Year	Department	Division/Section	Title
Liane Shekter Smith			
2015 - 2016	Environmental Quality	Executive	Assistant
2012 - 2015	Environmental Quality	Office of Drinking Water and Municipal Assistance	Office Chief
2011 - 2012	Environmental Quality	Office of Waste Management and Radiological Protection	Office Chief
2010 - 2011	Natural Resources and the Environment	Environmental Resources Management	Division Chief
2005 - 2010	Environmental Quality	Waste and Hazardous Materials	Division Chief
2002 - 2005	Environmental Quality	Waste and Hazardous Materials - Hazardous Waste	Environmental Manager
1996 - 2002	Environmental Quality	Drinking Water and Radiological Protection (Kalamazoo 2000-2002)	Engineer Manager
1994 - 1996	Natural Resources/Environmental Quality		Environmental Manager
1990 - 1994	Natural Resources		Environmental Quality Manager
1989 - 1993	Natural Resources		General Engineer/Environmental Engineer
1988 - 1989	Public Health		Student Assistant
Stephen Busch			
2014 -	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations - Lansing	Environmental Manager/District Coordinator
2013 - 2014	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations - Lansing	Environmental Manager
2011 - 2013	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations - Grand Rapids	Environmental Engineer
2010 - 2011	Natural Resources and the Environment	Environmental Resources Management/Field Operations - Grand Rapids	Environmental Engineer
2005 - 2010	Environmental Quality	Water Resources Bureau - Grand Rapids	Environmental Engineer
2002 - 2005	Environmental Quality	Water Resources Bureau - Grand Rapids, Kalamazoo	Environmental Engineer
2000 - 2002	Environmental Quality	Surface Water Quality	Environmental Engineer/General Engineer
Richard Benzie			
2015 -	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations	Section Manager
2013 - 2015	Environmental Quality	Office of Drinking Water and Municipal Assistance	Engineer Manager
2011 - 2013	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations	Engineer Manager
2010 - 2011	Natural Resources and the Environment	Environmental Resources Management	Engineer Manager
2004 - 2010	Environmental Quality	Water Resources Bureau - Community Drinking Water	Engineer Manager
2003 - 2004	Environmental Quality	Water Division - Technical Support	Engineer Manager
2002 - 2003	Environmental Quality	Water Division	Engineer Manager
2000 - 2002	Environmental Quality	Drinking Water and Radiological Protection/Field Operations	Engineer Manager
1998 - 2000	Environmental Quality		Environmental Engineer Specialist
1996 - 1998	Environmental Quality		Engineer Manager
1988 - 1996	Environmental Quality		Environmental Engineer
1981 - 1988	Environmental Quality		Sanitary Engineer
1979 - 1981	Public Health		Environmental Engineer
1978 - 1979	Public Health		General Engineer
1977 - 1978	Public Health		Sanitary Engineer

Adam Rosenthal

2016 -	Environmental Quality	Office of Drinking Water and Municipal Assistance - Environmental Health	Environmental Quality Analyst
2011 - 2016	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations - Lansing	Environmental Quality Analyst
2010 - 2011	Natural Resources and the Environment	Environmental Resources Management/Field Operations - Lansing	Environmental Quality Analyst
2004 - 2010	Environmental Quality	Water Resources Bureau - Lansing	Environmental Quality Analyst
2002 - 2004	Environmental Quality	Water Division - Lansing	Resource Analyst
2001 - 2002	Environmental Quality	Drinking Water and Radiological Protection/Field Operations-Shiawassee	Resource Analyst
1999 - 2001	Environmental Quality	Drinking Water and Radiological Protection/Field Operations-Plainwell	Resource Analyst

Michael Prysby

2011 -	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations - Lansing	Environmental Engineer
2010 - 2011	Natural Resources and the Environment	Environmental Resources Management/Field Operations - Lansing	Environmental Engineer
2004 - 2010	Environmental Quality	Water Resources Bureau - Lansing	Environmental Engineer
2002 - 2004	Environmental Quality	Water Division - Lansing	Environmental Engineer
1989 - 2002	Environmental Quality	Drinking Water and Radiological Protection/Field Operations-Shiawassee	Environmental Engineer
1988 - 1990	Environmental Quality		General Engineer

Patrick Cook

2015-	Environmental Quality	Office of Drinking Water and Municipal Assistance - Environmental Health	Environmental Engineer Specialist
2011 - 2015	Environmental Quality	Office of Drinking Water and Municipal Assistance/Field Operations	Environmental Engineer Specialist
2010 - 2011	Natural Resources and the Environment	Environmental Resources Management	Environmental Engineer Specialist
2004 - 2010	Environmental Quality	Water Resources Bureau - Community Drinking Water	Environmental Engineer Specialist
2002 - 2004	Environmental Quality	Water Division - Technical Support	Environmental Engineer Specialist
1990 - 2002	Environmental Quality	Drinking Water and Radiological Protection	Environmental Engineer
1988 - 1990	Environmental Quality		General Engineer

Rennaker, Joanne (DEQ)

From: Matta, Samir <SFMatta@lan-inc.com>
Sent: Thursday, April 03, 2014 3:57 PM
To: Prysby, Mike (DEQ)
Cc: Busch, Stephen (DEQ)
Subject: Re: Flint WTP - Bray Road Lagoon Proposal - MDEQ comments

Hi Mike,

Does the piping have to be schedule 80 steel as our system is under vacuum and not under pressure as required by ten states standards?

Thanks.

Lockwood, Andrews & Newnam
Samir Matta, PE
(517) 819-2367

On Apr 3, 2014, at 8:57 AM, "Prysby, Mike (DEQ)" <PRYSBYM@michigan.gov> wrote:

> Samir,
>
> Attached are our comments pertaining to submittals received for Phase II – Segments I and II for the Flint WTP. If you have any questions concerning our comments, I will be available till close of business today to discuss with you. After today, you will need to contact Steve Busch concerning any questions regarding the Flint WTP project. I will return from vacation on Monday April 21st.
>
> Michael Prysby, P.E.
> District Engineer
> Office of Drinking Water and Municipal Assistance
> 517 290-8817
>
> <Pre-lim Eng Reports - DEQ Comments III April 2, 2014.doc>

Rennaker, Joanne (DEQ)

From:	Prysby, Mike (DEQ)
Sent:	Thursday, April 03, 2014 9:57 AM
To:	sfmatta@lan-inc.com
Cc:	Busch, Stephen (DEQ)
Subject:	Flint WTP - Bray Road Lagoon Proposal - MDEQ comments
Attachments:	Pre-lim Eng Reports - DEQ Comments III April 2, 2014.doc

Samir,

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Michael Prysby, P.E.
District Engineer
Office of Drinking Water and Municipal Assistance
517 290-8817

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
April 3, 2014

Phase II – Segment 1 - Watermain Cut-in Plans

- **Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.**

- **Include a full-sized mid-point chlorination system schematic with the updated plans.**

- **It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.**

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- **LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.**

- **The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days**

storage is maintained in the LOX tank at all times.

- Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.

- Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.

- Add panic hardware to chlorinator room door (east and west exits).

- The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.

- Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

Rennaker, Joanne (DEQ)

From: Cook, Pat (DEQ)
Sent: Friday, April 04, 2014 12:54 PM
To: Busch, Stephen (DEQ)
Subject: RE: Flint WTP - Bray Road Lagoon Proposal - MDEQ comments

According to 4.4.5.2 in Recommended Standards only pipes carrying elemental liquid or dry gaseous Cl2 *under pressure* must be schedule 80 steel. Maybe there was some confusion about exactly where in the feed piping the gas was being converted from pressure to vacuum. Or maybe we missed the "under pressure" part in 4.4.5.2.

pat

From: Busch, Stephen (DEQ)
Sent: Friday, April 04, 2014 12:22 PM
To: Cook, Pat (DEQ)
Subject: FW: Flint WTP - Bray Road Lagoon Proposal - MDEQ comments

Pat,

Wouldn't plastic tubing be allowed under the vacuum conditions? I'm not finding anything that would require the schedule 80 steel pipe, and not sure if my got this comment mixed up. Mike's original comment is listed below.

- **It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.**

Stephen Busch, P.E.
Lansing and Jackson District Supervisor
Office of Drinking Water and Municipal Assistance
MDEQ
517-643-2314

From: Matta, Samir [mailto:SFMatta@lan-inc.com]
Sent: Thursday, April 03, 2014 3:57 PM
To: Prysby, Mike (DEQ)
Cc: Busch, Stephen (DEQ)
Subject: Re: Flint WTP - Bray Road Lagoon Proposal - MDEQ comments

Hi Mike,

Does the piping have to be schedule 80 steel as our system is under vacuum and not under pressure as required by ten states standards?

Thanks.

Lockwood, Andrews & Newnam
Samir Matta, PE
(517) 819-2367

On Apr 3, 2014, at 8:57 AM, "Prysby, Mike (DEQ)" <PRYSBYM@michigan.gov> wrote:

Samir,

Attached are our comments pertaining to submittals received for Phase II – Segments I and II for the Flint WTP. If you have any questions concerning our comments, I will be available till close of business today to discuss with you. After today, you will need to contact Steve Busch concerning any questions regarding the Flint WTP project. I will return from vacation on Monday April 21st.

Michael Prysby, P.E.
District Engineer
Office of Drinking Water and Municipal Assistance
517 290-8817

<Pre-lim Eng Reports - DEQ Comments III April 2, 2014.doc>

Rennaker, Joanne (DEQ)

From: Matta, Samir <SFMatta@lan-inc.com>
Sent: Wednesday, April 09, 2014 12:26 AM
To: Rennaker, Joanne (DEQ)
Cc: Busch, Stephen (DEQ)
Subject: RE: Flint Plan DropOff
Attachments: Flint WTP Phase II-Segment I and III MDEQ Permit App Pg2.pdf

Hi Joanne,

I was looking at my copy of the package I dropped for Steve's review and I noticed that I have 2 copies of the attached Page 2 of the permit form for the Plant work so I am not sure if you have this copy in your package.

Would you please add this page to the package you have and it will go with the replacement page 2 for the other permit form for the Bray Road work?

Thanks a lot.

Samir F. Matta
Senior Project Manager

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
D 517.819.2367 **C** 517.819.2367
www.lan-inc.com • sfmatta@lan-inc.com

6. **Facilities Description** – In the space below provide a detailed description of the proposed project. Applications without adequate facilities descriptions **will be returned**. SEE EXAMPLES BELOW. Use additional sheets if needed.

Improvements to the City of Flint WTP to enable treatment of Flint River water on an interim basis until the KWA Lake Huron Water Supply is available for connection and use by the City of Flint:

PHASE II, SEGMENT I - INITIAL WATERMAIN CUT-IN / REHABILITATION (@WTP):
* Replace existing 25 MGD HSP #1 at Pump Station No. 4 with a new 700 HP, vertically mounted, split-case centrifugal pump rated for 15 MGD at 185' TDH. New pump suction and discharge piping, valves and supports will also be provided.
* Construction of new ozone system LOX/LIN storage facility to provide system redundancy and a minimum of 30 days chemical storage. A new concrete containment structure will be constructed adjacent to the existing LOX/LIN storage facility. The new LOX and LIN tanks will have nominal capacities of 9000 gal. and 525 gal., respectively.
* Installation of Midpoint Chlorination. A 3"x6" dual walled chlorine solution line, approx. 665 LF, will be installed from the existing chlorine room at Pump Station No. 4 to a diffuser in the filter influent channel at Plant 2. The chlorine gas feed system shall consist of four 500 ppd feed systems (total 2000 ppd) to be installed by City personnel. Each 500 ppd system consists of a ton cylinder mounted vacuum regulator, control panel, ejector, and misc. piping, tubing & valves.
* Approx. 850 LF 42" raw watermain connection from existing 48" and 36" mains that feed the plant to convey KWA raw water to the Ozone Building. Work includes a 54x48 cross to make the initial connection at the Ozone Building, buried yard butterfly valves, access and air release manholes, and cathodic protection test stations.

PHASE II, SEGMENT III - ELECTRICAL IMPROVEMENTS (@WTP):
* Plant substation improvements, including two new 2500 kW transformers and switchgear. The substation switchgear has been fabricated with two utility main breakers, one generator breaker and two tie breakers. So provisions are in place for a future permanent generator. If a temporary generator is needed in the event of an outage to both independent utility services, provisions are in place to temporary cable a large portable generator through a manhole, duct bank and cable tray system to the generator breaker in the substation switchgear
* Plant 2 electrical improvements, including two new 500 kW transformers and switchgear.
* Pump Station No. 4 improvements, including new switchgear and VFD for HSP #1.

EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES	
Water Mains	500 feet of 8-inch water main in First Street from Main Street north to State Street. **OR** 250 feet of 12-inch water main in Clark Road from an existing 8-inch main in Third Avenue north to a hydrant.
Booster Stations	A booster station located at the southwest corner of Third Avenue and Main Street, and equipped with two, 15 Hp pumps each rated 150 gpm @ 200 feet TDH. Station includes backup power and all other equipment as required for proper operation.
Elevated Storage Tank	A 300,000 gallon elevated storage tank located in City Park. The proposed tank shall be spherical, all welded construction and supported on a single pedestal. The tank shall be 150 feet in height, 40 feet in diameter with a normal operating range of 130 – 145 feet. The interior coating system shall be ANSI/NSF Standard 61 approved or equivalent. The tank will be equipped with a cathodic protection system, and includes a tank level control system with telemetry.
Chemical Feed	A positive displacement chemical feed pump, rated at 24 gpd @ 110 psi to apply a chlorine solution for Well No. 1. Chlorine is 12.5% NaOCL, ANSI/NSF Standard 60 approved and will be applied at a rate of 1.0 mg/l of actual chlorine.
Water Supply Well	Well No. 3, a 200 foot deep well with 170 feet of 8-inch casing and 30 feet of 8-inch, 10 slot screen. The well will be equipped with a 20 Hp submersible pump and motor rated 200 gpm @ 225 feet TDH, set at 160 feet below land surface.
Treatment Facilities	A 5 million gpd water treatment plant located at the north end of Second Avenue. The facility will include 6 low service pumps, 2 rapid mix basins, 4 flocculation/sedimentation basins, 8 dual media filters, 3 million gallon water storage reservoir and 6 high service pumps. Also included are chemical feed pumps and related appurtenances for the addition of alum, fluoride, phosphate and chlorine.

231C

PERMIT APPLICATION FOR WATER SUPPLY SYSTEMS

(CONSTRUCTION - ALTERATION - ADDITION OR IMPROVEMENT) AS DESCRIBED HEREIN

Required under the Authority of 1976 PA 399, as amended

This application becomes an Act 399 Permit only when signed and issued by authorized Michigan Department of Environmental Quality (DEQ) Staff. See instructions below for completion of this application.

1. Municipality or Organization, Address and WSSN that will own or control the water facilities to be constructed. This permit is to be issued to:

City of Flint
4500 North Dort Highway
Flint, MI 48505

WSSN: 02310

Permit Stamp Area (DEQ use only)

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT NO. W 140025 APR 09 2014

EXAMINED AND APPROVED FOR COMPLIANCE WITH ACT 399, P.A. 1976

2. Owner's Contact Person (provide name for questions):

Contact: Brent Wright

Title: Plant Supervisor

Phone: 810-787-6537

3. Project Name (Provide phase number if project is segmented):

1) Flint WTP Phase II, Sement I - Initial Watermain Cut-In / Rehabilitation; 2) Flint WTP Phase II, Segment II - Lime Residual Disposal; 3) Flint WTP Phase II, Segment III - Electrical Improvements

4. Project Location (City, Village, Township):
City of Flint

5. County (location of project):
Genesee County

ISSUED UNDER THE AUTHORITY OF THE DIRECTOR OF THE DEPARTMENT OF ENVIRONMENT QUALITY

cc:

Issued by: _____

Reviewed by: Patrick Cook for MPP
for Mike Prysby

☐ **If this box is marked see attached special conditions.**

Instructions: Complete items 1 through 5 above and 6 through 21 on the following pages of this application. Print or type all information except for signatures. Mail completed application, plans and specifications, and any attachments to the DEQ District Office having jurisdiction in the area of the proposed construction.

Please Note:

a. This **PERMIT** only authorizes the construction, alteration, addition or improvement of the water system described herein and is issued solely under the authority of 1976 PA 399, as amended.
b. The issuance of this **PERMIT** does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other DEQ permits, or approvals from other units of government as may be required by law.
c. This **PERMIT** expires two (2) years after the date of issuance in accordance with R 325.11306, 1976 PA 399, administrative rules, unless construction has been initiated prior to expiration.
d. Noncompliance with the conditions of this permit and the requirements of the Act constitutes a violation of the Act.
e. Applicant must give notice to public utilities in accordance with 1974 PA 53; (MISS DIG), being Section 460.701 to 460.718 of the Michigan Compiled Laws, and comply with each of the requirements of that Act.
f. All earth changing activities must be conducted in accordance with the requirements of the Soil Erosion and Sedimentation Control Act, Part 91, 1994 PA 451, as amended.
g. All construction activity impacting wetlands must be conducted in accordance with the Wetland Protection Act, Part 303, 1994 PA 451, as amended.
h. Intentionally providing false information in this application constitutes fraud which is punishable by fine and/or imprisonment.
i. Where applicable for water withdrawals, the issuance of this permit indicates compliance with the requirements of Part 327 of Act 451, Great Lakes Preservation Act.

6. **Facilities Description** – In the space below provide a detailed description of the proposed project. Applications without adequate facilities descriptions **will be returned.** SEE EXAMPLES BELOW. Use additional sheets if needed.

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General Project Information – Complete all boxes below.

7. Design engineer's name, engineering firm, address, phone number, and email address:	8. Indicate who will provide project construction inspection:
Jeremy N. Nakashima, PE Lockwood, Andrews & Newnam, Inc. 1 Oakbrook Terrace, Suite 207 Oakbrook Terrace, IL 60181 630-495-4123 / jnnakashima@lan-inc.com	☒Organization listed in Box 1. ☒Engineering firm listed in Box 7. ☐Other - name, address, and phone number listed below.

9. Is a basis of design attached?
☒YES ☐NO

If no, briefly explain why a basis of design is not needed. Submitted previously under separate cover.

10. Are sealed and signed engineering plans attached?
☒YES ☐NO

If no, briefly explain why engineering plans are not needed. Plans and specs submitted previously under separate cover.

11. Are sealed and signed construction specifications attached?
☒YES ☐NO

If specifications are not attached, they need to be on file at DEQ.

12. Were Recommended Standards for Water Works, Suggested Practice for Water Works, AWWA guidelines, and the requirements of Act 399 and its administrative rules followed?
☒YES ☐NO

If no, explain which deviations were made and why.

13. Are all coatings, chemical additives and construction materials ANSI/NSF or other adequate 3rd party approved?
☒YES ☐NO

If no, describe what coatings, additives or materials did not meet the applicable standard and why.

14. Are all water system facilities being installed in the public right-of-way or a dedicated utility easement? (For projects not located in the public right-of-way, utility easements must be shown on the plans.)
☐YES ☒NO

If no, explain how access will be obtained. Most work will be on City owned property, except forcemain.

15. Is the project construction activity within a wetland (as defined by Section 324.30301(d)) of Part 303, 1994 PA 451?
☐YES ☒NO

If yes, a wetland permit must be obtained.

16. Is the project construction activity within a 100-year floodplain (as defined by R 323.1311(e)) of Part 31, 1994 PA 451, administrative rules?
☐YES ☒NO

If yes, a flood plain permit must be obtained.

17. Is the project construction activity within 500 feet of a lake, reservoir, or stream?
☒YES ☐NO

If yes, a Soil and Erosion Control Permit must be obtained or indicate if the owner listed in box 2 of this application is an Authorized Public Agency (Section 10 of Part 91, 1994 PA 451) ☐ Owner is APA.

18. Will the proposed construction activity be part of a project involving the disturbance of five (5) or more acres of land?
☐YES ☒NO
If yes, is this activity regulated by the National Pollutant Discharge Elimination System storm water regulations?
☐YES: NPDES Authorization to discharge storm water from construction activities must be obtained.

☐NO: Describe why activity is not regulated:
Please call 517-241-8993 with questions regarding the applicability of the storm water regulations.

19. Is the project in or adjacent to a site of suspected or known soil or groundwater contamination?
☐YES ☒NO

If yes, attach a copy of a plan acceptable to the DEQ for handling contaminated soils and/or groundwater disturbed during construction. Contact the local DEQ district office for listings of Michigan sites of environmental contamination.

20. IF YOU ARE A CUSTOMER/WHOLESALE/BULK PURCHASER, COMPLETE THE FOLLOWING

1) Name and WSSN of source water supply system (seller) _____

2) Does the water service contract require water producer/seller to review and approve customer/wholesale/bulk purchaser water system construction plans?
☐YES ☐NO

If yes to #2, the producer/seller approval letter must be attached when submitted to DEQ.

21. **Owner's Certification** The owner of the proposed facilities or the owner's authorized representative shall complete the owner's certification. It is anticipated that the owner will either be a governmental agency (city, village, township, county, etc.) or a private owner (individual, company, association, etc.) of a Type I public water supply.

OWNER'S CERTIFICATION

I, BRENT F. WRIGHT (print) (name), acting as the WATER PLANT SUPERVISOR (print) (title/position) for

CITY OF FLINT (print) (entity owning proposed facilities) certify that this project has been reviewed and approved as detailed by the Plans and Specifications submitted under this application, and is in compliance with the requirements of 1976 PA 399, as amended, and its administrative rules.

Signature*	Date	Phone
	3-31-2014	(810)787-6537

*Original signature only, no photocopies will be accepted.

PROJECT BASIS OF DESIGN – FOR WATER MAIN PROJECTS

PROJECT NAME: _____

For this PROJECT the following information must be provided per Act 399 unless waived by the Department. For projects other than water main installation, or if additional space is needed, attach separate sheet(s) with detailed Basis of Design calculations.

A. A general map of the initial and ultimate service areas
☐Included on engineering plans ☐Attached separately

B. Number of service connections served by this permit application _____

C. Total number of service connections ultimately served by entire project _____

D. Residential Equivalent Units (REUs) served by this permit application _____

E. Total Residential Equivalent Units (REUs) ultimately served by entire project _____

F. Water flow rates for proposed project based on REUs listed in "D' and "E" above

1. Initial design average day flow (mgd) _____
2. Initial design maximum day flow (mgd) _____
3. Total design average day flow (mgd) _____
4. Total design maximum day flow (mgd) _____
5. Required fire flows: (1) _____ gpm for _____ hours

G. Actual flows and pressures of existing system at the connection point(s) (2)
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi

H. Estimated minimum flows and pressures within the proposed water main system (3) _____ gpm at _____ psi

(1) Every water system must decide what levels of fire fighting flows they wish to provide. Fire flow should be appropriate for the area (residential, commercial, industrial) being served by the project. Typical fire flow rates can be obtained from the water supply, local fire dept., ISO or AWWA. The water system must then be designed to be able to provide the required fire flows while maintaining at least 20 psi in all portions of the distribution system.

(2) Flows and pressures at the connection points must be given to determine if the existing water main(s) are able to deliver water to the new service area. These numbers can be obtained from a properly modeled and calibrated distribution system hydraulic analysis or hydrant flow tests performed in the field. If more than one connection is proposed, list as needed.

(3) List what the estimated minimum flows can be expected in the proposed water mains based on estimated water demands, head losses, elevation changes and other factors that may affect flows, such as dead end mains.

Lockwood, Andrews & Newnam, Inc.

