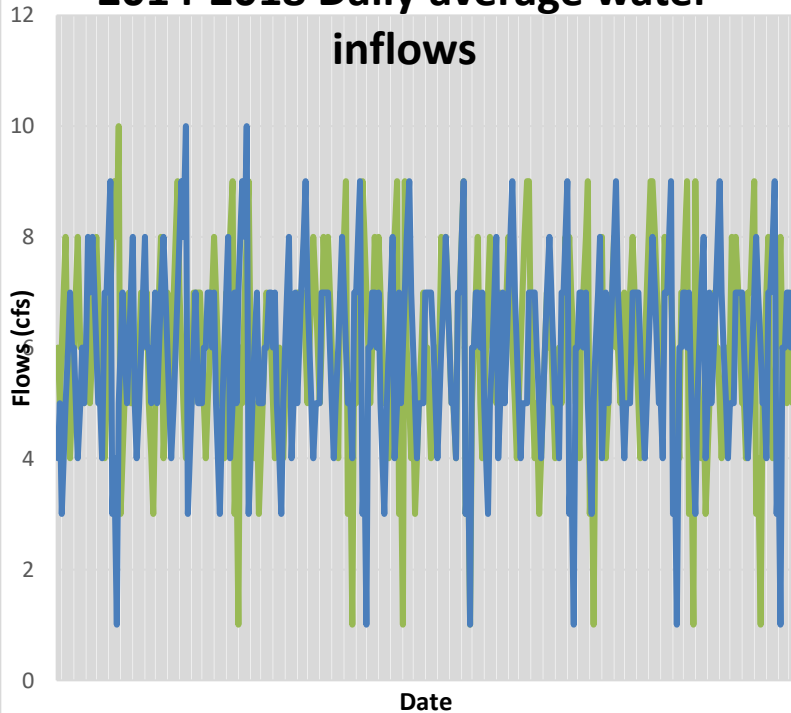
SIMULATION DREDGING GEOMETRY



The operating speed of the 3DD is adjusted in accordance with the flow through the fluid pathway to the downstream area. This method maintains the concentration of suspended solids to accommodate the regulated limit.
Average flow: 162 ft³/s

SIMULATION ANALYSIS

2014-2018 Daily average water inflows



80,000 yd³ of sediment around the bottom of the intake basin with a sediment thickness of 20 ft

SIMULATION #3 OPERATIONAL ANALYSIS

Description	Value	Unit
DISTANCE DREDGING AREA ON-SHORE STATION	500	ft
DEPTH OF THE SEDIMENT	220	ft
NAVIGATION TIME	333	sec
EXTRACTING TIME	220	sec
OPERATING TIME	553	sec
EXTRA MANEUVER TIME 20%	111	sec
CYCLE DURATION	664	sec
80% VOLUME OF THE BUCKET	2.41	yd ³
SEDIMENT FLOW - MADE BY THE 3DD	0.1	ft ³ /s
DAILY SEDIMENT REMOVAL (20 h operating time)	261	yd ³
MONTHLY SEDIMENT REMOVAL (25 days)	6,526	yd ³
SEDIMENT REMOVAL 12 MONTHS	78,313	yd ³
MAX LIMIT SOLID/WATER --> TURBIDITY	0.3745678	lb/ft ³
AVERAGE INTAKE FLOW	165	ft ³ /s
TURBIDITY DOWNSTREAM	0.07416	lb/ft ³
RATIO TURBIDITY/MAX ADMITTED TURBIDITY	19.80	%

SIMULATION FINANCIAL ANALYSIS

COSTS	
With hopper/auger sediment movement system	
3DD budgetary cost	500,000 USD
3DD installation – budgetary cost	300,000 USD
3DD asset depreciation - 10 Years	80,000 USD/yr
Hopper/auger with installation, budgetary cost	120,000 USD
Hopper/Auger asset depreciacion 10 Years	12,000 USD/yr
Maintenance & Services, 15% of the asset	92,000 USD
Technicians - 2 (scheduled maintenance, servicing intervention)	160,000 USD
ENERGY - 200 kW – 5,000 h – 0.2 USD/KWH	200,000 USD
OPERATION COSTS, ANNUALLY	544,000 USD
COST/yd³	7.02 USD

COSTS	
With alternative H200 sediment movement system	
3DD budgetary cost	500,000 USD
3DD installation – budgetary cost	300,000 USD
3DD asset depreciation - 10 Years	80,000 USD/yr
H200 budgetary cost	300,000 USD
H200 installation – budgetary cost	200,000 USD
H200 asset depreciacion - 10 Years	50,000 USD/yr
Maintenance & Services, 15% of the asset	120,000 USD
Technicians - 2 (scheduled maintenance, servicing intervention)	160,000 USD
ENERGY - 200 kW – 5,000 h – 0.2 USD/KWH	200,000 USD
OPERATION COSTS	610,000 USD
COST/yd³	7.83 USD



Questions?