PLANNING

ENGINEERING

PROGRAM MANAGEMENT

Est. 1935

AUSTIN, TX
CHICAGO, IL
CLEARWATER, FL
COLLEGE STATION, TX
DALLAS, TX
FLINT, MI
FORT WORTH, TX
HOUSTON, TX
HUNTINGTON BEACH, CA
LAS VEGAS, NV
LOS ANGELES, CA
MIAMI, FL
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PHOENIX, AZ
SACRAMENTO, CA
SAN ANTONIO, TX
SAN MARCOS, TX
WACO, TX

TRANSMITTAL

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To: Mr. Steve Busch, PE	**Date** 4-8-14
	Project Number 130-10701-001
Company: MDEQ	**Routing:**
Address: 525 WEST ALLEGAN STREET Lansing, MI 48933	
Project: City of Flint Water Treatment Plant Improvements.	

We Are Sending You:		These Are Transmitted:
☐ Shop Drawings	☐ Reports	☐ As Requested
☐ Original Drawings	☐ Submittal Data	☒ For Your Use
☒ Prints	☐ Proposal	☒ For Review and Comment
☐ Specifications	☐ As Noted	☐ For Your Signature

Quantity	Description
2	22x34 Plans - Phase II, Segment 1 – Rehabilitation
2	22x34 Plans - Phase II, Segment 1 – Initial Watermain Cut-In
2	22x34 Plans - Phase II, Segment II – Lime Residual Disposal
2	Final Bray Road Lime sludge management Plan
1	Updated page 2 for permit applications
1	LAN Team Response to MDEQ Review comments

Remarks

These plans are being submitted for permit issuance as discussed.

DEQ
RESOURCE MANAGEMENT DIVISION
APR 08 2014
LANSING DISTRICT

Distribution	Prepared By
1- Daugherty Johnson 2- Brent Wright 3- File	Samir Matta, PE

1311 SOUTH LINDEN ROAD
SUITE B
FLINT, MI 48532
TEL 810.820.2682
FAX 810.820.2703
www.lan-inc.com

If enclosures are not as noted, kindly notify us at once.

Flint WTP Improvements – Phase II, Segments I, II, and III
Responses to MDEQ Review Comments dated 4-3-2014

The MDEQ review comments dated 4-3-14 have been addressed as noted in the responses below. Revised drawings have also been prepared in conjunction with these responses and have been included in the attached revised drawing sets for Phase II, Segments I, II, and III.

Phase II – Segment 1 - Watermain Cut-in Plans

- **Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.**

  Response: The anti-siphon/ball valve is shown on revised Sheet C-104, dated 4-7-14.

- **Include a full-sized mid-point chlorination system schematic with the updated plans.**

  Response: The mid-point chlorination system schematic has been included in the Phase II, Segment I – Initial Watermain Cut-in drawings as Sheet C-509, dated 4-7-14.

- **It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.**

  Response: The above description of the midpoint chlorination system is essentially correct. As shown on Sheet C-509, the mid-point chlorination system is a vacuum system. The vacuum regulators are mounted directly to the chlorine storage cylinders. Vacuum lines run from the regulators to the chlorinator control panels where feed rate is controlled. Vacuum lines are then connected from the control panel to ejectors, where water supply flowing through the ejectors creates the vacuum required to pull gas from the storage tanks. While the ejectors are not located in the control panel, it is common to have the ejectors remotely mounted from the control panels. A review of the 10 State Standards requirement for Schedule 80 seamless steel tubing appears to be for pressure gas feed systems, and not vacuum gas feed systems as proposed for Flint. As such, the recommended vacuum line material for a 500

ppd system is 5/8" O.D. flexible polyethylene plastic tubing (see attached information from Hydro Instruments).

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- **LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.**

  Response: Revised drawings D2-101, D2-102, D2-301, D2-502, and D2-601 have been included in the updated plan set.

- **The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days storage is maintained in the LOX tank at all times.**

  Response: The City will provide MDEQ a copy of the contract between the City and their LOX supplier under separate cover. LOX can be supplied within 24 hours of when a purchase order is issued.

- **Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.**

  Response: Sheets C5-105, C5-508, and EP6-101, which are all specific to the chlorine scrubber work only, have been deleted in their entirety from the updated plan set.

- **Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.**

  Response: This intake duct detail is no longer applicable as it is for the chlorine scrubber system, which has been deleted. As noted in the previous MDEQ review comment responses, the City will extend the existing ventilation intake ductwork in the existing Chlorine Storage Room to finished floor level. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 7 of revised drawing Sheet C-103.

- **Add panic hardware to chlorinator room door (east and west exits).**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 8 of revised drawing Sheet C-103.

- **The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see notes on revised drawing Sheet C-103.

- **Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.**

  Response: The Contractor is required to field verify the elevation of the existing 54" pipeline. The City or the City's representative onsite observing construction will coordinate with the Contractor to ensure that the clearance between the 42" and 54" pipelines is increased to the maximum extent practical.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Response: 2 full sized sets of construction plans of proposed work at the Bray Road Sludge Lagoon are included for your review and file. The separation barrier between the concrete disposal area and the lime sludge disposal area will be accomplished by

establishing a clay barrier that extends to the bottom of the original lagoon bottom as shown in the detail on sheet C-501. The separation barrier will be constructed within the lime sludge lagoon away from the concrete disposal area as to provide complete separation as discussed.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

Response: A final version of the Bray Road Lime Sludge Management Plan is being included with this final submittal. A level working surface of 738.5' has been designated within the sludge lagoon after the pump station is operational. All debris or vegetation growth within the 742' elevation within the sludge lagoon is intended to be removed and cleared by the contractor.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Response: Sheet piling is no longer being used as the separation barrier based on further discussion with the contractor and availability. A clay berm will be constructed for the full depth within the lime sludge lagoon using the original bottom of the sludge lagoon as a base using the proposed alignment proposed for the sheet piling.

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

MDEQ Comments & LAN's Responses

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
April 3, 2014

Phase II – Segment 1 - Watermain Cut-in Plans

- Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.

- Include a full-sized mid-point chlorination system schematic with the updated plans.

- It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.

- The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

storage is maintained in the LOX tank at all times.

- Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.

- Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.

- Add panic hardware to chlorinator room door (east and west exits).

- The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.

- Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
March 19 , 2014

Segment 1 - Cut –in Piping

The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?

Written response needed.....

Segment 1 – WTP Rehab

1. **Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102**

   54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?

   Air-release manhole – same as Cut-in piping

   Current yard piping diagram?

Written response needed on the first 3 items. Yard piping diagram will be a work in progress.

2. **Mid-Point CL2 - Basis of design provided**

   - **Scale – use existing or proposed? If poposed - type, capacity**
   - **Scrubber?**
   - **Room air-exchange rate ?**
   - **Pipe penetrations – discuss protective seal**
   - **Floor drains – discuss**
   - **Door sweep - discuss**
   - **Scrubber piping – lower intake**

8 10 516 6793

- Check valve/anti-siphon at influent channel - include in final

3. High Service Pump

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   TDH of current pump and proposed pump?
   Conformance of proposed pump TDH with system head curve?

   Written response needed.....

4. LOX/LN Storage

   Piping configuration clarified
   The LN calculation (71 ppd) is not clear. Is there a % concentration or transfer efficiency?

5. Electrical improvements

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

   Written response needed.....

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
February 27, 2014

2 FKNS – Access manhole a.R. line – connect to corp – to connect air – to release air during filling

Segment 1 - Cut –in Piping

✓ The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?
→ (pump em down)

Segment 1 – WTP Rehab

1. ✓ Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102
   not 60"? ← gone till just prior to ... Availability

   ✓ 54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?
   → Field adjust the steel WM – maintain the vert sep.

   ✓ Air-release manhole – same as Cut-in piping
   → same design

   <u>Current yard piping diagram?</u> – work in progress – same op. concept

2. Mid-Point CL2 - Basis of design needed

   - Application rate (both mid-pt & post for CT)
   - CL2 gas max dosage LBs/Day
   - Scale – type, capacity ✓ 4 new scaletron Ind.
   - Rotometer (lbs/day)
   - Vacc reg, injector, educator (size)
   - Scrubber capacity – not being installed
   - Room air-exchange rate 1/3.3 min
   - Pipe penetrations – Sheet C-103 – linkseal – gas resistant? – will inspect & seal
   - Floor drains – to be plugged
   - Door sweep – new better sealing sweeps to be provided
   - Safety features – obs window, fan, lights, switches, panic bar
   - Scrubber piping – <u>lower intake</u> → will extend to floor w. 90° bend
   - Check valve/anti-siphon at influent channel – yes

hydraulic check valve will close on system failure/shut-down

3. **High Service Pump**

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   TDH of current pump and proposed pump? 185 will match w. smaller pump
   Conformance of proposed pump TDH with system head curve?

4. **LOX/LN Storage**

   LOX & LN piping clarification – Sheet D2-102 & D2-601
   BOD for storage
   Ozone was designed at 4.0 mg/l max dose @ 36 MGD (Sec. 3.5 WTP BOD)

   Ozone max dose at 18.0 MGD is 650 Lbs/day

   How many GPD does this equate to?

5. **Electrical improvements**

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

One switchgear – dual feed
&
Two breakers – Kirby

Flint WTP Improvements – Phase II, Segments I, II and III

Responses to MDEQ Review Comments dated 3/19/2014

Segment I – Initial Watermain Cut-in

1. Detail 2, Sheet C-504, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.

Segment 1 – Rehabilitation

1. Raw Water Piping
   a. Maintain back up supply from Genesee County during interim operation at C.S. #2. Installation of the 42" raw water piping has been delayed until the KWA project is closer to being ready to supply water to the City. This will allow the City to maintain the backup supply from Genesee County during interim operation.
   b. The crossing of the new 42" steel pipe over the existing 54" concrete pipe is shown in plan on drawing sheet C5-101, with Detail 5, Sheet C5-501 showing how the 42-inch line will be supported. As shown on Detail 5, Sheet C5-501, the new 42-inch line will have concrete pipe cradles constructed on either side of the existing 54" pipe, maintaining a minimum clearance of 12" on either side of the 54" pipe. Pipe loads from the 42" line will then be transferred to the pipe cradles and into the soil, and not the 54" pipe. The 6" clearance between the two pipes will be backfilled with CLSM material as it will be impossible to compact typical granular bedding material under the 42" pipe.
   c. Detail 2, Sheet C5-505, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.
   d. See attached color coded yard piping diagram.

2. Midpoint Chlorination
   a. Four (4) new scales will be provided for monitoring chlorine usage from ton containers. Scales shall be as manufactured by Scaletron Industries Ltd. with a load range of 0 to 4000 lbs.
   b. The City has not been able to determine that the chlorine scrubber is a requirement of any applicable code. At this time, the City will not be installing the chlorine scrubber shown on the design drawings and will rely on the existing ventilation system to exhaust air from the Chlorine Storage Room.
   c. The existing ventilation in the Chlorine Storage Room was tested to have a capacity of 18.3 air changes per hour, or 0.305 air changes per minute. Therefore, one room volume air

change would take approximately 3.3 minutes with the current ventilation system. See attached test results. Due to the size of the existing Chlorine Storage Room, a ventilation system of 1 air change per minute is not practical. While the existing ventilation system capacity is less than 1 air change per minute, it appears to be in compliance with 10 State Standards as lesser rates may be considered in cases where 1 air change per minute is not appropriate due to the size of the room.

d. WTP staff will identify and inspect all proposed and existing piping and conduit wall penetrations in the Chlorine Storage Room and seal as necessary to prevent gas leakage into other parts of Pump Station No. 4.
e. Existing floor drains in the Chlorine Storage Room were for condensate from the old chlorine evaporator system. These drains will no longer be used and will be plugged by WTP staff.
f. WTP staff will attach new door sweeps with better seals at existing doors as required.
g. WTP staff will extend existing ventilation intake ductwork to finished floor level with 90-degree bends.
h. Per Addendum No. 1, an Anti-siphon / Back Pressure Valve and additional ball valve shall be added just prior to the trough wall penetration. The anti-siphon / back pressure valve shall be PVC and designed for use with chlorine systems. The valve shall be a LMI #35856, Walchem E90422, or engineer approved equivalent. The valve shall be installed between the two ball valves to allow for isolation during servicing. The valve shall be located above the high water level in the trough. The Contractor shall install a 1" drain line from the relief port to the finished floor elevation of the pipe gallery.

3. High Service Pump
   a. The new 16" pump control ball valve for HSP #1 replaces the existing pump control ball valve in kind and will operate in the same manner as the existing valve. The valve will act like a check valve upon emergency shutdown of the pump through the use of a hydraulic cylinder actuator that will automatically close the valve. The cylinder actuator uses hydraulic water system pressure to supply the energy required to close the valve.
   b. The existing HSP #1 is rated for 25 MGD at 185' TDH. The proposed replacement HSP #1 is rated for 15 MGD at 185' TDH, matching the head condition of the existing pump.
   c. Results from the City's hydraulic model were used to develop system curves for max day and average day, which were used to confirm pump selection. The proposed HSP #1 will operate on a VFD which can be adjusted during operation to meet various duty points depending on demand.

4. LOX/LIN Storage
   a. Nitrogen usage is calculated based on 2.5 % of the oxygen usage:

      2,833 ppd O_2 x 0.025 = 71 ppd N_2

5. Electrical Improvements
   a. The operation of the pumps is contained within a single switchgear at Pump Station No. 4. However, there will be a dual feed coming into the main plant switchgear that will supply redundant power to the plant, including Pump Station No. 4. There will also be two breakers

at the main plant switchgear that feed two different breakers at Pump Station No. 4. Therefore, any one point of failure will not take the system down.

Proposed Scope of Upgrades to Flint WTP

Phase II - Segments I & II

1. Introduction

The City of Flint plans to utilize their existing WTP to provide water on a continuous basis. The city plans to treat water from the Flint River until construction of the proposed KWA supply is complete and the WTP can then be used to treat water from Lake Huron. The following proposed improvements are needed to place the WTP into service next spring. These improvements will remain in service once the KWA is in service.

2. Scope of Work

The proposed upgrades have been categorized into Phase II – Segment I and are to be completed as soon as practical so that the WTP can be utilized to treat water from the river in the spring of 2014. Engineering services will include final design, plans, contract documents, bidding assistance. Since time is of importance, specifications and schematic drawings will also be provided for pre-procurement of long lead item equipment and are outlined within each section below. Contract administration and construction phase services are not included within the initial scope of services.

- Design Progress Meetings: Meet with City staff to provide project status updates and to discuss specific design issues and details in order to facilitate timely design decisions. Meetings will include design team personnel from each discipline as required, City operations staff and administrative staff. Five (5) design progress meetings are included.
- Prepare and update opinion of probable construction cost at for each project bidding document submittal (40%, 80% and Final Draft). Prepare final opinion of probable construction cost prior to bidding.
- Quality Assurance/Quality Control: A Quality Control Plan (QCP) will be developed and implemented specifically for this project. At each project submittal stage, the document deliverables will be checked and reviewed by experienced personnel to ensure that the design meets applicable standards and normal engineering practice.
- Deliverables:
  40% Bidding Documents (Drawings and Technical Specification Outline)
  80% Bidding Documents (Drawings and Technical Specifications)
  Final Draft Bidding Documents (Drawings and Technical Specifications)
  Final Bidding Documents (One printed and one electronic set of Drawings and Technical Specifications
- Bidding Phase
  Conduct pre-bid meeting.
  Respond to contractor inquiries.
  Prepare construction document addenda, as necessary.

Review bids and supporting bid documentation. Prepare bid report summarizing bids, contractor references, and contractor qualifications; make recommendation for contract award.

- Construction Phase
  Review and respond to contractor submittals (First two reviews are included in level of effort, subsequent review cost will be paid for by contractor)
  Respond to contractor's request for information
  Prepare monthly payment documents
  Negotiate and prepare change orders for client review and approval
  Attend monthly project meetings
  Provide periodic onsite technical observer (have included two weeks per month in level of effort)
  Develop record documents (provide one hard and one electronic copy to owner)

Specific Work Tasks:

Item 1 – Chemical Systems / Ozone

The Michigan Department of Environmental Quality (MDEQ) requires 30 days of redundant storage of the chemical used in this treatment process. To bring the rehabilitated plant into regulatory compliance with the chemical storage requirements for primary use, additional storage facilities will need to be constructed for liquid oxygen and nitrogen.

One liquid oxygen and one liquid nitrogen storage tanks and unloading stations identical to the existing units will be installed north of the existing facilities. Details are listed as follows:

- Liquid Oxygen
  Capacity – 9000 gallons
  Diameter – 10 ft (maximum)

  Liquid Nitrogen
  Capacity – 540 gallons
  Diameter –5.5 ft (maximum)

Pre-procurement documents for the liquid oxygen and nitrogen tanks will be provided.

Item 2 – Electrical

The City of Flint Water Treatment Plant (WTP) represents a combination of administrative, process, and maintenance facilities which all require electrical power. At the completion of Phase I of the water treatment plant rehabilitation projects, much of the electrical distribution equipment such as motor control centers (MCCs), power/lighting panels, transformers, and electrical power feeders will have been upgraded. There is, however, significant additional work required to address remaining electrical equipment that has reached a point of obsolescence.

Switchgear in the sub-station was installed around 1960. It is antiquated and difficult to maintain. Very little work has been done to the station since its original installation. The plant has two 46 kV primary feeds into the sub-station. Replacement of the distribution switchgear with current technology

equipment would allow a higher degree of load protection, be serviceable by numerous sources, and have replacement parts availability. When the switchgear is replaced, the plant will have to stay in operation. Brief interruptions of power of selected plant processes could be accommodated during cut over to new equipment.

Proposed Substation Upgrade

- Coordinate upgrades to Consumers 46kV primary feeders to provide a single overhead 46KV primary service
- Replace the two Consumers 2.5kVA substation transformers and overhead structure with two 2.0 to 2.5 kVA 46KV pad-mounted transformers.
- Replace the City's substation switchgear in the substation building.

Pre-procurement documents for the pad mounted transformers and switchgear will be provided.

Pump Station No.4 contains the largest electrical loads in the plant. Four low service pumps and five high service pumps represent a combined total of approximately 4000 horsepower. Additional loads from HVAC, lighting, controls, and chemical feed are about 60 kVA. This represents a total load of 531 amps @ 2400 volts. The existing switchgear in Pump Station No.4 is antiquated and difficult to maintain. Current technology equipment will allow a higher degree of load protection.

Proposed Pump Station No. 4 Improvements

- Replace 2400V switchgear
- Provide one 15 MGD medium voltage VFD

Pre-procurement documents for the medium voltage VFD and switchgear will be provided.

As a base load facility capable of producing water at any time the Flint WTP must have the ability to deal with power outages. In order to meet these electrical need in the event of a loss of power to the plant site or the loss of one of the substation transformers a new standby diesel generator is proposed to be located adjacent to the new substation.

Proposed Standby Power Improvements

- One 2.0 to 2.5 mVA generators and fuel tank. – Provisions, But no actual generator

Pre-procurement documents for the generator set will be provided.

There are four 2400V to 480V transformers in Plant 2 that are antiquated and difficult to maintain. Replacement parts are no longer available and reliability is questionable.

Proposed Plant 2 Improvements

- Replace two 300kVA 2.4KV transformer/switchgear.
- Replace two 100kVA 2.4KV transformer/switchgear.

Pre-procurement documents for the transformers and switchgear will be provided.

Item 3 – Mid-Point Chlorination

Mid-point chlorination facilities are proposed to increase reliability of the disinfection process and improve Ct. For this initial stage the existing chlorine equipment in Pump Station No. 4 will be used and a new chlorine solution line will be installed from Pump Station No. 4 to the filter influent channel in Plant 2. A chlorine scrubber system will be installed in Pump Station No.4 to protect against a leaking chlorine ton container.

Proposed Chlorine Improvements

- New chlorine solution line to filter gallery.
- Chlorine system improvements.
- Dry scrubber system.

Item 4 – Low and High Service Pump Station No. 4

As a result of decreased demands, pumps at Pump Station No. 4 are "over-sized" and do not efficiently operate. Some of the pumps experience vibrations in the shafts and steady bearings. The existing pump station will be rehabilitated to replace "over-sized" pumps and obsolete equipment and provide needed maintenance.

Proposed Pump Station No. 4 Improvements

- Install one new High Service Pump (15 MGD @190 feet TH, vertically mounted pumps with 800 HP 2400/4160 V inverter duty motors, with 20 feet of shaft and steady bearings)
- Replacement of existing piping, valves, supports, and bearings
- New intermediate platforms, ladders, & stairs
- New ventilation (for exhausting heat from VFD's)
- Demolition of existing equipment to accommodate new equipment

Pre-procurement documents for the pump, motor, control valves and isolation valves will be provided.

Item 5 – Raw Water Piping Connection

The proposed KWA raw water pipeline will connect to the existing 72" PCCP finished water supply line near Center and Pierson Roads. (East of this connection, the 72" PCCP will be utilized by GCDC-WWS for distribution of finished water in the GCDC-WWS service area.) Raw water from Lake Huron will be conveyed to the WTP site via the 72" PCCP pipeline. On the WTP site, the 72" pipeline will be tapped for a 42" pipe and for a 36" pipe to convey raw water for treatment. Connections to the existing pipe will be made at this time to avoid future plant shutdowns for connections.

Proposed Pump Station No. 4 Improvements

- 48-inch pipe connections
- 36-inch pipe connection
- 54-inch pipe connection

Pre-procurement documents for the valves and connection fittings will be provided.

Phase II – Segment II:

The proposed upgrade for item 6 has been categorized as Phase II – Segment II and is to be completed with the same urgency as the rest of the work so that the WTP can be utilized to treat water from the river in the spring of 2014. However, the use of the Bray Road lagoon for other disposal activities will require that this issue be addressed independently to certain extent as to isolate the problem areas while working with MDEQ to permit its use for lime sludge disposal.

Item 6 – Softening Residuals Disposal

Develop, evaluate, design and implement a lime residuals disposal plan to handle softening sludge for the interim period of operation using the Flint River as a water source. These options may include the use of Bray Road lagoon, construction of temporary dewatering and loading facilities, and other temporary storage options.

The use of Bray Road Lagoon will require additional survey, geotechnical and environmental testing at the site in order to assess the condition of the lime sludge in the basin and to verify the capacity of the lagoon system. Based on the findings of this evaluation, proposed improvements will be designed to accommodate the use of the facility in the interim basis while addressing some of the MDEQ concerns about the site and any unauthorized discharges into the nearby stream. Permitting for site use will be incorporated as part of the overall design improvements at the WTP and submitted to the MDEQ at the 80% design stage for their pre-permit review and comments. A final package will be submitted to the MDEQ at the 100% design stage for permit issuance and approval of work plan.

Pre-procurement documents for specific equipment may be provided as needed.

3. Schedule

The work included in this work authorization is anticipated to be performed in accordance with the following schedule, based on the Notice-To-Proceed (NTP) date of November 1, 2013. For the purposes of this proposal, we anticipate a 3 month design phase and 1 month bid phase. Schedule revisions may be necessary as information becomes available and work priorities change.

Project Milestone	Date
Project Kickoff Meeting	November 6, 2013
Equipment Procurement Documents	December 6, 2013
Submit 40% Bidding Documents	December 18, 2013
Submit 80% Bidding Documents	January 10, 2014
Submit Final Draft Bidding Documents	January 31, 2013
Submit Final Bidding Documents	February 7, 2014
Bid Advertising	February 10, 2014
Pre-Bid Meeting	February 17, 2014
Bid Opening	TBD by City
Recommendation of Contract	TBD by City
Contract Award issued by City	TBD by City

4. Compensation

The Reimbursable Compensation method with a maximum not-to-exceed limit will be used for this contract. Labor rates shall be based on personnel classifications according to the existing rate sheet. Reimbursable expenses shall be invoiced at the actual cost times a factor of 1.0 for processing and handling. The estimated maximum not-to-exceed fee for this project is $962,800 which includes a $15,000 allowance for surveying and $15,000 allowance for geotechnical services.

Description	Fee
Design and Bidding Assistance	$ 752,800
Surveying Allowance	$ 15,000
Geotechnical Allowance	$ 15,000
Construction Phase Services	$ 180,000
Total Maximum Not to Exceed Fee	**$ 962,800**

Any other work beyond the Scope of Services herein will require a subsequent Work Authorization with prior approval from the City.

May 21, 2013

TO: Brent Wright, Supervisor
Water Plant

FROM: Derrick F. Jones,
Purchasing Manager

SUBJECT: SEALED BIDS

Attached are the sealed bids that were received for the annual supply of LOX-l.iquid Oxygen for your review. These copies are yours to keep. The proposals were opened on May 14, 2013 under proposals #14-513.

Your review and recommendation are needed as soon as possible. Attach a staff resolution form when you send back your recommendation and make sure that your requisition has been updated and pre-encumbered with the correct price. If your recommendation is under $10,000.00, you do not need to include a staff resolution form.

Please note: if your project is being funded by any grants issued by the federal government, you must go to www.sam.gov to ensure that the selected vendor has not been debarred.

Attachment

AIR LIQUIDE

Mr. Brent Wright

City of Flint, Water Treatment Plant

4500 N. Dort Highway

Flint, MI 48505

Mr. Wright,

Air Liquide Industrial U.S. LP appreciates your business and the opportunity to provide the City of Flint with a reliable and economic supply of bulk liquid oxygen. Air Liquide strives for quick and reasonable turn-around time for your oxygen deliveries when your order is placed with the National Scheduling Center. Air Liquide's typical standard delivery time frame is within 24 to 48 hours upon order.

Thank you and please call me directly at 708-579-7977.

Sincerely,

Amy Waszczak

National Municipal Business Coordinator

Air Liquide Industrial U.S. LP

REQUIREMENTS / TABULATION

Treatment Chemical Specifications

Flint Water Plant

- Product to meet or exceed AWWA Standard B510-00 Column H of Table 1 and ANSI/NSF 60, see attached table.
- Delivery to be by pressurized vessel tanker truck, not to exceed 20 ton deliverable product and conforming to all applicable local, state and federal regulations.
- Trailer must have proper DOT markings, including the nomenclature "Guaranteed by VENDOR to meet the requirements of AWWA B510 Standard for".
- Weight Certificate from certified weigher, supplied by selected vendor for each delivery. Certified liquid meter tickets may be acceptable substitute.
- Purity Standards with certification for every load. Affadavit of certified analysis. 02 Purity must be 99.5%
- Copy to owner of selected vendor's QC/QA program.
- Water Plant Staff training for the initial load to bulk storage.
- The vendor shall contact the Water Plant Supervisor 24 hours prior to delivery to confirm: 810-787-6537.

LOX-LIQUID OXYGEN 99.5%
FOR USE IN STATE MANDATED PLANT TEST RUNS

CONTACT PHONE#: 810.785.7877

FURNISH AS REQUESTED FOR THE PERIOD 7/1/13 - 6/30/14.
APPROXIMATE QUANTITIES, NOT GUARANTEED

FOR MORE INFORMATION CONTACT:
BRENT WRIGHT @810.787.6537 EXT# 3510

LIQUID OXYGEN TO BE USED IN OZONE PROCESS.

$0.381 /cu ft. *

Only the specifier has the responsibility and judgment for determining whether a proposed substitution is an "or equal or exceeding" specification. Mfg., model #, and supporting documentation of specifications for alternates must be provided.

* Amendment Number 2 to the existing Bulk Product Agreement is made a part of Air Liquide's bid for bulk liquid oxygen.

THIS PAGE MUST BE COMPLETED AND INCLUDED WITH SUBMITTAL:
The undersigned herby certifies, on behalf of the respondent named in this Certification (the "Respondent"), that the information provided in this offer submitted to the City of Flint is accurate and complete, and that I am duly authorized to submit same. I hereby certify that the Respondent has reviewed all documents and requirements included in this offer and accept its terms and conditions.

Cash Discounts will be computed from the date of receipt of invoice. Prices firm unless stated otherwise by bidder. Delivery can be made in ( ) days ARO (after receipt of order).

Payment Terms: 30 Delivery Dest.: F.O.B. Fed. ID #: 90 0186946
(All Freight Terms are considered F.O.B., Prepaid unless otherwise noted by seller)

COMPANY NAME (Respondent): Air Liquide Industrial US LP
(Printed)
ADDRESS : 5220 East Avenue
CITY/STATE/ZIP : Countryside IL 60525
PHONE : 708-579-7977 FAX: 708 579 7933
EMAIL : amy.waszczak@airliquide.com
PRINT NAME and Title : Amy Waszczak, Municipal Business Coordinator
(Authorized Representative)
SIGNED : Amy Waszczak DATE: 5/13/2013
(Authorized Representative)

Please submit original documents plus one copy.

New vendors are required to complete and submit an IRS W-9 Form and Vendor ACH Form with the City of Flint. Link is available at www.cityofflint.com/finance/purchasing.

Bid results may be viewed next business day online at www.cityofflint.com/finance/purchasing

Technical Bulletin
Vacuum Tubing & Piping

Vacuum Tubing / Piping Sizing Guide for Chlorine & Sulfur Dioxide

Gas Feed Rate	100 ft.	200 ft.	300 ft.	500 ft.	1000 ft.	1500 ft.
50 PPD / 1 kg/h	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"
100 PPD / 2 kg/h	3/8"	1/2"	5/8"	5/8"	3/4"	3/4"
250 PPD / 5 kg/h	1/2"	5/8"	3/4"	3/4"	1"	1"
500 PPD / 10 kg/h	5/8"	3/4"	1"	1"	1-1/2"	1-1/2"
1000 PPD / 20 kg/h	1"	1"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
2000 PPD / 40 kg/h	1"	1-1/2"	1-1/2"	2"	2"	2"
4000 PPD / 80 kg/h	1-1/2"	1-1/2"	2"	2"	2"	3"
6000 PPD / 120 kg/h	1-1/2"	2"	2"	2"	3"	3"

NOTES:

1. In the above table:
   a. 3/8", 1/2" and 5/8" refer to the OD (outer diameter) of flexible polyethylene plastic tubing.
   b. 3/4", 1", 1-1/2", 2" and 3" refer to Schedule 80 PVC rigid piping.

2. The above recommendations are based on calculations limiting friction loss to 0.5" Hg or less.

Hydro Instruments 600 Emlen Way Telford, PA 18969 Phone: 215.799.0980 Fax: 215.799.0984 Email: sales@hydroinstruments.com Web Address: www.hydroinstruments.com

City of Flint
Water Treatment Plant Improvements
Midpoint Chlorination System Basis of Design

Basis of Design for Midpoint Chlorination:

Q, Design Max Day = 18 MGD

Cl_2 Dosage, Max = 5.5 mg/L [per City of Flint plant staff]

Cl_2 Usage, Max = 18 x 5.5 x 8.34 = 826 ppd Cl_2

Provide minimum 1,000 ppd gas chlorination system.

assume 3.0 mg/L demand
leaves 2.5 mg/L Avail
→ Meets 10 states of 4.4.1.2 of 2.5 mg/L M.C

Prov. Dcs adequate stand-By — 4.4.1.3

Proposed Gas Chlorination System:

1. Four (4) 500 ppd Cl_2 vacuum gas feed systems with chlorine solution piping manifold for total installed capacity of 2,000 ppd Cl_2.
2. Each 500 ppd Cl_2 vacuum gas feed system shall consist of the following:
    a. One (1) 500 ppd vacuum regulator (direct mounted to chlorine ton containers or remote mounted). Each unit shall include an actuator for emergency closure of the chlorine container valve. Vacuum regulators shall be Hydro Instruments Series 700 with integral drip leg and heater.
    b. One (1) wall mounted control panel with the following equipment:
        i. One (1) automatic valve for feed rate control, Hydro Instruments Omni-Valve Model OV-110.
        ii. One (1) 500 ppd rotameter, Hydro Instruments Model RM-701.
        iii. One (1) vacuum monitor, Hydro Instruments Model VM-150.
        iv. One (1) 500 ppd differential pressure regulator, Hydro Instruments Model DP-500.
        v. PVC bypass piping.
    c. One (1) 500 ppd ejector nozzle/check valve assembly, Hydro Instruments Model EJ-5000
3. One (1) existing chlorine gas leak detector as manufactured by MSA.
4. Four (4) existing ton container load cells.

Note: All new equipment shall be as manufactured by Hydro Instruments of Telford, PA. Catalog cutsheets for all new equipment are attached.

Description of Operation:

Each 500 ppd Cl_2 gas feed system will operate based on signals from the plant PLC. Based on operator set dosage, the PLC will send a signal to open the water supply solenoid valve(s) that will allow supply water to flow through the ejector(s) to create the vacuum necessary for gas flow from the ton container(s). If the set point is less than 500 ppd, only one solenoid valve will open. If the set point is greater than 500 ppd, two solenoid valves will open, and the other two 500 ppd systems will remain as standby units. Initially, the dosage will be controlled by the operator manually adjusting the setpoint at the PLC. However, the system has the capability of automatically controlling the feed rate through a flow pacing signal or through a chlorine residual analyzer compound feedback loop.

→ Auto Proportional 4.4.1.5

Each 500 ppd system will be fed from a single one ton chlorine container with its own load cell to monitor chlorine usage. The PLC will monitor each load cell and will signal an alarm when the container is empty; the PLC will automatically close the solenoid valve for the 500 ppd system with the empty container and will start one of the standby units so that the empty ton container can be changed out.

osta switch yes

meets 4.4.1.4

Estimated Chlorine Feed Rates - lbs./day

Examination of previous chlorine demand tests and past plant operation data using Flint River water, shows a chlorine demand around 3.0 mg/L on average. The chart below shows the pounds per day of chlorine that will need to be applied for different flows and different chlorine dosages that may be encountered.

Flow (MG) \ Chlorine dosage (mg/L)	3	4	4.5	5	5.5	6	6.5
12	300.2	400.3	450.4	500.4	550.4	600.5	650.5
18	450.4	600.5	675.5	750.6	825.7	900.7	975.8
24	600.5	800.6	900.7	1000.8	1100.9	1201.0	1301.0

In order to produce a 1.5 mg/L chlorine residual in finished water to meet Ct requirements, the dosage will most likely be between 4.5 & 5.5 mg/L. The demand may increase if ozone production decreases, or if the source water contains large amounts of turbidity during spring runoff, or heavy rains.

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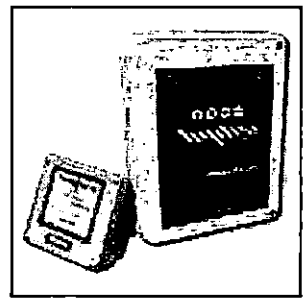
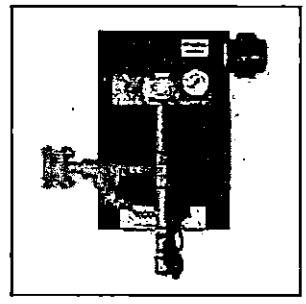
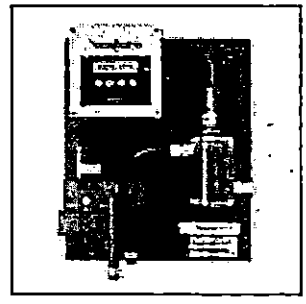
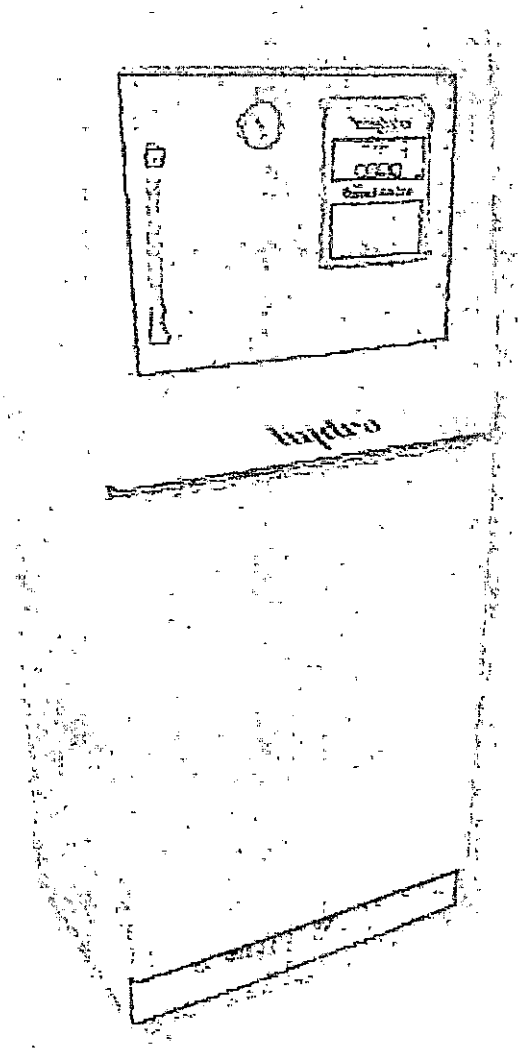
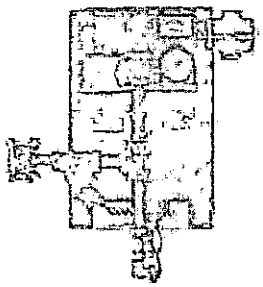
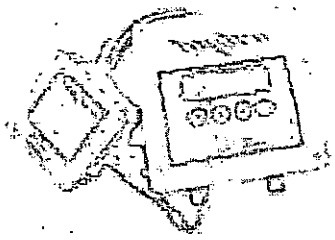


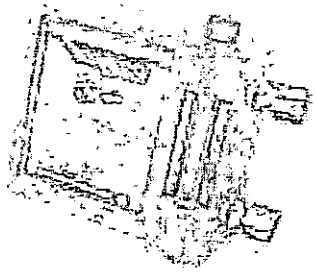












Application: Gas chlorination systems are used for water disinfection and other purposes in a variety of applications. Compared to other disinfection methods, chlorine offers the advantage of a stable and long lasting residual that can remain in the water protecting it from recontamination after treatment. Among chlorination methods, chlorine gas is the most economical and the equipment is also the most reliable and easy to operate. Some of the most common applications for large scale gas chlorination systems are surface water treatment plants, waste water treatment plants, and cooling towers for power plants, oil refineries, etc...Gas chlorination systems are also used in a variety of industrial, mining, and agricultural applications.

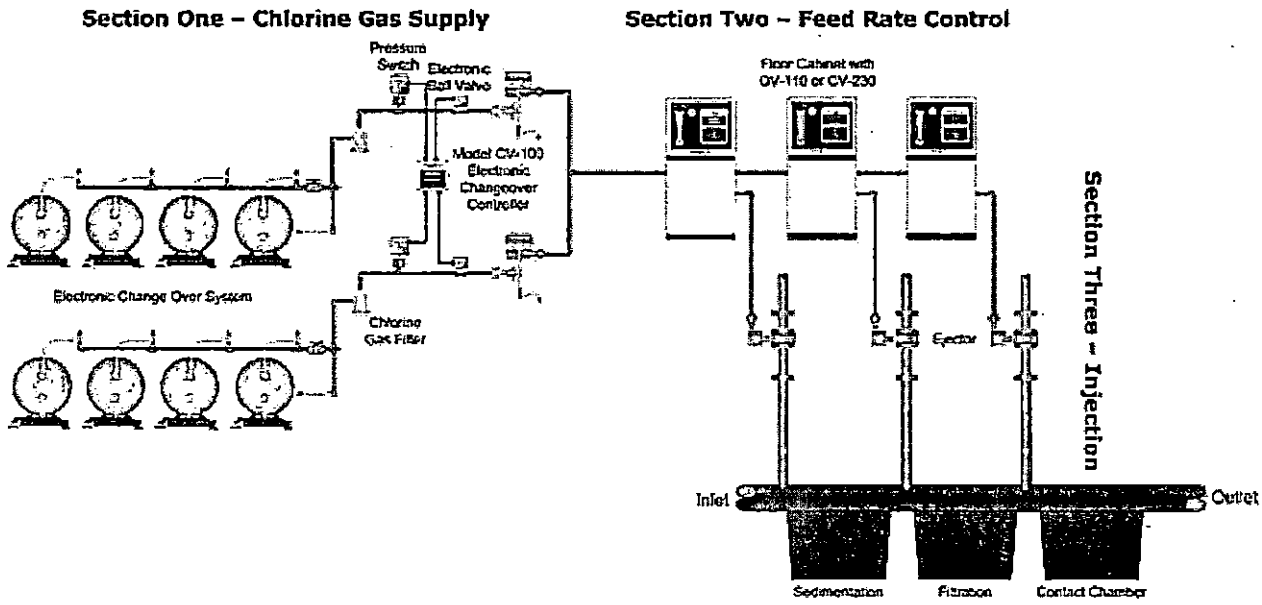
Purpose: Regardless of the application, the gas chlorination system will be required to inject chlorine gas into the process water at one or more locations (with the goal of achieving a desired level of residual chlorine to the process water). Different applications have different requirements for the residual chlorine concentration depending on the water quality and the application. Chlorine residual is quantified in units of parts per million (PPM or mg/L). In order to maintain a constant residual in the water, as the process water flow rate increases and decreases the chlorine feed rate should proportionally increase and decrease. It also must be realized that a certain amount of chlorine will be consumed in reactions upon entering the process water and that this amount of chlorine will not be available as chlorine residual. The amount of chlorine residual consumed in this way is sometimes referred to as the chlorine demand of the water (in units of PPM). The chlorine demand is different for every process water and can range from close to zero to over 20 PPM. Keeping the above points in mind, the following equation is used to determine the required chlorine gas feed rate for each chlorine gas injection point:

[Process Water Flow (m^3/hr)] x [Dosage (PPM)] = Chlorine Gas Feed Rate (gr/hr)

NOTES:
Water Flow (m^3/hr) = Process water flow rate in cubic meters per hour
Dosage (PPM) = [chlorine demand] + [desired chlorine residual]

System Example (Surface Water Treatment Plant): Figure 1 shows a very basic schematic of a surface water treatment plant. The diagram shows three chlorine gas injection points. One gas chlorination system with three injection points is shown in the diagram. The gas chlorination system can be broken down into three sections as indicated in Figure 1.

Figure 1: Surface Water Treatment Plant (Example)



Typical: Gas chlorination systems follow a modular design principle. As seen in Figure 1 above, the gas chlorination equipment can be divided into three sections starting from the chlorine gas containers and ending at the ejectors as follows:

(1) **Chlorine Gas Supply** – This part of the system is designed to provide an uninterupted supply of chlorine gas flowing under vacuum.

(2) **Feed Rate Control** – In this section, equipment is provided to monitor and control the feed rate of chlorine gas to each injection point. The feed rate control can be manual or automatic based on 4-20mA input signals from water flow meters or residual chlorine analyzers. (Step feed control based on switch inputs is also available.)

(3) **Ejector System** – The ejectors create the vacuum that operates the system in an on-off fashion. The chlorine gas enters the water inside the ejector and then the chlorinated water solution is piped to the injection point where it is delivered to the main process water flow.

Safety and monitoring equipment such as gas leak detectors, residual chlorine analyzers, container scales, emergency valve closure systems, emergency repair kits, and chlorine leak absorption systems (scrubber systems) are also available from Hydro Instruments and our sales representatives.

There are many options available for designers to select. This document will review general options for each stage of the system. Please also refer to additional Hydro Instruments product literature for additional details.

Figure 2 is a diagram depicting several of the more common equipment configurations for each part of the gas chlorination system. This figure shows three different options for the chlorine gas supply section and four different options for the feed rate measurement and control section of a system.

Note that one chlorine gas supply section is frequently used to supply chlorine gas to multiple injection points.

Figure 2: System Layout Options

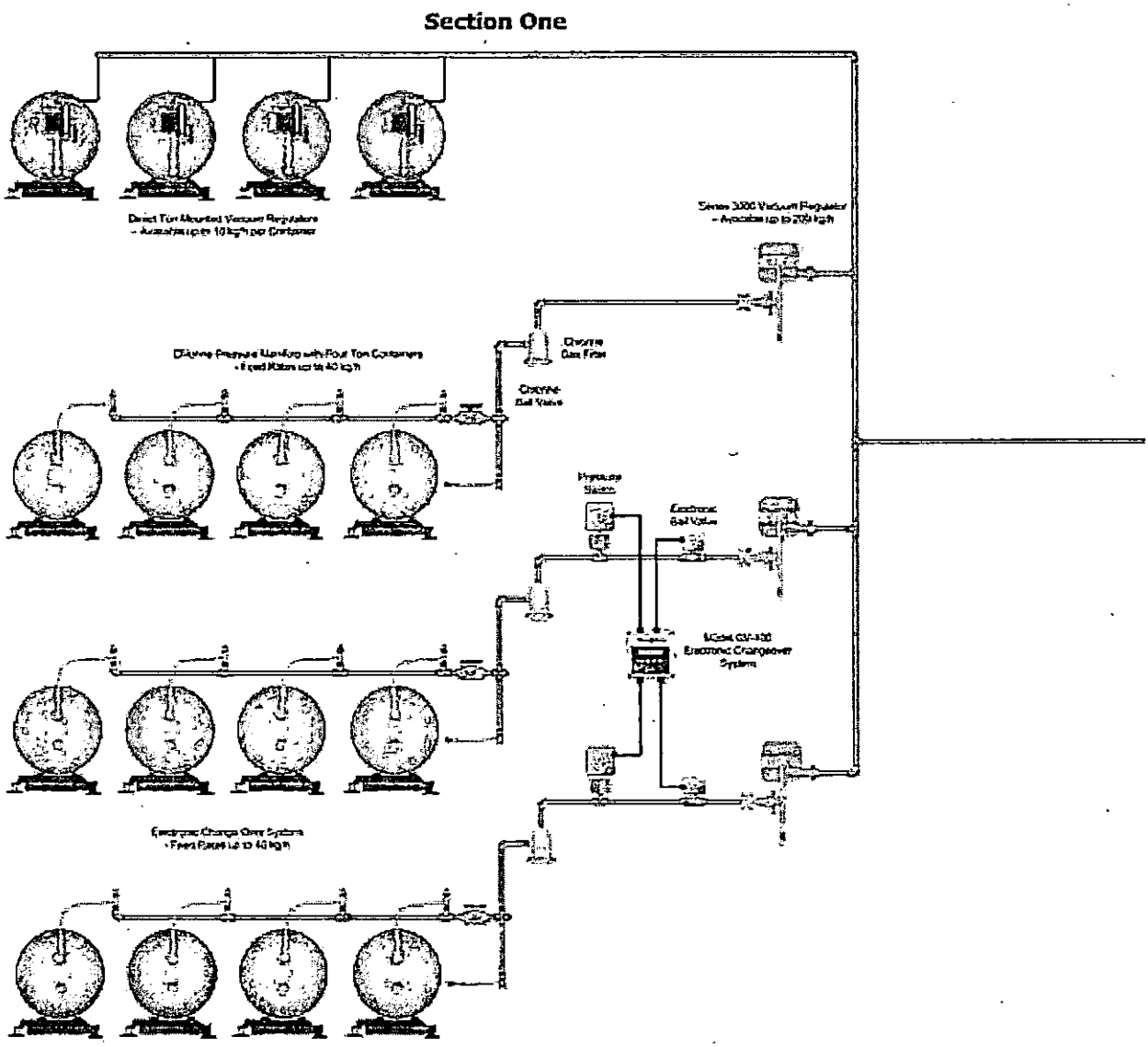
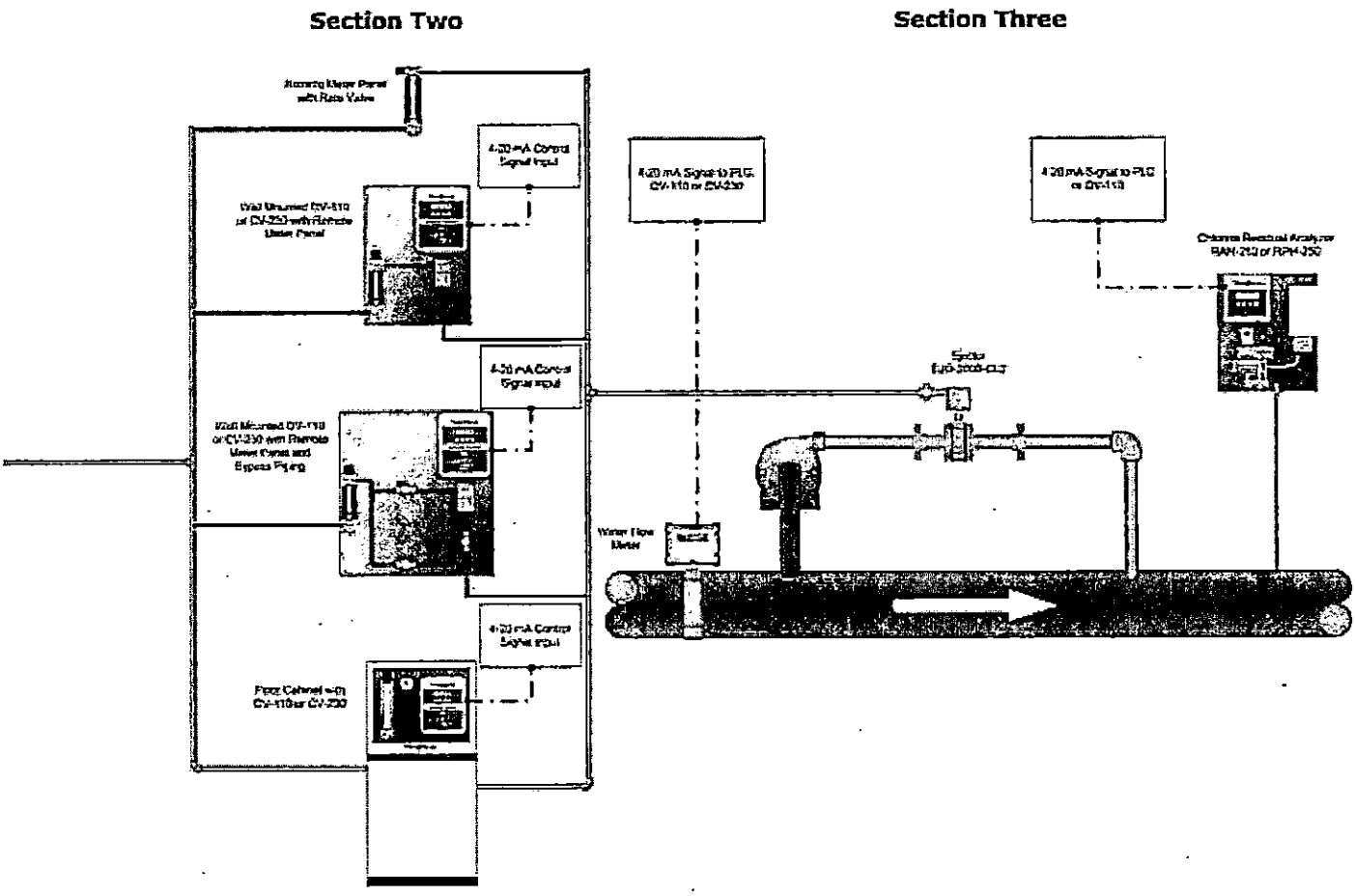


Figure 2: System Layout Options

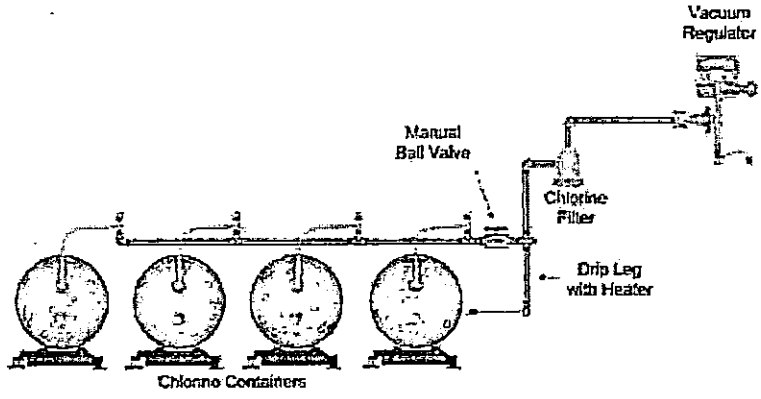


Section 1 – Chlorine Supply: This section of the equipment consists of the chlorine containers, manifolds, vacuum regulators and changeover system.

1a. Ton Containers & Chlorine Manifolds: NOTE: For more detailed technical information, please refer to the latest copy of Hydro Instruments TCM-DC design guide for ton container mounted manifolds.

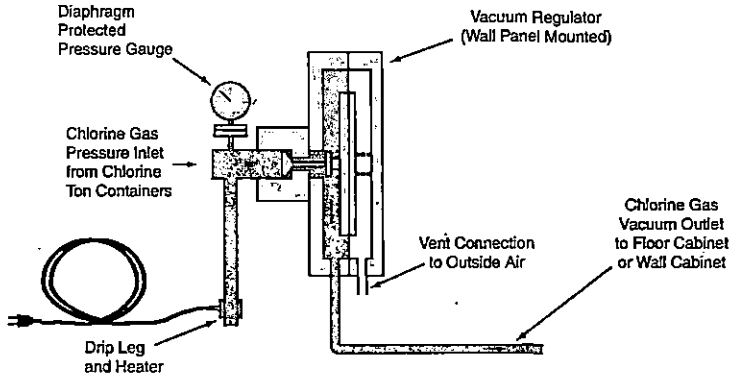
Evaporation cooling limits the chlorine gas withdrawal rate for a single chlorine ton container to approximately 10 kg/hr (500 PPD). Therefore, a 40 kg/hr (2000 PPD) system should be designed so that four ton containers are feeding simultaneously. This can be accomplished by mounting a vacuum regulator on each ton container or by connecting four ton containers together with a pressurized manifold. Pressurized chlorine manifolds are used to collect chlorine gas from one or more chlorine ton containers. The manifold must trap and evaporate liquid chlorine to prevent it from entering and damaging the vacuum section of the equipment.

Figure 3: Chlorine Pressure Manifold

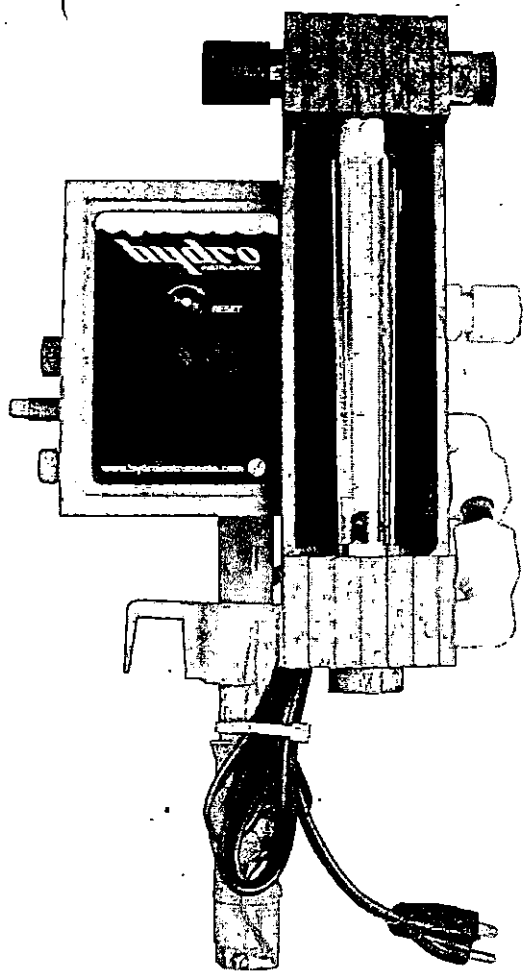


1b. Vacuum Regulators: Chlorine gas enters the vacuum regulator under pressure. When the ejector is in operation it creates a vacuum (that vacuum extends to the rear cavity of the vacuum regulator) that causes the diaphragm assembly to press back against the spring loaded normally closed inlet valve, causing it to open and allow chlorine gas to flow in under vacuum conditions. When vacuum is lost for any reason, the inlet valve spring will close the valve and stop the flow of chlorine immediately.

Figure 4: Vacuum Regulator



The most durable gas chlorinator on the market...



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- Sanitary Sewage
- Industrial Waste Water
- Community Water Systems
- Power Plants
- Swimming Pools & Fountains

EASY INSTALLATION: Advanced product design eliminates the probability of troublesome installations.

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TOTAL RELIABILITY: Every part is optimally designed and manufactured using materials proven to be chemically resistant to chlorine gas. Therefore, Hydro Instruments' Series 700 and 750 components can be used to handle chlorine gas with safety and complete control at capacities up to 500 lbs/day (10,000 grams/hour).

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BULLETIN 700/750 Rev. 6/10

Prysby, Mike (DEQ)

From:	Matta, Samir <SFMatta@lan-inc.com>
Sent:	Wednesday, March 19, 2014 6:49 PM
To:	Prysby, Mike (DEQ)
Subject:	FW: City of Flint WTP Improvements Phase II - MDEQ Comments.
Attachments:	Flint WTP 2013 Site Plan.pdf

Hi Mike,

Does this address your needs for the "current yard piping diagram"?

The language below was also used for the addendum that the City issued to the contractor for the Mid-Point Clorination

1. Sheet C-104 – Construction Notes: Add the following Note 6 – A 1" Anti-syphon / Back Pressure Valve and additional 1" ball valve shall be added just prior to the trough wall penetration. The anti-syphon / back pressure valve shall be PVC and designed for use with chlorine systems. The valve shall be a LMI #35856, Walchem E90422, or engineer approved equivalent. The valve shall be installed between the two 1" ball valves to allow for isolation during servicing. The valve shall be located above the high water level in the trough. The Contractor shall install a 1" drain line from the relief port to the finished floor elevation of the pipe gallery.

Jeremy will provide written responses for your file on the other questions as requested.

Thanks.

Samir F. Matta
Senior Project Manager

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
D 517.819.2367 C 517.819.2367
www.lan-inc.com • sfmatta@lan-inc.com

HYDRO GAS CHLORINATORS

Principle of Operation

For a particular ejector back pressure, a minimum water supply is required at the ejector inlet to create vacuum at a level strong enough to operate the chlorinator. This vacuum originates in the throat of the ejector's Venturi nozzle and after opening the ejector check valve, extends into the body of the chlorinator. There it causes the regulating diaphragm to open the inlet safety valve, allowing gas under pressure to pass into the drip leg where the initial liquid is collected. A heater attached to the drip leg evaporates the liquid that is in the eduction tube of the gas valve on startup of a new ton container. This heater remains on constantly, permitting only gas to flow to the vacuum regulator. As it flows across the inlet safety valve assembly, it is filtered and reduced to a vacuum.

The gas then enters a chamber where the vacuum level is maintained by a spring-opposed, sealed regulating diaphragm. It is then drawn through the chlorine flow meter, across the rate control valve and on to the ejector where it dissolves in water. The resultant, highly concentrated solution exits at the ejector outlet and flows to the desired point of application.

Accuracy

Flow meter accuracy is within 4% of the meter's maximum capacity.

Capacities Available

Maximum total operating rate is 500 pounds per day (10,000 grams per hour). Minimum feed rate is 5% of maximum.

Installation of Hydro Gas Chlorinators

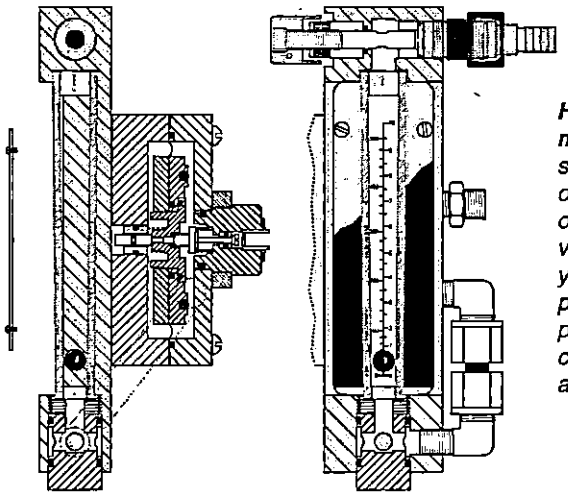
Units of the **Hydro Gas Chlorinator System** can be used for practically any requirement. The schematics show various types of installations using single or multiple containers as well as application of chlorine to pool, basin or pipeline...direct or remote. Basic **Hydro** gas chlorinator units are simply combined to cover all applications.

CHLORINATOR SIZE SHOULD BE BASED ON MAXIMUM POSSIBLE FLOW.

GPM x 0.012 x (PPM) Dosage = PPD

Example:
600 GPM x 0.012 x 3 PPM = 21.6 PPD

In this example a **Hydro** 50 PPD chlorinator would be adequate.



***Hydro Series 700* ton-container mounted gas chlorinators** are designed for manual or semi-automatic operation to meet the highest standards of reliability. They incorporate advanced design features gained through years of research and in-the-field experience. Simplified design and fewer parts mean less maintenance, lower cost with better performance, reliability and long life.*

HYDRO Series 700 Chlorinator

A ton ironwork* is used to mount the **Hydro** chlorinator directly to the container. **This eliminates all pressure lines.** Chlorine gas is taken under vacuum to the point of injection. **This eliminates pressurized solution lines.**

Operator Indicator

During operation the indicator window remains gray; red indicates depletion of the chlorine source.

Inlet Safety Valve

Spring opposed safety valve seals off chlorine in container upon loss of vacuum. Safety valve is encapsulated to permit quick disassembly and cleaning without special tools.

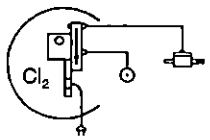
Inlet Sealing Valve

A sealing valve at the chlorinator inlet closes if chlorine supply is interrupted or depleted, sealing the entire vacuum system. Dirt or moisture cannot enter the system when containers are changed.

Regulating Diaphragm

Constant vacuum level is maintained inside the chlorinator by the diaphragm which is O-ring sealed along its entire inner and outer surface to prevent leakage or warping of parts from excessive tightening of the body bolts.

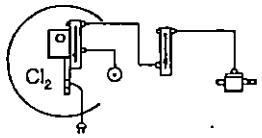
500 PPD systems with one or more wall mounted remote meter(s) (701, 701-2, 702, 702-2, etc.) are standard with chlorinato chlorinator body(ies). The price is reduced if the customer wishes to receive chlorinator(s) with no meter assembly(ies) (*blank at the source (only at the wall mounted remote meter) and on automatic standby systems one will not be able to visually deter



Hydro Model 700
Single-Point Application

Hydro chlorinator mounted on a single container with direct ejector to pipeline or basin. Chlorine capacity to 500 PPD (10,000 grams/hr).

⊙ Vent to safe outside location

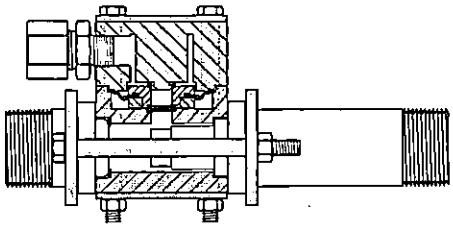


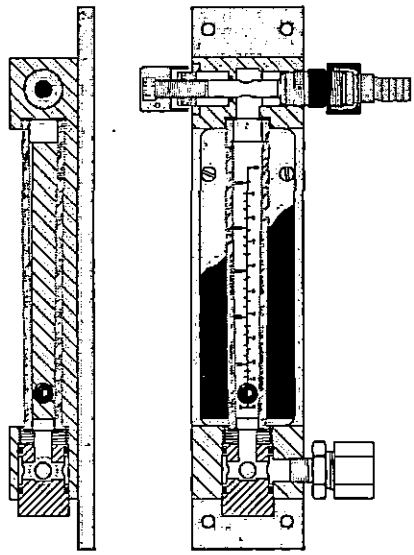
Hydro Model 701
Remote Meter for Single Point of Application

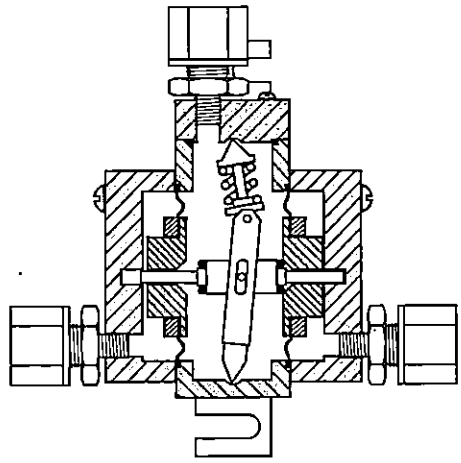
Hydro chlorinator mounted on a single container feeding a remote wall mounted meter with rate valve supplying a single ejector. Chlorine capacity to 500 PPD (10,000 grams/hr).

***The Series 750 is the same as the Series 700 but without the ton ironwork. The Series 750**

A complete system for totally reliable control.







HYDRO EJ-5000 Ejector

The **Hydro** ejector utilizes a specially designed O-ring seal check valve which prevents the backflow of water into the chlorinator. The ejector operates on a venturi created by water passing through the ejector nozzle causing the spring opposed diaphragm check valve to open and mix the chlorine gas with the water. The ejector should be supplied with reasonably clean water at temperatures below 80°F (27°C). The **Hydro** ejector is made of durable materials that are resistant to wet and dry chlorine gas use.

HYDRO RM-701 Remote Meter

Any number of **Hydro** Remote Meters may be used in an installation if required. Only the vacuum line is required to the individual ejector which it supplies. Chlorine gas can then be precisely metered at each remote location. If more (or less) is required at one location the meter is simply set at the desired level for that location. By this control of metering at remote locations a perfectly balanced system can be maintained. **Hydro** Remote Meters are practically maintenance free. **Hydro** Remote Meters use a solid silver rate valve. Flow meters are accurate to ±4%.

HYDRO SW-500 Automatic Switchover

Multiple chlorine containers, which prolong the time span before depletion, are easily installed and automatically switch over from a depleted container to the unused container. A **Hydro** Chlorinator is installed on each container and only one Automatic Switchover is required to handle the two containers. The **Hydro** Automatic Switchover can be used with either one remote meter or with two or more remote meters. Use of this switchover module is a great time saver and is a great aid in assuring a more constant supply of chlorine. Once installed, the **Hydro** Automatic Switchover is completely automatic and needs no adjustment or setting.

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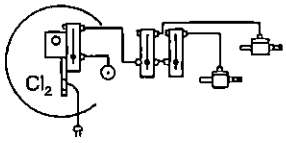
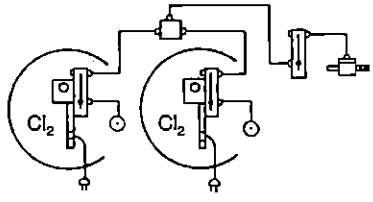
ors that have a remote meter without a rate valve ("plugged") on the ed"), however it will not be possible to measure the chlorine feed rate mine which unit is regulating the chlorine supply.



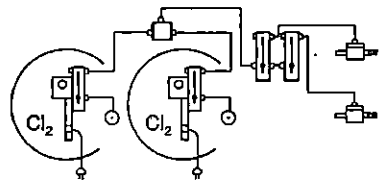
Hydro Model 701-2
Multi-Point Application

Hydro chlorinator mounted on a single container feeding two remote meters for two points of injection using two ejectors. Each meter and ejector operates independently. Chlorine capacity to 500 PPD (10,000 grams/hr).



Hydro Model 702
Automatic Stand-By

Hydro chlorinators – two chlorinators mounted on two containers with switchover module feeding one remote meter with rate valve feeding a single ejector. Capacity to 500 PPD (10,000 grams/hr) maximum.



Hydro Model 702-2
Automatic Stand-By with Multi-Point Feeding

Hydro chlorinators – two chlorinators mounted on two containers with switchover module feeding two or more remote meters with rate valves supplying two ejectors. Capacity to 500 PPD (10,000 grams/hr) maximum.

chlorinator comes complete with a yoke assembly and is used for manifold mounting.

Series 700 and 750
GAS CHLORINATORS

The installation of **Hydro Gas Chlorinators** is easily accomplished. The following will be useful information.

System Operating Temperatures

For best operation and safety, the chlorinator and chlorine supply should be protected from the elements and from direct sunlight.

Methods of Control

Manual

Adjustment of rate valve and start/stop of water to ejector.

Semi-Automatic

- Shutting off booster pump to ejector.
- Using solenoid valve to close vacuum line to ejector.

Step-Feed to multiple flow meters is available using solenoid valves in the vacuum line or water line to the ejector.

STANDARD TUBING CONNECTIONS

Vacuum Tubing Size				Vent
Feed Rate		Length of Tubing		
PPD	Gr/Hr	100 Feet (30m)	200 Feet (60m)	25 Feet (7.5m)
50	1000	3/8" (9.52mm)	3/8" (9.52mm)	3/8" (9.52mm)
100	2000	3/8" (9.52mm)	1/2" (12.7mm)	3/8" (9.52mm)
200	4000	1/2" (12.7mm)	5/8" (15.8mm)	3/8" (9.52mm)
500	10,000	5/8" (15.8mm)	3/4" (19mm)	3/8" (9.52mm)

ACCESSORY EQUIPMENT AVAILABLE

- Loss of Chlorine Alarm
- Multiple Remote Flow Meters and Ejectors
- Inlet Water Assemblies
- Automatic Switchover System
- Booster Pumps
- Gas Masks
- Analyzers
- Leak Detectors

CHLORINE WITHDRAWAL RATE from Horizontal Ton Container

Maximum Chlorinator Withdrawal Capacity		Minimum Ambient Temperature	
PPD	gr/hr	°F	°C
500	10,000	40	4
250	5000	16	-9
150	3000	0	-18
100	2000	-6	-21
50	1000	-20	-29

Ejector Installation

1. Ejector connections must be kept above freezing temperatures.
2. At point of application maximum back pressure for standard ejector is 100 psig. (High pressure ejectors are available.)
3. Long solution lines from ejector should be avoided and if not, solution lines must be of adequate ID to reduce friction loss.
4. To create a vacuum the water supply to the ejector inlet must be higher than the pressure at the point of application (approximately 40 psig differential).
5. Maximum ejector operating temperature is 110° F (43° C).
6. Ejector may be wall mounted for remote applications.

Series No.	(PPD) Maximum Capacity	Mounting
500 Series	100 PPD (2000 gr/hr)	150 lb. cylinder, manifold*, or ton container
200 Series	200 PPD (4000 gr/hr)	150 lb. cylinder, manifold*, or ton container
700 Series	500 PPD (10,000 gr/hr)	Ton container
750 Series	500 PPD (10,000 gr/hr)	Manifold

* For manifold units there is the additional cost of wall mounting manifolds.

Hydro Model EJ-5000 (500 PPD) Ejector Connections

	Standard	Options
Ejector Water Inlet (Nozzle)	EN-296 Nozzle for 1 1/4" NPT	EN-275 Nozzle for 1 1/4" NPT
Ejector Water Outlet (Diffuser)	EDH-560 Diffuser for 1 1/2" ID Hose	EDT-560 Diffuser for 1 1/4" NPT

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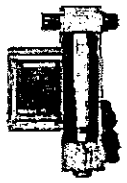
BULLETIN 700/750 Rev. 6/10

Vacuum Regulators

Hydro Instruments manufactures many different designs of vacuum regulators. Some of the most common configurations are shown in the following table. Other designs and configurations are available. Please review our website for more information.

750

- 10 kg/hr
- Optional flow meter
- Optional direct ton container mounting

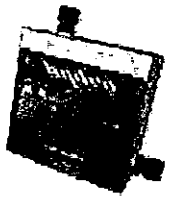


750W-DL

- 10 kg/hr
- Optional flow meter
- Wall-mounted
- Optional drip leg and heater
- Diaphragm protected pressure gauge

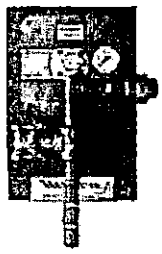
SVR-500-CL2

- 10 kg/hr
- Integral vacuum switchover design
- Optional flow meter (5 kg/hr maximum)
- Wall-mounted
- Optional direct ton container mounting



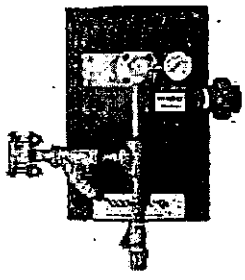
VRH-2000-CL2

- 40 kg/hr
- Drip leg and heater
- 3/4" Steel Union Inlet
- 1" PVC Union Outlet
- Diaphragm protected pressure gauge
- Optional flow indication tube



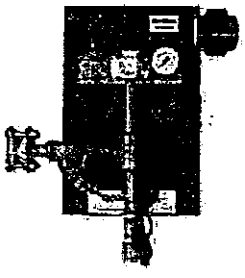
VRH-8000-CL2

- 150 kg/hr
- Drip leg and heater
- 3/4" Steel Union Inlet
- Y-Strainer Inlet Filter
- 1.5" PVC Union Outlet
- Diaphragm protected pressure gauge
- Optional flow indication tube



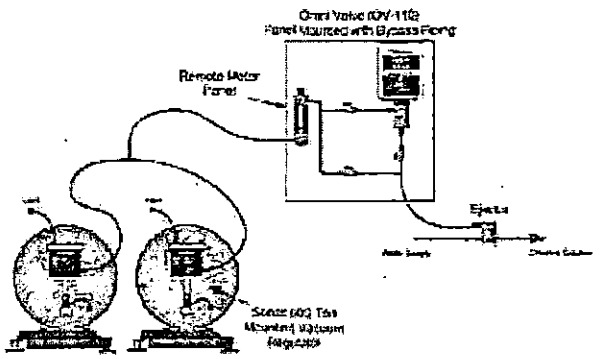
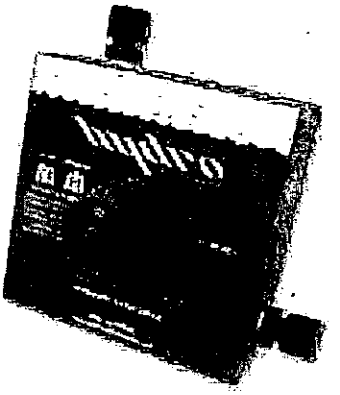
VRH-10000-CL2

- 200 kg/hr
- Drip leg and heater
- 3/4" Steel Union Inlet
- Y-Strainer Inlet Filter
- 2" PVC Union Outlet
- Diaphragm protected pressure gauge
- Optional flow indication tube

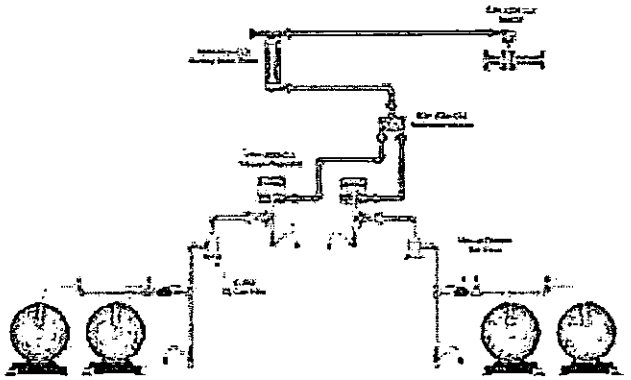
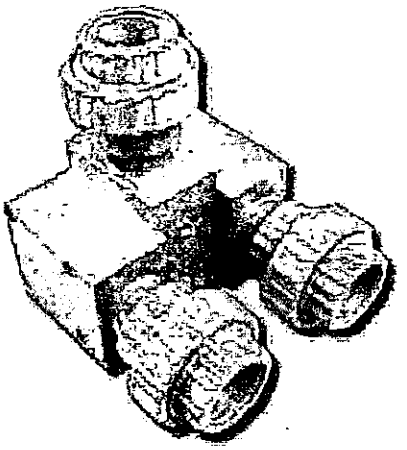


1c. Changeover Equipment: Hydro Instruments offers three types of automatic changeover equipment. The function of this equipment is to automatically switch the chlorine gas supply to the standby manifold when the duty manifold containers are empty.

i. Vacuum Switchover by integral switchover vacuum regulators (Series 900): This equipment is only available for feed rates up to 10 kg/hr (500 PPD). The Series 900 vacuum regulator design offers automatic switchover based on the high vacuum condition that occurs when the duty chlorine containers are going empty. Once the duty containers are nearly empty, the vacuum level in the system will increase and cause the standby vacuum regulator to switch automatically into the feeding position. The advantage of this system is its simplicity and low cost.

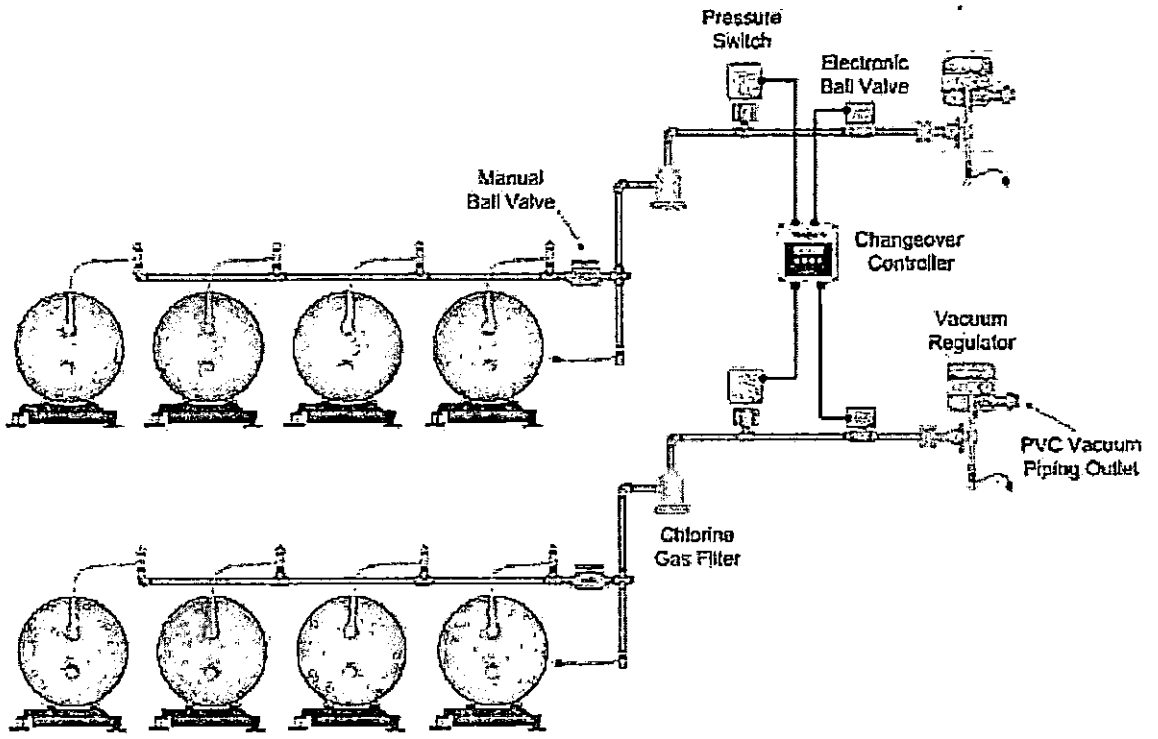
Series 900 System (10 kg/hr)	Series 900 Vacuum Regulator
	

ii. Vacuum Switchover Modules: The operation of the vacuum switchover is also based on the rising vacuum level that accompanies the duty manifold ton containers going empty. The switchover module includes a spring loaded mechanism and two diaphragm assemblies. The advantage of this type of switchover mechanism is again the simplicity and relatively low cost.

Model 3105C System (20 kg/hr)	SOH-4000-CL2 (80 kg/hr max.)
	

iii. **Electronic Changeover System (Series CV-100):** The Hydro Instruments Series CV-100 automatic changeover system is designed to allow continuous supply of chlorine gas when using a duty/standby gas container system layout.

Figure 5: Series CV-100 Electronic Changeover System



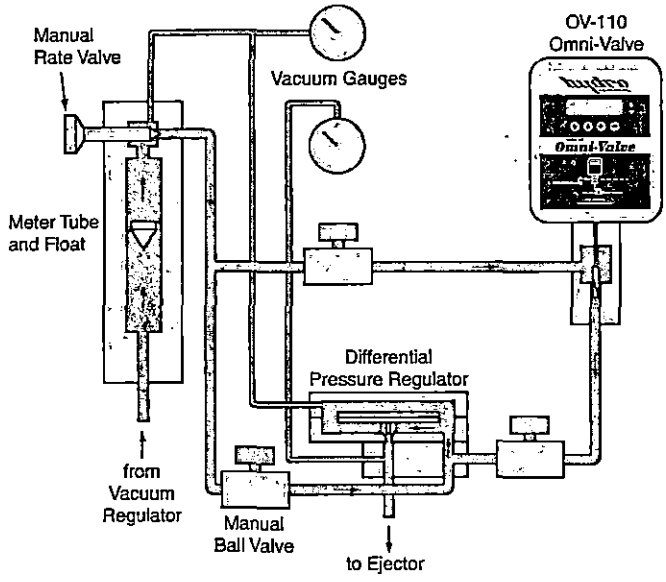
The system consists of a dedicated controller Model CV-100 designed for this application, two pressure switches, and two electronically actuated ball valves. In normal operation, the Model CV-100 controller will keep one of the ball valves open (duty) and the other closed (standby). Upon receiving a low pressure alarm relay signal indicating that the duty gas supply source is nearly depleted, the controller will close the duty ball valve and open the standby ball valve. After such a changeover event, the operator will be required to silence the changeover alarm, change the empty containers, and then acknowledge the container empty alarm.

The Model CV-100 controller also can be used to manually change which ball valve is in operation and to shut down both valves simultaneously. The Model CV-100 controller records the time that each ball valve has been in the duty condition and displays the time of day, day of the week and date of the year on the screen. LEDs on the controller also indicate operation and container empty status for both sides.

Section 2 – Feed Rate Control: This section of the equipment consists of a rotameter type flow meter, manual control valve, automatic control valves and other optional equipment.

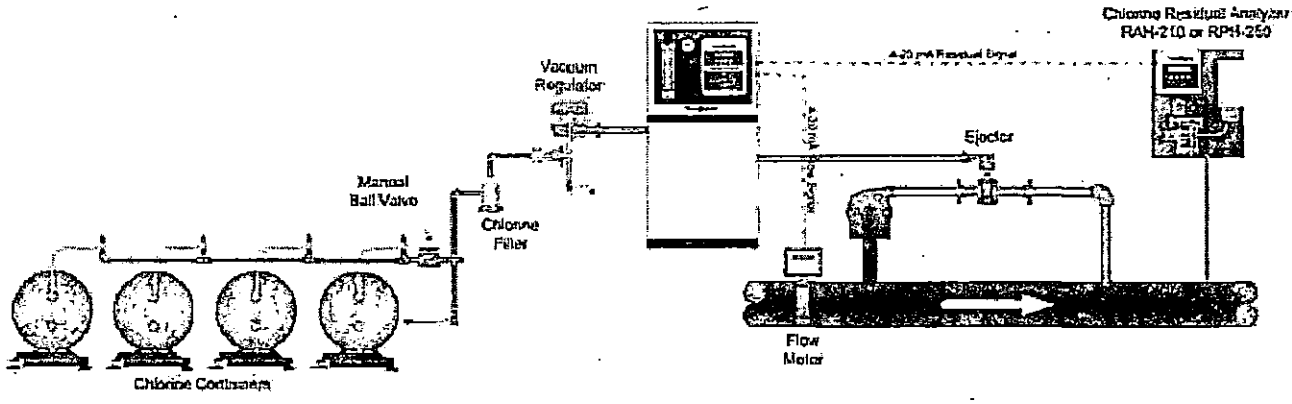
Between the vacuum regulator and the ejector, the chlorine gas flows under vacuum. A chlorine gas flow meter is installed in this section of the system to give a visual indication of the chlorine gas feed rate. Each gas chlorination system will have a manual rate control valve installed after the flow meter tube. An automatic control valve can also be installed in between the flow meter tube and the ejector. Differential pressure regulators, vacuum gauges, vacuum alarms etc. are optional.

Figure 6: Feed Rate Control Equipment



Control Type: The goal of a chlorine gas system is to inject chlorine into the water at a rate that will maintain a desired residual level in the treated process water. Therefore, as the water flow rate and the water quality change, the chlorine feed rate must also be adjusted accordingly to maintain the desired residual in the treated process water. Manual feed rate control can be used in systems where the process water flow and the water quality are both constant. If the water flow rate or water quality are variable, then it is best to use an automatic control system.

Figure 7: Automatic Control System (Compound Loop Control)

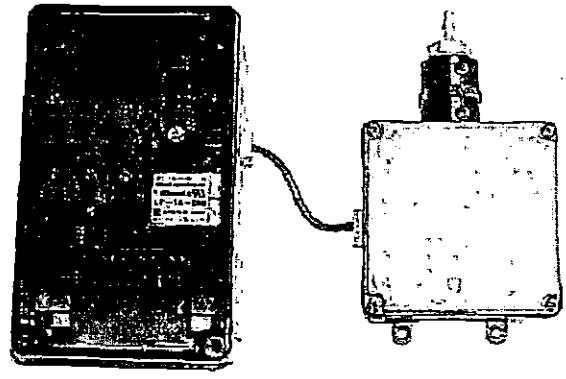


VM-150 Vacuum Monitor

The VM-150 vacuum monitor is 100% electronic, full featured monitoring system with a three digit digital readout. The system utilizes the latest in integrated sensor technology that results in improved accuracy, reliability, versatility , and chemical compatibility. All monitors come standard with an analog output for connection to local monitoring equipment.

The VM-150 comes standard with an oil based protection device that allows direct contact with many gases and liquids including chlorine and sulfur dioxide.

This unit has three alarm relays. One low alarm, one high alarm and one latch relay. All relays are general purpose NO/NC type. These relays give the end user many options on how to respond to an alarm condition.



Specifications & Features

- Input Voltage
  - 115V 60 Hz, 0.1 AMPS
  - 230V 50 Hz, 0.1 AMPS
- Alarm Relays
  - 120V @ 5 AMPS
  - 240V @ 5 AMPS
- NEMA 4X Enclosure
- 1 - 100 Second Alarm Delay
- Temperature Range: -20 - 50 C
- Three Digit LED Digital Readout
- Analog Output: 0 - 30V DC, 0 - 3.0 mA
- One Year Warranty
- Water Tight Fittings
- Three Alarm Relay Outputs:
  1. One NO/NC High
  2. One NO/NC Low
  3. One NO/NC Latch
- Independently Adjustable High/Low Trip Points
- LED Indicator for High/Low Latch Alarm
- IP65 External Latch Alarm Reset Switch

Ordering Information

Model #	Range	Low Alarm	High Alarm	Pressure	Gauge Guard
VM-150-115	0-30 in. Hg	0-15 in. Hg	15-30 in. Hg	30 PSI	Oil
VM-150-230	0-30 in. Hg	0-15 in. Hg	15-30 in. Hg	30 PSI	Oil

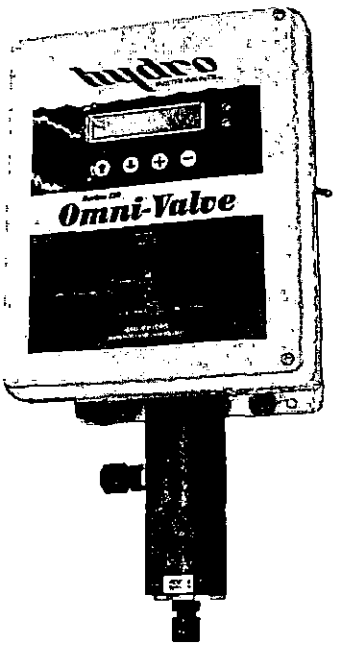
Hydro Instruments 600 Emlen Way Telford, PA 18969 Phone: 215.799.0980 Fax: 215.799.0984 Email: sales@hydroinstruments.com Web Address: www.hydroinstruments.com

Series 110
Omni-Valve

The valve that does it all...

- **Excellent Accuracy and Repeatability**
- **Maximum Versatility**
- **Remote adjustment and monitoring**
- **Gas or Liquid Metering**
- **Designed for Minimal Wear and Long Life**

With the capability of operating in eight different control modes, handling a wide range of chemicals, covering a wide range of capacities and having a multitude of control options, adjustable features and settings, the Hydro Instruments Omni-Valve is truly an all-in-one automatic control valve for chemical feed.



Control Options (all standard)

Manual Control
Proportional (Flow) Control
Set Point (Residual) Control
Set Point (ORP) Control
Compound Loop (PID) Control
Step Feed Rate Control
Dual Input Feed Forward Control
Dual Set Point Control

Control modes are field selectable and can be changed at any time.

Highlighted Features

2 x 20 Character Liquid Crystal Display
Modbus Communication (RS-485)
3 Analog Inputs
(Flow, Residual and Remote Dosage)
Adjustable: Dosage, Set Points, Lag Time, Signal Filters, Display Ranges, Alarms & More
Linear Operation Eliminates Rotary Drive Gears & All Rotating Motion
Broad Range of Chemicals & Capacities
Two 4-20 mA Outputs
Password Protected Settings

Because of Hydro Instruments' innovative approach to manufacturing, the ***Omni-Valve*** is the industry's first true directly linear drive control valve design. This linear design provides vast improvements over problematic rotary-driven valves. The ***Omni-Valve*** is the industry leader in terms of offering 8 different control modes (all standard) and a wealth of flexible settings and features. Our state-of-the-art microprocessor technology, highest quality materials of construction, precision machining and a minimal number of moving parts combine to make the ***Omni-Valve*** extremely reliable over long periods of continuous operation and truly the best automatic control valve available on the market.

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BULLETIN OV-110 Rev. 5/13

Series 110 Omni-Valve

OV-110 Ordering Information

Model: OV-110 - ____ - ____ - ____ - ____ - ____ - ____ - ____ - ____

MAXIMUM CAPACITY
1. 500 ppd (10 kg/hr)
2. 2000 ppd (40 kg/hr)
3. 6000 ppd (120 kg/hr)

GAS OR LIQUID
A. Ammonia (NH_3)
B. Sodium Bisulfite ($NaHSO_3$)
C. Chlorine (Cl_2)
S. Sulfur Dioxide (SO_2)
H. Sodium Hypochlorite (NaOCl)
Other: Consult Factory

RANGE
1. 10 ppd (200 gr/hr)
2. 25 ppd (500 gr/hr)
3. 50 ppd (1 kg/hr)
4. 100 ppd (2 kg/hr)
5. 250 ppd (5 kg/hr)
6. 500 ppd (10 kg/hr)
7. 1000 ppd (20 kg/hr)
8. 2000 ppd (40 kg/hr)
9. 3000 ppd (60 kg/hr)
10. 4000 ppd (80 kg/hr)
11. 6000 ppd (120 kg/hr)

Note: For liquid use please specify the desired max capacity.

POWER REQUIREMENTS
1. 120V 60Hz
2. 240V 50Hz

CONTROL CONFIGURATION
1. Flow Pacing
2. Residual
3. ORP
4. Compound Loop (Residual)
5. Compound Loop (ORP)
6. Step Feed
7. Dual Input Feed Forward
8. Dual Set Point

POWER CABLE LENGTH
1. 6 feet (1.5 m) standard
2. Other (consult factory)

SIGNAL CABLE LENGTH
1. 25 feet (8 m) per input channel
2. Specify length required

POWER LINE ISOLATOR
1. None (standard)
2. Included

Capacity Ranges	
Gas Feed	10, 25, 50, 100, 250, 500, 1000, 2000, 3000, 4000, & 6000 PPD
Liquid Feed	4 GPH through 10 GPM

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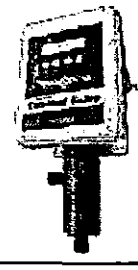
Automatic Control Valves

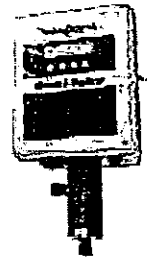
Hydro Instruments offers two different automatic control valves with the below listed general specifications. The Model 0V-110 offers complete Compound Loop (PID) control capabilities, while the CV-230 is more economical in price for applications that only require proportional control. Both valves use the same 10 point linearization process and automatic self calibration checking. These valves can be provided on wall panels or in floor cabinets.

CV-230



- Flow Pacing Control Only
- One 4-20mA Input Channel
- One Relay Alarm Output
- Two 4-20mA Output Channels
- 120 kg/hr maximum capacity (Cl_2)
- 2 line, 20 character LCD Display
- Linear Stepper Motor

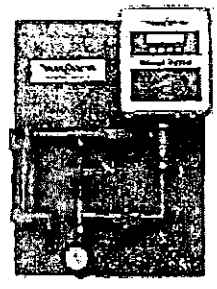
OV-110



- Flow, Residual, Compound Loop & Step Feed
- Three 4-20mA Input Channels
- Four Relay Input Channels (step feed)
- One Relay Alarm Output
- Two 4-20mA Output Channels
- 120 kg/hr maximum capacity (Cl_2)
- 2 line, 20 character LCD Display
- Linear Stepper Motor

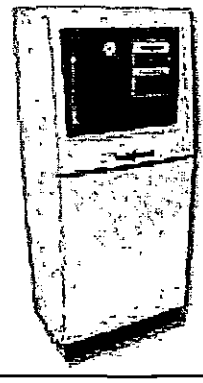
Wall Panel

Hydro Instruments offers prefabricated and tested wall panel mounted chlorine gas feed rate control panels in a variety of configurations. An example of the most common configuration with Model 0V-110 Omni-Valve, bypass piping with true union ball valves, and remote meter with rate valve is shown here. Such wall panels can be provided with vacuum gauges, differential pressure regulators, high/low vacuum alarms, etc.



Floor Cabinet

Hydro Instruments offers prefabricated and tested free standing floor cabinets with a variety of optional features to chose from. Floor cabinets offer a convenient and aesthetic appearance for mounting the control and indication equipment for each chlorine gas feed point. Floor cabinets house the automatic control valve (CV-230 or OV-110), the flow meter tube and manual rate valve, and at least one vacuum gauge with diaphragm protection. Optional equipment includes a second vacuum gauge, high/low vacuum alarm, and differential pressure regulator.



Differential Pressure Regulators

Recommended for feed rates 40 kg/hr and higher
Not necessary for 10 kg/hr and below
Used for stabilizing rotameter indicator float

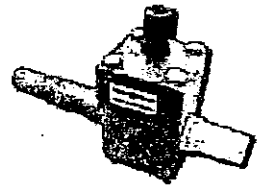
Will install DP-500

Section 3 – Ejectors: This section creates the vacuum that operates the system and mixes the chlorine gas with the water.

High velocity water flow through the ejector venturi nozzle creates the vacuum that operates the gas chlorination system. Chlorine gas feed is stopped by stopping the water flow to the ejector. When the system is not operating and there is no water flow through the ejector nozzle, there will be no vacuum. Each ejector includes at least one check valve to prevent water from flowing back into the gas chlorination equipment when the system is turned off. Hydro Instruments manufactures a variety of different ejector designs. Refer to the nozzle performance charts and curves that can be found in the Hydro Instruments instruction manuals to consider the water flow and pressure requirements for each ejector. In general, several nozzles are available for each ejector. A list of common ejectors is given here.

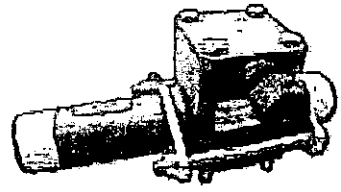
EJH-142-CL2, EJH-242-CL2, EJH-542-CL2

- 10 kg/hr Maximum Capacity
- 3/4" NPT (2 kg/hr)
- 1 1/4" NPT (5 & 10 kg/hr)
- 10 kg/cm² (standard b.p.)
- 20 kg/cm² (high b.p. option)
- Check Valve without diaphragm



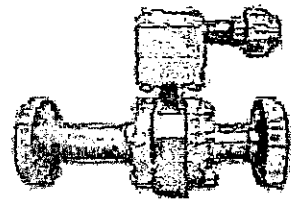
EJ-1000, EJ-2000, EJ-5000

- 10 kg/hr Maximum Capacity
- 3/4" NPT (2 kg/hr)
- 1 1/4" NPT (5 & 10 kg/hr)
- Double Check Valve option available
- 10 kg/cm² (standard b.p.)
- 20 kg/cm² (high b.p. option)
- Diaphragm Check Valve



EJH-2000-CL2 and EJH-3000-CL2

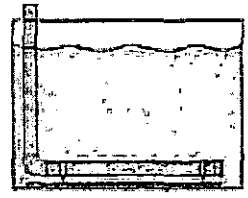
- 120 kg/hr Maximum Capacity
- 2" Flanged and 3" Flanged sizes
- 10 kg/cm² (maximum b.p.)
- Diaphragm Check Valve



The water exiting the ejector contains highly concentrated chlorine solution. Hydro Instruments manufactures a variety of diffusers and corporation stop assemblies that can be used to conveniently and safely inject this solution into the process stream. Secondary check valves are also available for greater protection against water backflow during system stop conditions.

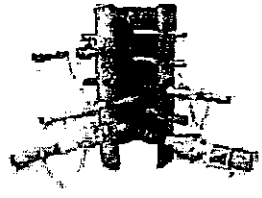
Open Channel Diffusers

Provides more effective mixing in open channels and contact chambers 1/2" through 4" pipe diameter. Every unit is custom-built: pipe size, length, hole diameter, hole quantity, hole spacing and inlet connection.



Spray Diffusers and Corporation Stops

Prevents corrosion of the solution & process piping and provides better mixing in the process line. Corporation stops are designed to allow removal of the diffuser while the process pipe remains pressurized. Available in a range of sizes and materials.



Gas Leak Detectors

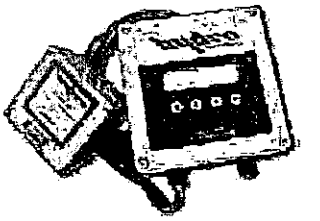
Hydro Instruments manufactures two series of gas leak detection equipment. Both series use the same sensors and therefore offer detection of the same set of gases. Sensors are available for Cl_2, SO_2, NH_3, O_3, ClO_2, H_2S, CO_2, H_2, O_2, NO, NO_2, & HCl. The general specifications are shown here below.

GA-170

- 1 to 4 sensors per monitor
- 2 line, 16 character display
- Integral 90 dB audible alarm
- Optional battery backup
- 6 adjustable relay outputs
- 2 LED indicators per sensor
- RS-232 and 4-20mA outputs

GA-171

- 1 to 2 sensors per monitor
- 2 line, 16 character display
- 1 adjustable common relay output
- 2 LED indicators per sensor
- RS-232 and 4-20mA outputs

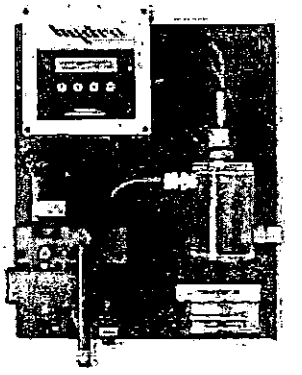


Residual Analyzers

Hydro Instruments produces two series of residual analyzers for online measurement. Both instruments utilize the amperometric method of measurement. The Series RAH-210 incorporates an open flow cell design with large electrode surface area and continuous motor driven cleaning for rugged operation. The Series RPH-250 incorporates a semipermiable membrane and electrolyte design.

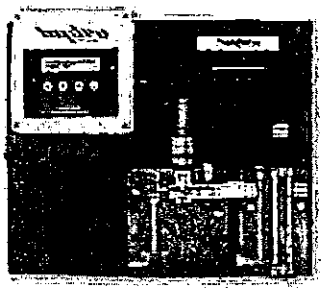
RAH-210

- Free Chlorine, Total Chlorine, & ClO_2
- Continuous Self Cleaning
- PID controller included
- One 4-20mA input channel
- Two 4-20mA output channels
- One alarm relay output
- 2 line, 20 character display
- 2 LED indicators
- RS-232 output
- Temperature Sensor
- Optional pH probe
- Optional Buffer Chemical Feed Systems
- Optional pH Compensation in software



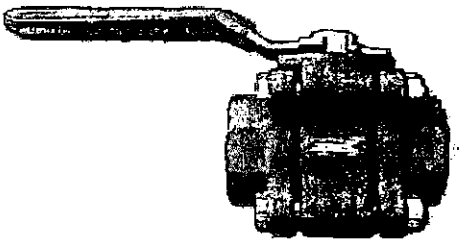
RPH-250

- Free Chlorine & ClO_2
- PID controller included
- One 4-20mA input channel
- Two 4-20mA output channels
- One alarm relay output
- 2 line, 20 character display
- 2 LED indicators
- RS-232 output
- Temperature Sensor
- Optional pH probe
- Optional pH Compensation in software



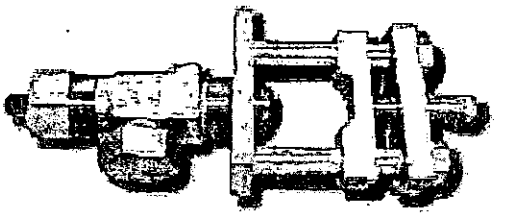
Additional Gas Chlorination Equipment

Chlorine Service Ball Valves



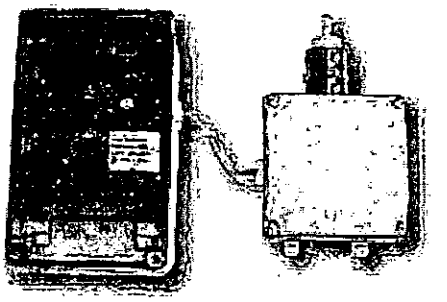
- Manual and electronic with a range of connection sizes. Teflon seals and Carbon Steel housings. Optional Monel or Hastelloy C ball and stem.

Isolation Valve Assemblies



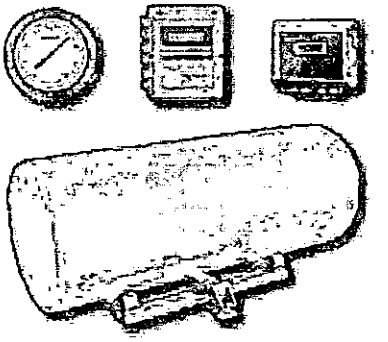
- Eliminate the stress on flexible connectors during cylinder changes. Increase the safety and convenience of changing chlorine containers.

Vacuum Monitor



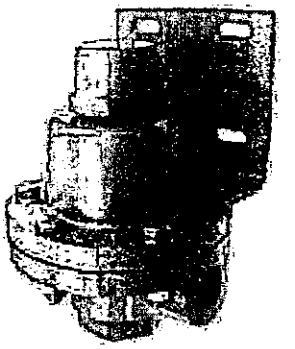
- Continuously monitor the chlorine gas vacuum level with digitial display. Adjustable high and low alarm relays. Specifically designed for chlorine gas application.

Chlorine Container Scales



- Used for monitoring and recording chlorine supply and usage. Electronic and hydraulic scales are available from Hydro Instruments in a variety of configurations. Scale sets are available for weighing the contents of one, two or more chlorine containers simultaneously.

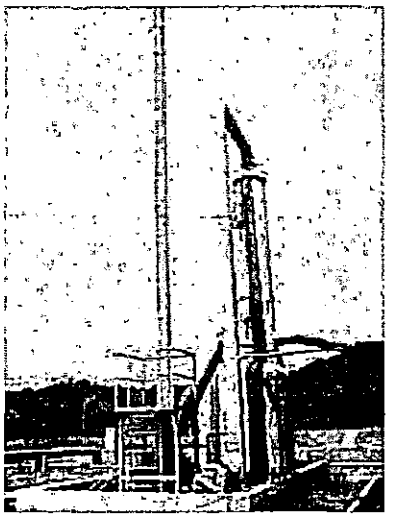
Pressure Reducing Valve



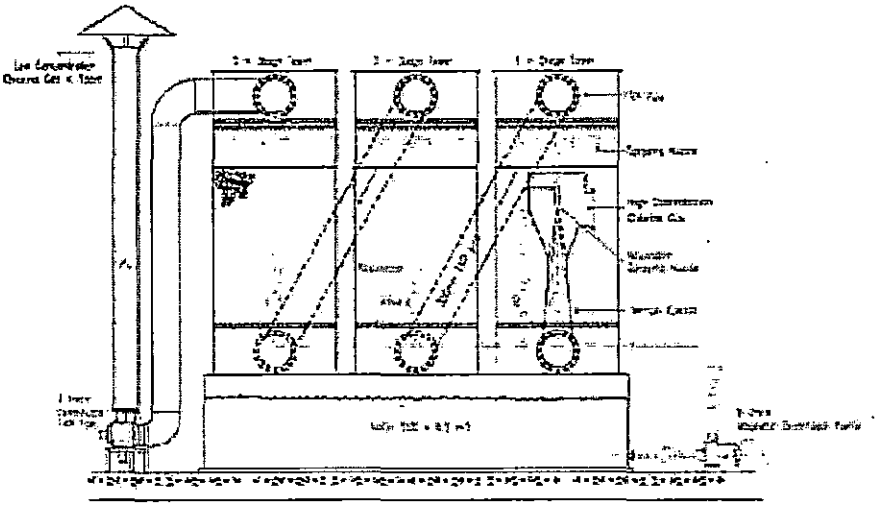
- The Hydro Instruments Series PRV-71H Pressure Reducing Valve is used to reduce and control the gas pressure downstream of the valve. The PRV-71H is designed for chlorine or sulfur dioxide gas service.

Chlorine Leak Absorption Systems

The chlorine scrubber system operation is activated by an alarm relay signal from a gas leak detector. Chlorine storage room air is drawn into the scrubber system where the chlorine is chemically extracted before exhausting the cleaned air to the outside environment. Chlorine scrubber systems are available from Hydro Instruments and our sales representatives in a variety of configurations and sizes.



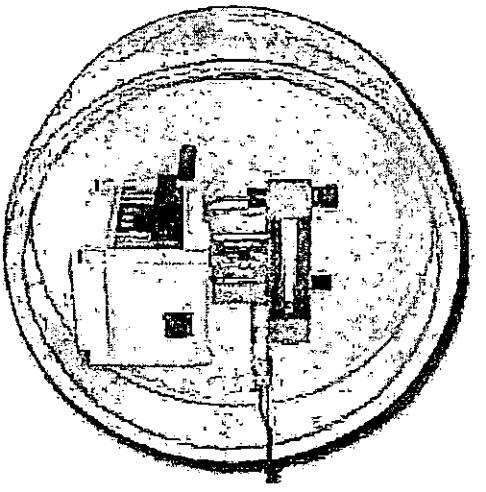
SINGLE STAGE SCRUBBER



3 STAGE SCRUBBER

Emergency Shut-Off Systems

These systems are activated by an alarm relay signal from a gas leak detector. A valve closure acutator (shut-off device) is mounted directly on the chlorine container valve. In the event of a leak, the device will close all of the chlorine container valves immediately to stop the leak. Emergency shut-off systems are available from Hydro Instruments and our sales representatives in a variety of configurations and sizes.



Contact us:

Hydro Instruments
600 Emlen Way
P.O. Box 387
Telford, PA 18969 USA
TEL: 215-799-0980
FAX: 215-799-0984
Website: http://www.hydroinstruments.com/

USA & Canada
E-mail: sales@hydroinstruments.com

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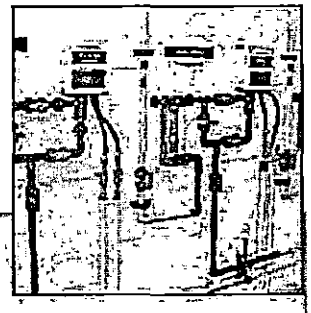
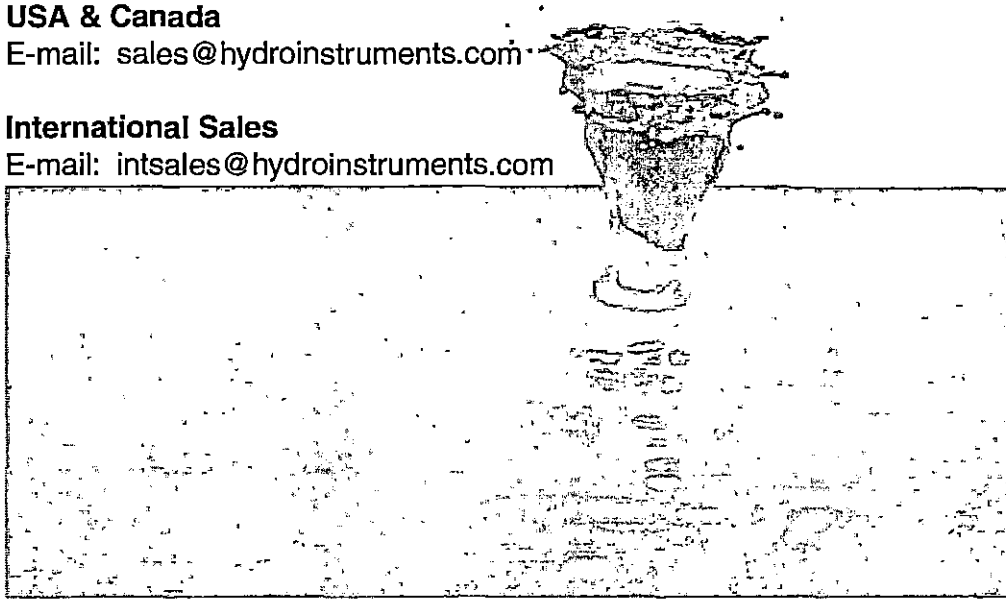
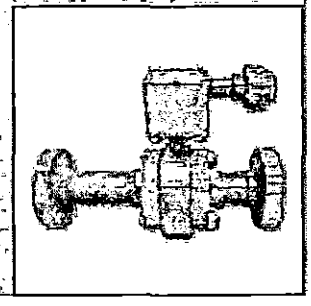






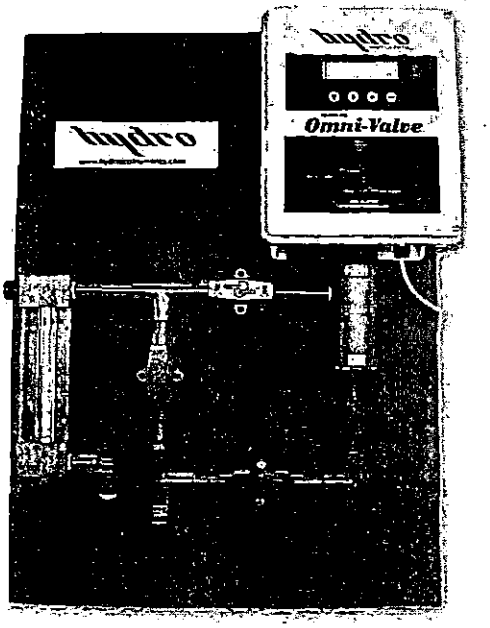
Represented by:

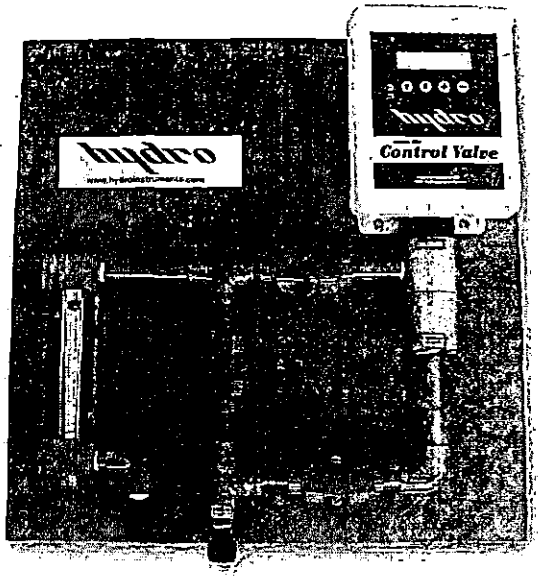
Wall Panel Series
Panel Mounted Products

Wall Panel Series

The Wall Panel Series offers the ability to panel mount the OV-110 and CV-230 automatic feed rate control valves offered by Hydro Instruments.

- Wall panel mounting simplifies the installation process providing easy access to the equipment for operation and maintenance. Panel mounting minimizes the equipments footprint which conserves space and eliminates the use of cabinets.
- Every panel is constructed from the highest quality "high density polyethylene" plastic and schedule 80 PVC piping. Panels are available in standard sizing for the most common configurations. Custom panels are also available. The bypass piping and valve arrangements allows for simple manual feed control whenever maintenance or calibrations are needed on the control valve.





OV-110 Control Options (all standard)

Manual Control
Proportional (Flow) Control
Set Point (Residual) Control
Set Point (ORP) Control
Compound Loop (PID) Control
Step Feed Rate Control
Dual Input Feed Forward
Dual Set Point Control

Control modes are field selectable and can be changed at any time.

OV-110 Highlighted Features

2 x 20 Character Liquid Crystal Display
Modbus Communication (RS-485)
3 Analog Inputs (Flow, Residual and Remote Dosage)
Adjustable: Dosage, Set Points, Lag Time, Signal Filters, Display Ranges, Alarms & More
Linear Operation Eliminates Rotary Drive Gears & All Rotating Motion
Broad Range of Chemicals & Capacities
Two 4-20 mA Outputs
Password Protected Settings
External control of: Duty/Standby & Auto/Manual

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BULLETIN WP Rev. 5/13

Custom Configurations and Options

Wall Panel Series 110 Omni-Valve Order Information

Model: WPOV-110 – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____
A B C D E F G H I J K

Position	Feature	Description
A. MAXIMUM CAPACITY	1	500 ppd (10 kg/hr):
	2	2000 ppd (40 kg/hr):
	3	6000 ppd (120 kg/hr):
B. GAS OR LIQUID	A	Ammonia (NH_3)
	B	Sodium Bisulfite ($NaHSO_3$)
	C	Chlorine (Cl_2)
	S	Sulfur Dioxide (SO_2)
	H	Sodium Hypochlorite (NaOCl)
	Other	Consult Factory
C. FLOW METER CAPACITY *Note: For liquid use please specify the desired max capacity.*	1	10 ppd (200 gr/hr)
	2	25 ppd (500 gr/hr)
	3	50 ppd (1 kg/hr)
	4	100 ppd (2 kg/hr)
	5	250 ppd (5 kg/hr)
	6	500 PPD (10 kg/hr)
	6A	500 PPD (10 kg/hr) RM-702 *RM-702 Rate Valve Knob protrudes from front of meter*
	7	1000 ppd (20 kg/hr)
	8	2000 ppd (40 kg/hr)
	9	3000 ppd (60 kg/hr)
	10	4000 ppd (80 kg/hr)
	11	6000 ppd (120 kg/hr)
D. POWER REQUIREMENTS	1	120V 60Hz
	2	240V 50Hz
E. CONTROL CONFIGURATION	1	Flow Pacing
	2	Residual
	3	ORP
	4	Compound Loop (Residual)
	5	Compound Loop (ORP)
	6	Step Feed
	7	Dual Input Feed Forward
	8	Dual Set Point
F. POWER CABLE LENGTH	1	6 feet (1.5 m) standard
	2	Other (consult factory)
G. SIGNAL CABLE LENGTH	1	25 feet (8 m) per input channel
	2	Specify length required
H. 4-20 mA OUTPUT	1	Not Included
	2	Included
I. POWER LINE ISOLATOR	1	None (standard)
	2	Included
J. BYPASS PIPING ARRANGEMENT	1	None
	2	Up to 500 ppd (10 kg/hr)
	3	2000 ppd (40 kg/hr)
	4	3000 ppd (60 kg/hr)
	5	6000 ppd (80 kg/hr)
K. DIFFERENTIAL PRESSURE REGULATOR	1	None
	2	Up to 250 ppd (5 kg/hr)
	3	500 ppd (10 kg/hr)
	4	2000 ppd (40 kg/hr)
	5	3000 ppd (60 kg/hr)
	6	4000 ppd (80 kg/hr)
	7	6000 ppd (120 kg/hr)

NOTES:

1. Standard flow tubes for up to 250 PPD (5 kg/hr) are 3" length. For 6" flow tubes on Item C=1-5, add an "A" after this number (i.e., 3 becomes 3A).
2. Port sizes are as follows:
   - up to 250 PPD (5 kg/hr) has ¼" NPT
   - 500 PPD (10 kg/hr) has ½" NPT
   - 1000 & 2000 PPD (20 & 40 kg/hr) has 1" NPT
   - 3000, 4000, & 6000 PPD (60, 80, & 120 kg/hr) has 1.5" Socket

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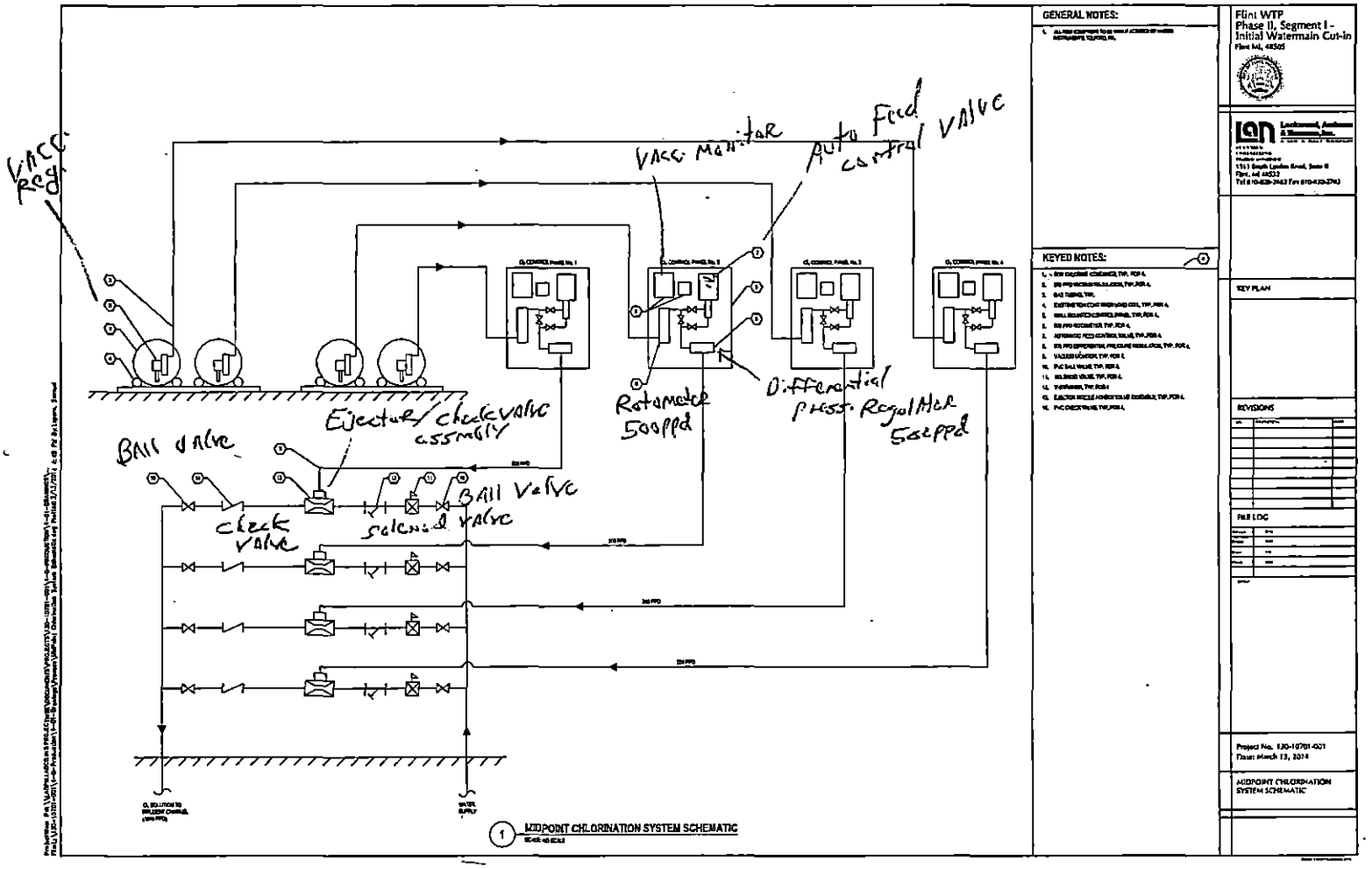
Affects that feeder
feed rate control - not make-up water
— piping not from tank to feeder?
— then from feed to make-up line?



Provide Full Size

OZONE CALCULATIONS

Flint WTP

OXYGEN AND NITROGEN SYSTEMS CAPACITIES

DATA LEGEND

REQUIRED DATA
FIXED DATA - DO NOT CHANGE UNLESS EQUIPMENT IS REPLACED
DATA SHOULD NOT CHANGE (MAY BE TWEAKED BASED ON OPERATIONAL RESULTS)
CALCULATION RESULTS

LOX SYSTEM (AVG DAY - AVG DOSE)	
PRESSURE RATING (psig)	175
OPERATING WT (lbs)	119,600
TARE WT (lbs)	33,000
EFFECTIVE VOLUME (lbs)	86,600
EFFECTIVE VOLUME (gals)	9,084
OXYGEN USAGE (ppd)	2833
OXYGEN GAS FLOW (scfm)	23.8
EFFECTIVE STORAGE (days)	30.6

9.53 LBS / GAL

LN SYSTEM (AVG DAY - AVG DOSE)	
PRESSURE RATING (psig)	250
OPERATING WT (lbs)	7,100
TARE WT (lbs)	3,800
EFFECTIVE VOLUME (lbs)	3,300
EFFECTIVE VOLUME (gals)	540
NITROGEN USAGE (ppd)	71
NITROGEN GAS FLOW (scfm)	0.7
EFFECTIVE STORAGE (days)	46.6

6.11 LBS / GAL

OPERATING CONDITIONS (AVG DAY)	
WATER PLANT FLOW (MGD)	10
OZONE DOSE (mg/l)	2.5
OZONE CONCENTRATION (%)	8
TRANSFER EFFICIENCY (%)	92
OZONE FEED RATE (ppd)	227

2833 ok

OPERATING CONDITIONS (MAX DAY)	
WATER PLANT FLOW (MGD)	18
OZONE DOSE (mg/l)	4
OZONE CONCENTRATION (%)	8
TRANSFER EFFICIENCY (%)	92
OZONE FEED RATE (ppd)	653

8159

STORAGE REQUIREMENTS		
DAYS @ AVG DAY - AVG DOSE	30	
LIQUID OXYGEN (lbs)	84986	
LIQUID NITROGEN (lbs)	2125	Use
NUMBER OF LOX TANKS	0.98	1
NUMBER OF LN TANKS	0.64	1

SUMMARY OF RESULTS

Based on Average Day Demand of 10 MGD and Average Dosage of 2.5 mg/L ozone at 8% concentration, a single 9,084 gallon LOX tank and a single 540 gallon LIN tank will provide the 30 days of storage. Two LOX tanks and two LIN tanks are provided for redundancy.

LOX AVG DAY FEED RATE: $2.5\ mg/l * 10 * 8.34 = 208.5\ ppd * \frac{100\ LBS\ O_2}{8\ LBS\ LOX} * \frac{100}{92} = 2833\ LBS/DAY$ = 30 DAY

Ref. WTP BOD 3.5 MAX DAY: $4.5 * 18 * 8.34 * \frac{100}{8} * \frac{100}{92} = 8159\ LBS/DAY$

at 12 MGD → 3400 LB/DAY OR 25 DAYS

~~LIN → AVG DAY 2.5 * 10 * 8.34 = 208.5 LBS/DAY~~

LN → 2833 * 0.025 = 71 ppd LN → 46 DAYS

@ 12 MGD → 85.2 PPD → 39 DAYS

at 12 MGD MAX 4.0 % = 5440 LB/DAY OR 16 DAYS

23 IC

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT APPLICATION FOR WATER SUPPLY SYSTEMS

(CONSTRUCTION - ALTERATION - ADDITION OR IMPROVEMENT) AS DESCRIBED HEREIN

Required under the Authority of 1976 PA 399, as amended

This application becomes an Act 399 Permit only when signed and issued by authorized Michigan Department of Environmental Quality (DEQ) Staff. See instructions below for completion of this application.

1. Municipality or Organization, Address and WSSN that will own or control the water facilities to be constructed. This permit is to be issued to:

City of Flint
4500 North Dort Highway
Flint, MI 48505

WSSN: 02310

2. Owner's Contact Person (provide name for questions):

Contact: Brent Wright
Title: Plant Supervisor
Phone: 810-787-6537

Permit Stamp Area (DEQ use only)

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT NO. W 140026 APR 09 2014

EXAMINED AND APPROVED FOR COMPLIANCE WITH ACT 399, P.A. 1976

3. Project Name (Provide phase number if project is segmented):

Flint WTP Phase II, Segment II - Lime Residual Disposal

4. Project Location (City, Village, Township):
City of Flint

5. County (location of project):
Genesee County

ISSUED UNDER THE AUTHORITY OF THE DIRECTOR OF THE DEPARTMENT OF ENVIRONMENT QUALITY

cc:

Issued by: _____

Reviewed by: Patrick Cook for MFP for Mike Prysby

☐ **If this box is marked see attached special conditions.**

Instructions: Complete items 1 through 5 above and 6 through 21 on the following pages of this application. Print or type all information except for signatures. Mail completed application, plans and specifications, and any attachments to the DEQ District Office having jurisdiction in the area of the proposed construction.

Please Note:

a. This **PERMIT** only authorizes the construction, alteration, addition or improvement of the water system described herein and is issued solely under the authority of 1976 PA 399, as amended.
b. The issuance of this **PERMIT** does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other DEQ permits, or approvals from other units of government as may be required by law.
c. This **PERMIT** expires two (2) years after the date of issuance in accordance with R 325.11306, 1976 PA 399, administrative rules, unless construction has been initiated prior to expiration.
d. Noncompliance with the conditions of this permit and the requirements of the Act constitutes a violation of the Act.
e. Applicant must give notice to public utilities in accordance with 1974 PA 53, (MISS DIG), being Section 460.701 to 460.718 of the Michigan Compiled Laws, and comply with each of the requirements of that Act.
f. All earth changing activities must be conducted in accordance with the requirements of the Soil Erosion and Sedimentation Control Act, Part 91, 1994 PA 451, as amended.
g. All construction activity impacting wetlands must be conducted in accordance with the Wetland Protection Act, Part 303, 1994 PA 451, as amended.
h. Intentionally providing false information in this application constitutes fraud which is punishable by fine and/or imprisonment.
i. Where applicable for water withdrawals, the issuance of this permit indicates compliance with the requirements of Part 327 of Act 451, Great Lakes Preservation Act.

6. **Facilities Description** – In the space below provide a detailed description of the proposed project. Applications without adequate facilities descriptions **will be returned.** SEE EXAMPLES BELOW. Use additional sheets if needed.

Improvements to the City of Flint Lime Sludge Lagoons at Bray Road to allow lime sludge from the the Flint WTP to be stored during the interim period when the plant will be treating Flint River water. The lagoons will not be needed for continuous use when the plant switches to treatment of raw water from the KWA Lake Huron Water Supply:

PHASE II, SEGMENT II - LIME RESIDUAL DISPOSAL (@BRAY ROAD):
* Plugging and abandonment of 8" inlet piping; construction of 306 LF of new 10" inlet piping; installation of bulkhead on existing outlet structure to prevent discharge to surface water.
* Clay Berm barrier improvements to separate concrete debris pile from lime sludge.
* Construction of new decant tower structure, 8" gravity sewer, and decant pump station (duplex submersible) with CO2 feed system for pH adjustment. Vortex impeller pumps (2) shall each be rated at 140 gpm at 22' TDH; CO2 feed consists of 6 ton storage tank, 15 pph pH controlled feed system, SS gas piping, and diffusers installed in the decant tower.
* Construction of approx. 3,800 LF of 6" HDPE decant forcemain and connection to existing City santiary sewer system.

EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES	
Water Mains	500 feet of 8-inch water main in First Street from Main Street north to State Street. **OR** 250 feet of 12-inch water main in Clark Road from an existing 8-inch main in Third Avenue north to a hydrant.
Booster Stations	A booster station located at the southwest corner of Third Avenue and Main Street, and equipped with two, 15 Hp pumps each rated 150 gpm @ 200 feet TDH. Station includes backup power and all other equipment as required for proper operation.
Elevated Storage Tank	A 300,000 gallon elevated storage tank located in City Park. The proposed tank shall be spherical, all welded construction and supported on a single pedestal. The tank shall be 150 feet in height, 40 feet in diameter with a normal operating range of 130 – 145 feet. The interior coating system shall be ANSI/NSF Standard 61 approved or equivalent. The tank will be equipped with a cathodic protection system, and includes a tank level control system with telemetry.
Chemical Feed	A positive displacement chemical feed pump, rated at 24 gpd @ 110 psi to apply a chlorine solution for Well No. 1. Chlorine is 12.5% NaOCL, ANSI/NSF Standard 60 approved and will be applied at a rate of 1.0 mg/l of actual chlorine.
Water Supply Well	Well No. 3, a 200 foot deep well with 170 feet of 8-inch casing and 30 feet of 8-inch, 10 slot screen. The well will be equipped with a 20 Hp submersible pump and motor rated 200 gpm @ 225 feet TDH, set at 160 feet below land surface.
Treatment Facilities	A 5 million gpd water treatment plant located at the north end of Second Avenue. The facility will include 6 low service pumps, 2 rapid mix basins, 4 flocculation/sedimentation basins, 8 dual media filters, 3 million gallon water storage reservoir and 6 high service pumps. Also included are chemical feed pumps and related appurtenances for the addition of alum, fluoride, phosphate and chlorine.

General Project Information – Complete all boxes below.

7. Design engineer's name, engineering firm, address, phone number, and email address:

Jeremy N. Nakashima, PE
Lockwood, Andrews & Newnam, Inc.
1 Oakbrook Terrace, Suite 207
Oakbrook Terrace, IL 60181
630-495-4123 / jnnakashima@lan-inc.com

8. Indicate who will provide project construction inspection:
☒Organization listed in Box 1.
☒Engineering firm listed in Box 7.
☐Other - name, address, and phone number listed below.

9. Is a basis of design attached?
☒YES ☐NO

If no, briefly explain why a basis of design is not needed. Submitted previously under separate cover.

10. Are sealed and signed engineering plans attached?
☒YES ☐NO

If no, briefly explain why engineering plans are not needed. Plans and specs submitted previously under separate cover.

11. Are sealed and signed construction specifications attached?
☒YES ☐NO

If specifications are not attached, they need to be on file at DEQ.

12. Were Recommended Standards for Water Works, Suggested Practice for Water Works, AWWA guidelines, and the requirements of Act 399 and its administrative rules followed?
☒YES ☐NO

If no, explain which deviations were made and why.

13. Are all coatings, chemical additives and construction materials ANSI/NSF or other adequate 3rd party approved?
☒YES ☐NO

If no, describe what coatings, additives or materials did not meet the applicable standard and why.

14. Are all water system facilities being installed in the public right-of-way or a dedicated utility easement? (For projects not located in the public right-of-way, utility easements must be shown on the plans.)
☐YES ☒NO

If no, explain how access will be obtained. Most work will be on City owned property, except forcemain.

15. Is the project construction activity within a wetland (as defined by Section 324.30301(d)) of Part 303, 1994 PA 451?
☐YES ☒NO

If yes, a wetland permit must be obtained.

16. Is the project construction activity within a 100-year floodplain (as defined by R 323.1311(e)) of Part 31, 1994 PA 451, administrative rules?
☐YES ☒NO

If yes, a flood plain permit must be obtained.

17. Is the project construction activity within 500 feet of a lake, reservoir, or stream?
☒YES ☐NO

If yes, a Soil and Erosion Control Permit must be obtained or indicate if the owner listed in box 2 of this application is an Authorized Public Agency (Section 10 of Part 91, 1994 PA 451) ☐ Owner is APA.

18. Will the proposed construction activity be part of a project involving the disturbance of five (5) or more acres of land?
☐YES ☒NO
If yes, is this activity regulated by the National Pollutant Discharge Elimination System storm water regulations?
☐YES: NPDES Authorization to discharge storm water from construction activities must be obtained.

☐NO: Describe why activity is not regulated:
Please call 517-241-8993 with questions regarding the applicability of the storm water regulations.

19. Is the project in or adjacent to a site of suspected or known soil or groundwater contamination?
☐YES ☒NO

If yes, attach a copy of a plan acceptable to the DEQ for handling contaminated soils and/or groundwater disturbed during construction. Contact the local DEQ district office for listings of Michigan sites of environmental contamination.

20. IF YOU ARE A CUSTOMER/WHOLESALE/BULK PURCHASER, COMPLETE THE FOLLOWING

1) Name and WSSN of source water supply system (seller) _____

2) Does the water service contract require water producer/seller to review and approve customer/wholesale/bulk purchaser water system construction plans?
☐YES ☐NO

If yes to #2, the producer/seller approval letter must be attached when submitted to DEQ.

21. **Owner's Certification** The owner of the proposed facilities or the owner's authorized representative shall complete the owner's certification. It is anticipated that the owner will either be a governmental agency (city, village, township, county, etc.) or a private owner (individual, company, association, etc.) of a Type I public water supply.

OWNER'S CERTIFICATION

I, BRENT F. WRIGHT (print) (name), acting as the WATER PLANT SUPERVISOR (print) (title/position) for

CITY OF FLINT (print) (entity owning proposed facilities) certify that this project has been reviewed and approved as detailed by the Plans and Specifications submitted under this application, and is in compliance with the requirements of 1976 PA 399, as amended, and its administrative rules.

Signature* 3-31-2014 Date (810)787-6537 Phone

*Original signature only, no photocopies will be accepted.

PROJECT BASIS OF DESIGN – FOR WATER MAIN PROJECTS

PROJECT NAME: _____

For this PROJECT the following information must be provided per Act 399 unless waived by the Department. For projects other than water main installation, or if additional space is needed, attach separate sheet(s) with detailed Basis of Design calculations.

A. A general map of the initial and ultimate service areas
☐Included on engineering plans ☐Attached separately

B. Number of service connections served by this permit application _____

C. Total number of service connections ultimately served by entire project _____

D. Residential Equivalent Units (REUs) served by this permit application _____

E. Total Residential Equivalent Units (REUs) ultimately served by entire project _____

F. Water flow rates for proposed project based on REUs listed in "D' and "E" above

1. Initial design average day flow (mgd) _____
2. Initial design maximum day flow (mgd) _____
3. Total design average day flow (mgd) _____
4. Total design maximum day flow (mgd) _____
5. Required fire flows: (1) _____ gpm for _____ hours

G. Actual flows and pressures of existing system at the connection point(s) (2)

_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi

H. Estimated minimum flows and pressures within the proposed water main system (3) _____ gpm at _____ psi

(1) Every water system must decide what levels of fire fighting flows they wish to provide. Fire flow should be appropriate for the area (residential, commercial, industrial) being served by the project. Typical fire flow rates can be obtained from the water supply, local fire dept., ISO or AWWA. The water system must then be designed to be able to provide the required fire flows while maintaining at least 20 psi in all portions of the distribution system.

(2) Flows and pressures at the connection points must be given to determine if the existing water main(s) are able to deliver water to the new service area. These numbers can be obtained from a properly modeled and calibrated distribution system hydraulic analysis or hydrant flow tests performed in the field. If more than one connection is proposed, list as needed.

(3) List what the estimated minimum flows can be expected in the proposed water mains based on estimated water demands, head losses, elevation changes and other factors that may affect flows, such as dead end mains.

Flint WTP Improvements
Bray Road Lime Sludge Lagoon
MDEQ Comments
March 21, 2014

1. The placement of the proposed liner and berm fails to establish physical separation between the lime sludge collection area and concrete fill area. For complete separation of these areas, the berm needs to be constructed down to native soil.

   As proposed, this appears to constitute the first step towards a "cap-in-place" of the existing materials. If waste is left in place within the berm, the city will be required to construct the berm to meet Part 115 cap requirements. In addition, long term groundwater monitoring, financial assurance, closure and post closure plans will be required.

2. Please provide a residuals management plan for the lime sludge collection area. In additional to removal of new lime sludge produced, the plan must also include the gradual removal of existing lime sludge.

3. The working depth of the lime sludge collection area does not appear to meet 10-States Standard's minimum depth of 5 feet. The available volume appears to be 60,000 cubic yards based on 2.6 feet of working depth. Please confirm this. What is the surface area of the lagoon? Please provide a basis of design that includes the amount of lime sludge produced at average day demand and the available days of storage at this production rate. These parameters will need to be used towards developing the residuals management plan. Finally, an acceptable residuals management plan is needed for us to consider a deviation from the 10-State Standards guidelines.

4. An effluent sampling point needs to be provided for decant water.

Flint WTP Improvements – Phase II, Segments I, II, and III
Responses to MDEQ Review Comments dated 4-3-2014

The MDEQ review comments dated 4-3-14 have been addressed as noted in the responses below. Revised drawings have also been prepared in conjunction with these responses and have been included in the attached revised drawing sets for Phase II, Segments I, II, and III.

Phase II – Segment 1 - Watermain Cut-in Plans

- **Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.**

  Response: The anti-siphon/ball valve is shown on revised Sheet C-104, dated 4-7-14.

- **Include a full-sized mid-point chlorination system schematic with the updated plans.**

  Response: The mid-point chlorination system schematic has been included in the Phase II, Segment I – Initial Watermain Cut-in drawings as Sheet C-509, dated 4-7-14.

- **It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.**

  Response: The above description of the midpoint chlorination system is essentially correct. As shown on Sheet C-509, the mid-point chlorination system is a vacuum system. The vacuum regulators are mounted directly to the chlorine storage cylinders. Vacuum lines run from the regulators to the chlorinator control panels where feed rate is controlled. Vacuum lines are then connected from the control panel to ejectors, where water supply flowing through the ejectors creates the vacuum required to pull gas from the storage tanks. While the ejectors are not located in the control panel, it is common to have the ejectors remotely mounted from the control panels. A review of the 10 State Standards requirement for Schedule 80 seamless steel tubing appears to be for pressure gas feed systems, and not vacuum gas feed systems as proposed for Flint. As such, the recommended vacuum line material for a 500

ppd system is 5/8" O.D. flexible polyethylene plastic tubing (see attached information from Hydro Instruments).

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- **LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.**

  Response: Revised drawings D2-101, D2-102, D2-301, D2-502, and D2-601 have been included in the updated plan set.

- **The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days storage is maintained in the LOX tank at all times.**

  Response: The City will provide MDEQ a copy of the contract between the City and their LOX supplier under separate cover. LOX can be supplied within 24 hours of when a purchase order is issued.

- **Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.**

  Response: Sheets C5-105, C5-508, and EP6-101, which are all specific to the chlorine scrubber work only, have been deleted in their entirety from the updated plan set.

- **Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.**

  Response: This intake duct detail is no longer applicable as it is for the chlorine scrubber system, which has been deleted. As noted in the previous MDEQ review comment responses, the City will extend the existing ventilation intake ductwork in the existing Chlorine Storage Room to finished floor level. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 7 of revised drawing Sheet C-103.

- **Add panic hardware to chlorinator room door (east and west exits).**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 8 of revised drawing Sheet C-103.

- **The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see notes on revised drawing Sheet C-103.

- **Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.**

  Response: The Contractor is required to field verify the elevation of the existing 54" pipeline. The City or the City's representative onsite observing construction will coordinate with the Contractor to ensure that the clearance between the 42" and 54" pipelines is increased to the maximum extent practical.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Response: 2 full sized sets of construction plans of proposed work at the Bray Road Sludge Lagoon are included for your review and file. The separation barrier between the concrete disposal area and the lime sludge disposal area will be accomplished by

establishing a clay barrier that extends to the bottom of the original lagoon bottom as shown in the detail on sheet C-501. The separation barrier will be constructed within the lime sludge lagoon away from the concrete disposal area as to provide complete separation as discussed.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

Response: A final version of the Bray Road Lime Sludge Management Plan is being included with this final submittal. A level working surface of 738.5' has been designated within the sludge lagoon after the pump station is operational. All debris or vegetation growth within the 742' elevation within the sludge lagoon is intended to be removed and cleared by the contractor.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Response: Sheet piling is no longer being used as the separation barrier based on further discussion with the contractor and availability. A clay berm will be constructed for the full depth within the lime sludge lagoon using the original bottom of the sludge lagoon as a base using the proposed alignment proposed for the sheet piling.

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

Lockwood, Andrews & Newnam, Inc.

PLANNING

ENGINEERING

PROGRAM MANAGEMENT

Est. 1935

AUSTIN, TX
CHICAGO, IL
CLEARWATER, FL
COLLEGE STATION, TX
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FLINT, MI
FORT WORTH, TX
HOUSTON, TX
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LAS VEGAS, NV
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MIAMI, FL
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SAN MARCOS, TX
WACO, TX

TRANSMITTAL

Filing Data Code 1-07

☐ UPS ☐ FEDEX ☐ DELIVERY SERVICE ☒ HAND DELIVER ☐ OVERNIGHT ☐ REGULAR MAIL ☐ PICK-UP ☐ OTHER Extranet(To PM)

To: Mr. Steve Busch, PE	**Date** 4-8-14
Company: MDEQ	**Project Number** 130-10701-001
Address: 525 WEST ALLEGAN STREET Lansing, MI 48933	**Routing:**
Project: City of Flint Water Treatment Plant Improvements.	

We Are Sending You:		These Are Transmitted:
☐ Shop Drawings	☐ Reports	☐ As Requested
☐ Original Drawings	☐ Submittal Data	☒ For Your Use
☒ Prints	☐ Proposal	☒ For Review and Comment
☐ Specifications	☐ As Noted	☐ For Your Signature

Quantity	Description
2	22x34 Plans - Phase II, Segment 1 – Rehabilitation
2	22x34 Plans - Phase II, Segment 1 – Initial Watermain Cut-In
2	22x34 Plans - Phase II, Segment II – Lime Residual Disposal
2	Final Bray Road Lime sludge management Plan
1	Updated page 2 for permit applications
1	LAN Team Response to MDEQ Review comments

Remarks

These plans are being submitted for permit issuance as discussed.

DEQ
RESOURCE MANAGEMENT DIVISION
APR 08 2014
LANSING DISTRICT

Distribution	Prepared By
1- Daugherty Johnson 2- Brent Wright 3- File	Samir Matta, PE

1311 SOUTH LINDEN ROAD
SUITE B
FLINT, MI 48532
TEL 810.820.2682
FAX 810.820.2703
www.lan-inc.com

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
April 3, 2014

Phase II – Segment 1 - Watermain Cut-in Plans

- Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.

- Include a full-sized mid-point chlorination system schematic with the updated plans.

- It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.

- The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

storage is maintained in the LOX tank at all times.

- Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.

- Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.

- Add panic hardware to chlorinator room door (east and west exits).

- The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.

- Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
March 19 , 2014

Segment 1 - Cut –in Piping

The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?

Written response needed.....

Segment 1 – WTP Rehab

1. **Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102**

   54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?

   Air-release manhole – same as Cut-in piping

   Current yard piping diagram?

Written response needed on the first 3 items. Yard piping diagram will be a work in progress.

2. **Mid-Point CL2 - Basis of design provided**

   - **Scale – use existing or proposed? If poposed - type, capacity**
   - **Scrubber?**
   - **Room air-exchange rate ?**
   - **Pipe penetrations – discuss protective seal**
   - **Floor drains – discuss**
   - **Door sweep - discuss**
   - **Scrubber piping – lower intake**

FIL 516 6793

- Check valve/anti-siphon at influent channel - include in final

3. High Service Pump

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   TDH of current pump and proposed pump?
   Conformance of proposed pump TDH with system head curve?

   Written response needed.....

4. LOX/LN Storage

   Piping configuration clarified
   The LN calculation (71 ppd) is not clear. Is there a % concentration or transfer efficiency?

5. Electrical improvements

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

   Written response needed.....

(((

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
February 27, 2014

2 FKNS – ACCESS MONHOLE A.R. INC – CONNECT TO CORP TO CONNECT A.R. TO RELEASE DURING FILLING

Segment 1 - Cut –in Piping

✓ The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole? ↳ (Pump em down)

Segment 1 – WTP Rehab

1. ✓ Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102 — Not going to exist until proven available

   ✓ 54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support? ↳ Field adjust the steel WM – maintain the vert sep.

   ✓ Air-release manhole – same as Cut-in piping ↳ Same design

   Current yard piping diagram? — work in progress — SAME AP. CONCEPT

2. Mid-Point CL2 - Basis of design needed

   - Application rate (both mid-pt & post for CT)
   - CL2 gas max dosage LBs/Day
   - Scale – type, capacity ✓ 4 new scaletron Ind.
   - Rotometer (lbs/day)
   - Vacc reg, injector, educator (size)
   - Scrubber capacity – not being installed
   - Room air-exchange rate 1/3.3 MIN
   - Pipe penetrations – Sheet C-103 – linkseal – gas resistant? – will inspect & seal
   - Floor drains – to be plugged
   - Door sweep – New better sealing sweeps to be provided
   - Safety features – obs window, fan, lights, switches, panic bar
   - Scrubber piping – lower intake → will extend to Floor w. 90° bend
   - Check valve/anti-siphon at influent channel – Yes

hydraulic check valve will close on system failure/shut-down

3. **High Service Pump**

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   185 will match w. small pump

   TDH of current pump and proposed pump?
   Conformance of proposed pump TDH with system head curve?

4. **LOX/LN Storage**

   LOX & LN piping clarification – Sheet D2-102 & D2-601
   BOD for storage
   Ozone was designed at 4.0 mg/l max dose @ 36 MGD (Sec. 3.5 WTP BOD)

   Ozone max dose at 18.0 MGD is 650 Lbs/day

   How many GPD does this equate to?

5. **Electrical improvements**

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

One switchgear – dual feed
Two breakers – kirk key

Flint WTP Improvements – Phase II, Segments I, II and III

Responses to MDEQ Review Comments dated 3/19/2014

Segment I – Initial Watermain Cut-in

1. Detail 2, Sheet C-504, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.

Segment 1 – Rehabilitation

1. Raw Water Piping
   a. Maintain back up supply from Genesee County during interim operation at C.S. #2. Installation of the 42" raw water piping has been delayed until the KWA project is closer to being ready to supply water to the City. This will allow the City to maintain the backup supply from Genesee County during interim operation.
   b. The crossing of the new 42" steel pipe over the existing 54" concrete pipe is shown in plan on drawing sheet C5-101, with Detail 5, Sheet C5-501 showing how the 42-inch line will be supported. As shown on Detail 5, Sheet C5-501, the new 42-inch line will have concrete pipe cradles constructed on either side of the existing 54" pipe, maintaining a minimum clearance of 12" on either side of the 54" pipe. Pipe loads from the 42" line will then be transferred to the pipe cradles and into the soil, and not the 54" pipe. The 6" clearance between the two pipes will be backfilled with CLSM material as it will be impossible to compact typical granular bedding material under the 42" pipe.
   c. Detail 2, Sheet C5-505, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.
   d. See attached color coded yard piping diagram.

2. Midpoint Chlorination
   a. Four (4) new scales will be provided for monitoring chlorine usage from ton containers. Scales shall be as manufactured by Scaletron Industries Ltd. with a load range of 0 to 4000 lbs.
   b. The City has not been able to determine that the chlorine scrubber is a requirement of any applicable code. At this time, the City will not be installing the chlorine scrubber shown on the design drawings and will rely on the existing ventilation system to exhaust air from the Chlorine Storage Room.
   c. The existing ventilation in the Chlorine Storage Room was tested to have a capacity of 18.3 air changes per hour, or 0.305 air changes per minute. Therefore, one room volume air

change would take approximately 3.3 minutes with the current ventilation system. See attached test results. Due to the size of the existing Chlorine Storage Room, a ventilation system of 1 air change per minute is not practical. While the existing ventilation system capacity is less than 1 air change per minute, it appears to be in compliance with 10 State Standards as lesser rates may be considered in cases where 1 air change per minute is not appropriate due to the size of the room.

d. WTP staff will identify and inspect all proposed and existing piping and conduit wall penetrations in the Chlorine Storage Room and seal as necessary to prevent gas leakage into other parts of Pump Station No. 4.
e. Existing floor drains in the Chlorine Storage Room were for condensate from the old chlorine evaporator system. These drains will no longer be used and will be plugged by WTP staff.
f. WTP staff will attach new door sweeps with better seals at existing doors as required.
g. WTP staff will extend existing ventilation intake ductwork to finished floor level with 90-degree bends.
h. Per Addendum No. 1, an Anti-siphon / Back Pressure Valve and additional ball valve shall be added just prior to the trough wall penetration. The anti-siphon / back pressure valve shall be PVC and designed for use with chlorine systems. The valve shall be a LMI #35856, Walchem E90422, or engineer approved equivalent. The valve shall be installed between the two ball valves to allow for isolation during servicing. The valve shall be located above the high water level in the trough. The Contractor shall install a 1" drain line from the relief port to the finished floor elevation of the pipe gallery.

door sweeps not fail FAIL

window to Read Cl2 & stuff

3. High Service Pump
   a. The new 16" pump control ball valve for HSP #1 replaces the existing pump control ball valve in kind and will operate in the same manner as the existing valve. The valve will act like a check valve upon emergency shutdown of the pump through the use of a hydraulic cylinder actuator that will automatically close the valve. The cylinder actuator uses hydraulic water system pressure to supply the energy required to close the valve.
   b. The existing HSP #1 is rated for 25 MGD at 185' TDH. The proposed replacement HSP #1 is rated for 15 MGD at 185' TDH, matching the head condition of the existing pump.
   c. Results from the City's hydraulic model were used to develop system curves for max day and average day, which were used to confirm pump selection. The proposed HSP #1 will operate on a VFD which can be adjusted during operation to meet various duty points depending on demand.

4. LOX/LIN Storage
   a. Nitrogen usage is calculated based on 2.5 % of the oxygen usage:

      2,833 ppd O_2 x 0.025 = 71 ppd N_2

5. Electrical Improvements
   a. The operation of the pumps is contained within a single switchgear at Pump Station No. 4. However, there will be a dual feed coming into the main plant switchgear that will supply redundant power to the plant, including Pump Station No. 4. There will also be two breakers

at the main plant switchgear that feed two different breakers at Pump Station No. 4. Therefore, any one point of failure will not take the system down.

Proposed Bray Road Lime Sludge Management Plan

1. Introduction

The City of Flint plans to utilize their existing WTP to provide water on a continuous basis. The city plans to treat water from the Flint River until construction of the proposed KWA supply system is complete and the WTP can then be used to treat water from Lake Huron. Until then, The City of Flint will be utilizing the Bray Road Disposal site to pump lime sludge for interim storage with decant water being pumped into the City of Flint sanitary sewer system. The Flint River and consequently the Bray Road facility will be utilized during the KWA Supply System era for emergencies or to supplement water supply demands beyond current max day provided by KWA.

2. Proposed Lime Sludge Management Plan

LAN has been working with the City to evaluate, design and implement a lime residuals disposal plan to handle softening sludge for the interim period and long term operation of using the Flint River as a water source. The most feasible option is the use of Bray Road lagoon which was constructed in 1958. The site has been used intermittently since then during select test runs by the City. However, a concern by the MDEQ about unauthorized discharges into the neighboring stream and disposal of street sweeping, concrete and asphalt chunks has made this site off limits for the time being. Our team is working with City staff to develop a preliminary work plan and schedule that will address the concerns of the MDEQ and allow the use of the site for continued discharges of lime sludge in the interim basis and in the long run when emergencies and supplemental water supply require the use of lime softening at the water treatment plant.

EXISTING SYSTEM

The most common sludge dewatering method is use of lagoons to settle the lime sludge and decant the water. The lime sludge from the water treatment clarifiers is transferred by pipe to a dewatering lagoon, e.g. at the Bray road site. The pipe network for the discharge line into the Bray Road site consists of an 8 " pipe with multiple discharge feeders with valves that distributes the flow of the lime sludge into the dewatering lagoon. This facility has one large dewatering lagoon and one small lagoon for decant water. The two are separated by a dike and a concrete structure with an adjustable stop log system that controls the flows between the two lagoons. The large dewatering lagoon is capable of decanting the water on top of the sludge (supernatant) to the adjacent small lagoon for discharge to the nearby Cornwell Drain via an outlet tower. See Figure 1 - Existing Site Layout. Figure 2 – Decant Lagoon Blow Up.

The site was constructed in the late 1950s and was used on a permanent basis until the City entered into a contract to obtain treated water from the City of Detroit, at which time; the site was used occasionally for test runs as a redundant system. During this period, the City of Flint did not control fully site activities and some unauthorized discharges of illegal debris got placed within the site that has compromised the use of the site. As a result, The MDEQ has, on multiple occasions, requested that the City secure the site and insures that these activities are suspended while addressing the illegal disposal of street sweeping, concrete and asphalt debris within the site. See Figure 3.

PROPOSED SYSTEM

The proposed upgrades associated with the Softening Residuals Disposal have been categorized into Phase II – Segment II and are to be completed as soon as practical so that the WTP can be utilized to treat water from the Flint River in the spring of 2014. However, the use of the Bray Road lagoon for other disposal activities will require that this issue be addressed independently to certain extent as to isolate the problem areas while working with MDEQ to permit its use for lime sludge disposal.

In order to analyze the issues, define the possibility of using the site and address MDEQ concerns, the LAN Team has performed additional survey, geotechnical and environmental testing at the site in order to assess the condition of the lime sludge in the basin and to verify the capacity of the lagoon system. Based on the preliminary findings of this evaluation, proposed improvements will be designed to accommodate the use of the facility in the interim basis (during the use of the Flint river) while addressing some of the MDEQ concerns about the site and any unauthorized discharges into the nearby stream. Permitting for site use will be incorporated as part of the overall design improvements at the WTP and submitted to the MDEQ for their pre-permit review and comments. A final package will be submitted to the MDEQ at the 100% design stage for permit issuance and approval of work plan.

The intended Work plan encompasses the following action items:

1. Evaluate the existing conditions in comparison to the original site design and its intended functionality in order to evaluate required design changes. Figures 1 & 2 highlight the original design and select key elements while Figure 3 shows the changes that may affect proper operation of the system.
2. Site survey of the project site has been completed. Collected data confirms the plan that the site has the required capacity to handle the continuous full time operation of the plant during the next 30 to 36 months until the KWA system is constructed and connection is made at which time, lime softening will not be required. Figure 4 highlights the current

site features and proposed elevation for the required volume and anticipated 2 feet free board.

3. In order to address MDEQ concerns about discharges to the Cornwell Drain, the outlet tower will be capped to terminate any discharges to the stream while lime softening is in use at the WTP.
4. A separation barrier will be constructed to isolate the disposal area from the lime sludge discharge bay as shown in Figure 4.
5. A decant structure and submersible pump station will be constructed in the SE corner of the upper lagoon bay to treat and dispose of flows into the City's sanitary system. This system will be fully operational while the plant is treating river water and lime softening is required. A new storm treatment outlet structure may be reestablished with the approval of MDEQ after the KWA connection is online and lime softening is no longer in use.
6. In order to assess the potential impact of the disposal site on the ground water, two new monitoring wells were installed along the west side of the site in order to analyze the characteristics of the flow entering the site while using the existing monitoring wells to check whether these characteristics have worsened or not. Based on the results of the well data collected, it does not seem that the debris area is a cause for contamination to the site; However, The City will have to develop a more definitive environmental work plan to further evaluate and insure that the debris will not cause any detrimental effect on the groundwater system.

PROPOSED MANAGEMENT PLAN

Drying and selling lime sludge for agricultural lime is a desirable solution to the disposal problem, since the money made by the sale offsets the disposal cost paid by the water treatment plant: if the lime sludge were not sold as a product, no value for the material could be recovered. However, The City of Flint has not had the time to research this option and find a suitable consumer(s) for such a transaction. But this option will be pursued and the plan will be modified for approval by the MDEQ when such option becomes viable.

Lime sludge could be disposed of in municipal solid waste (MSW) landfills. However, it is Safe to assume that MSW landfills would prefer stockpiled lime sludge to be somewhat dry, because landfills need to minimize the amount of leachate they generate. Furthermore, if lime sludge were sent to a MSW landfill, the producer of the sludge may have to pay for the costs of drying, loading, and transporting the sludge, plus tipping fees.

Since the sludge may need to be retained in the lagoon for an average 10 -12 months before it is excavated from the dewatering lagoon with a backhoe and isolated to be dried in the sun during the summer in a month or two depending on air temperature, sun exposure, and humidity. Therefore The City of Flint is proposing the following approach to their lime sludge management plan:

1. The City is committed to removing all new lime sludge to be generated during the operation of the plant using Flint River water in addition to 10% of the lime sludge already in place at the site.
2. The equivalent of 10% of existing lime sludge and all future accumulations will be disposed of site either at the landfill or using approved land application sites.
3. Existing lime sludge on site will be manipulated and stored in two semi isolated bays along the north side of the lagoon in order to allow the City to start removing it from site for disposal at the landfill until land application sites are determined and approved by MDEQ.
4. The four available orifices, on site, will be utilized to discharge lime sludge into the lagoon system based on a quarterly or semi-annual rotating schedule as to allow for proper distribution of the lime sludge within the lagoon.
5. No flows will be permitted into the decant lagoon until the pump station is fully operational. However, the plan is to maintain the level working surface within the sludge lagoon at 738.5' while the pump station and decant system is operational.

3. Implementation Schedule

The majority of the work associated with the operation of the WTP will need to be accomplished and completed by April 15, 2014 so the plant can be operational by April 17, 2014. All work associated with the Bray road site may not be complete but the following activities will be completed in order to allow for the successful operation of the Plant with MDEQ approval. The activities to be completed immediately are as follows:

1. Suitable Barrier of clay berm will be constructed to isolate the disposal area from the dewatering lagoon and will be completed as agreed to with MDEQ.
2. Outlet Tower will be bulk headed out of the decant lagoon as to insure no outflow to the stream nearby (Cornwell Drain).
3. New orifice will be installed near the SE corner of the site to replace the two damaged that will be abandoned.
4. Stop logs will be in place to isolate the dewatering lagoon from the decant lagoon until the pump station is operational.
5. Existing lime sludge will be manipulated along the edges as to excavate and store dry lime sludge in the upper two semi isolated bays for regular removal and disposal at the landfill until land application options are available for permitted use.

The City is committed to provide the appropriate improvements for the proper use of the site as a lime sludge disposal facility while addressing the issues associated with the unauthorized disposal areas so the site can be closed suitably and allow it to function as initially intended.

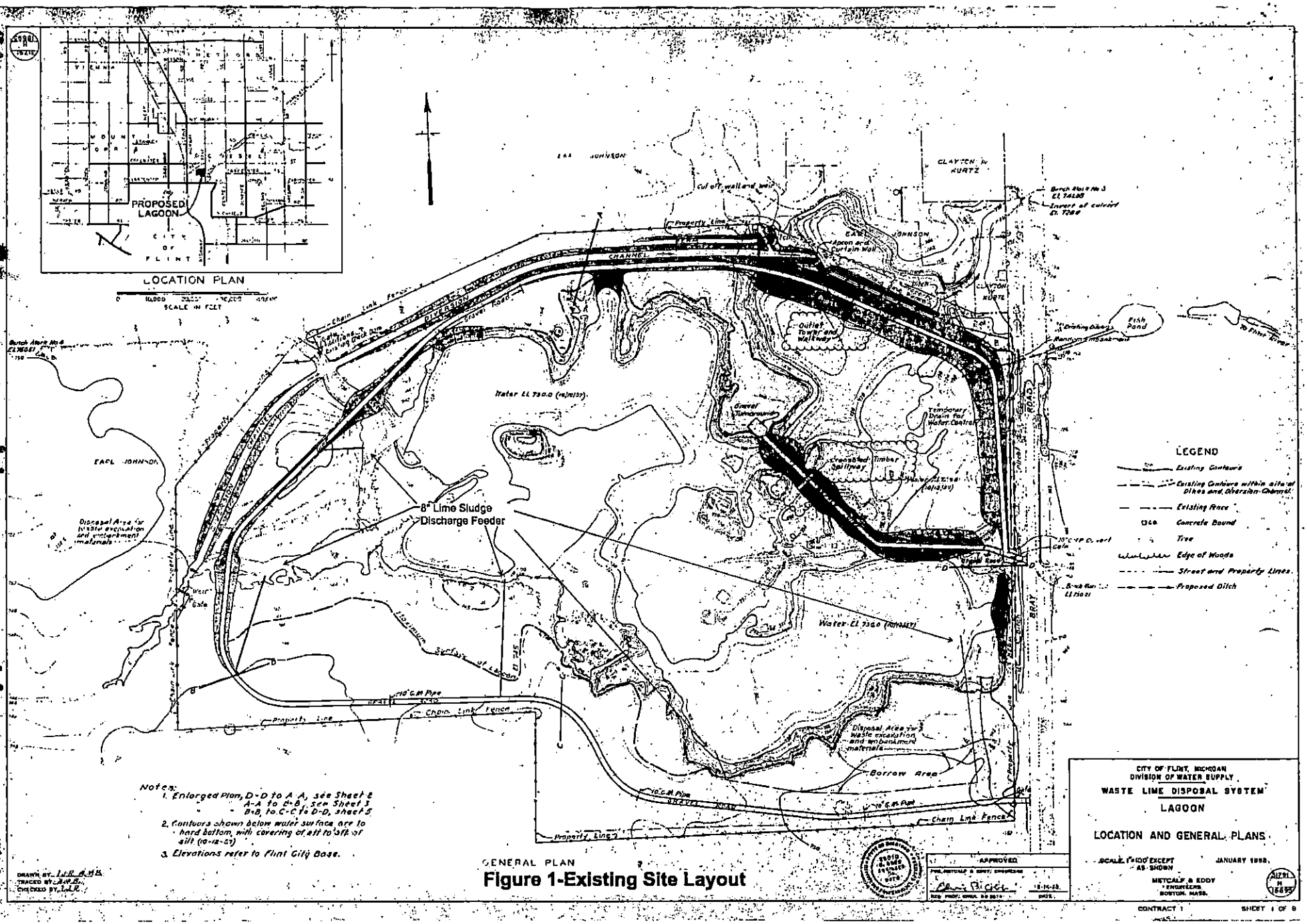


Figure 1-Existing Site Layout

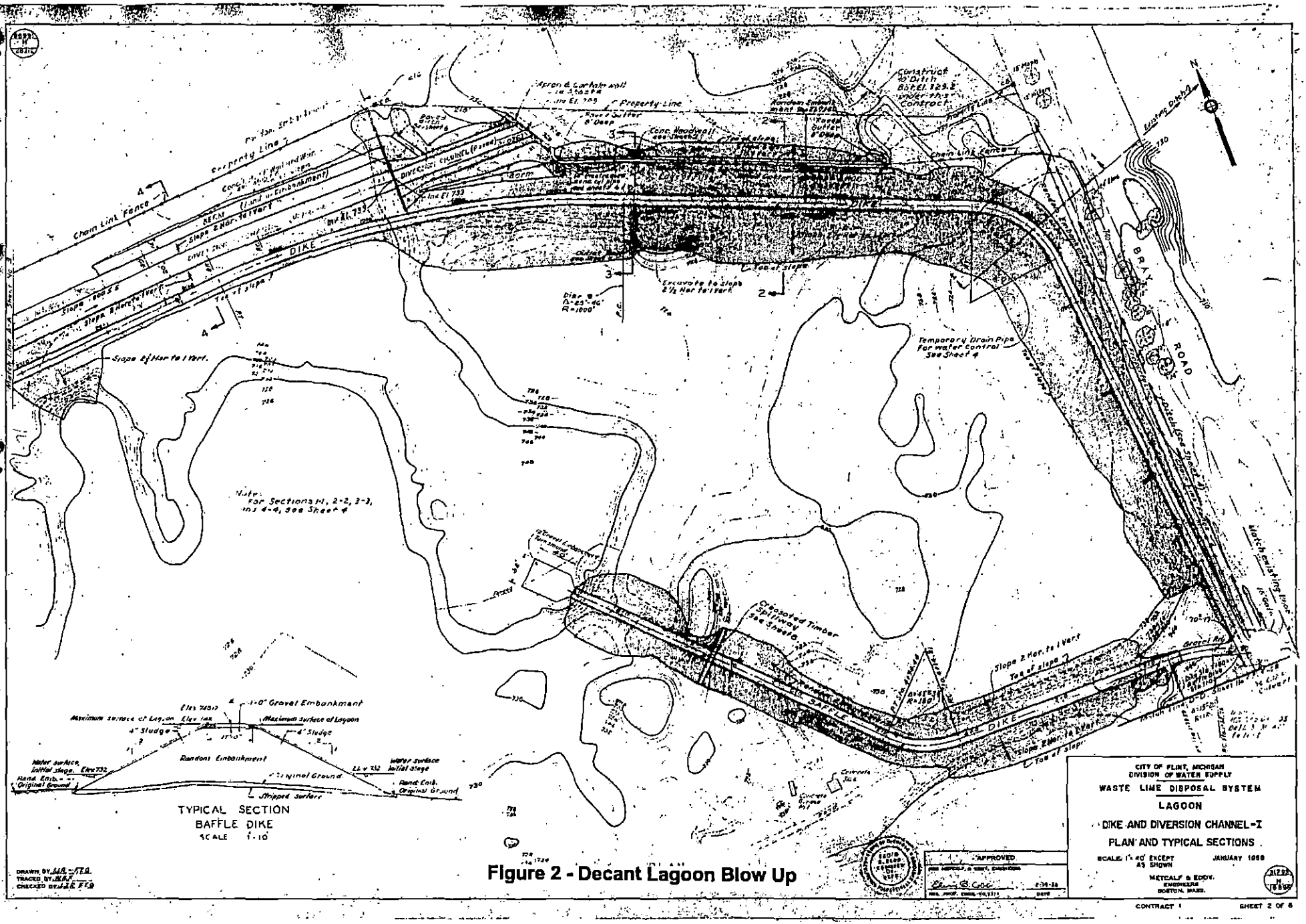


Figure 2 - Decant Lagoon Blow Up

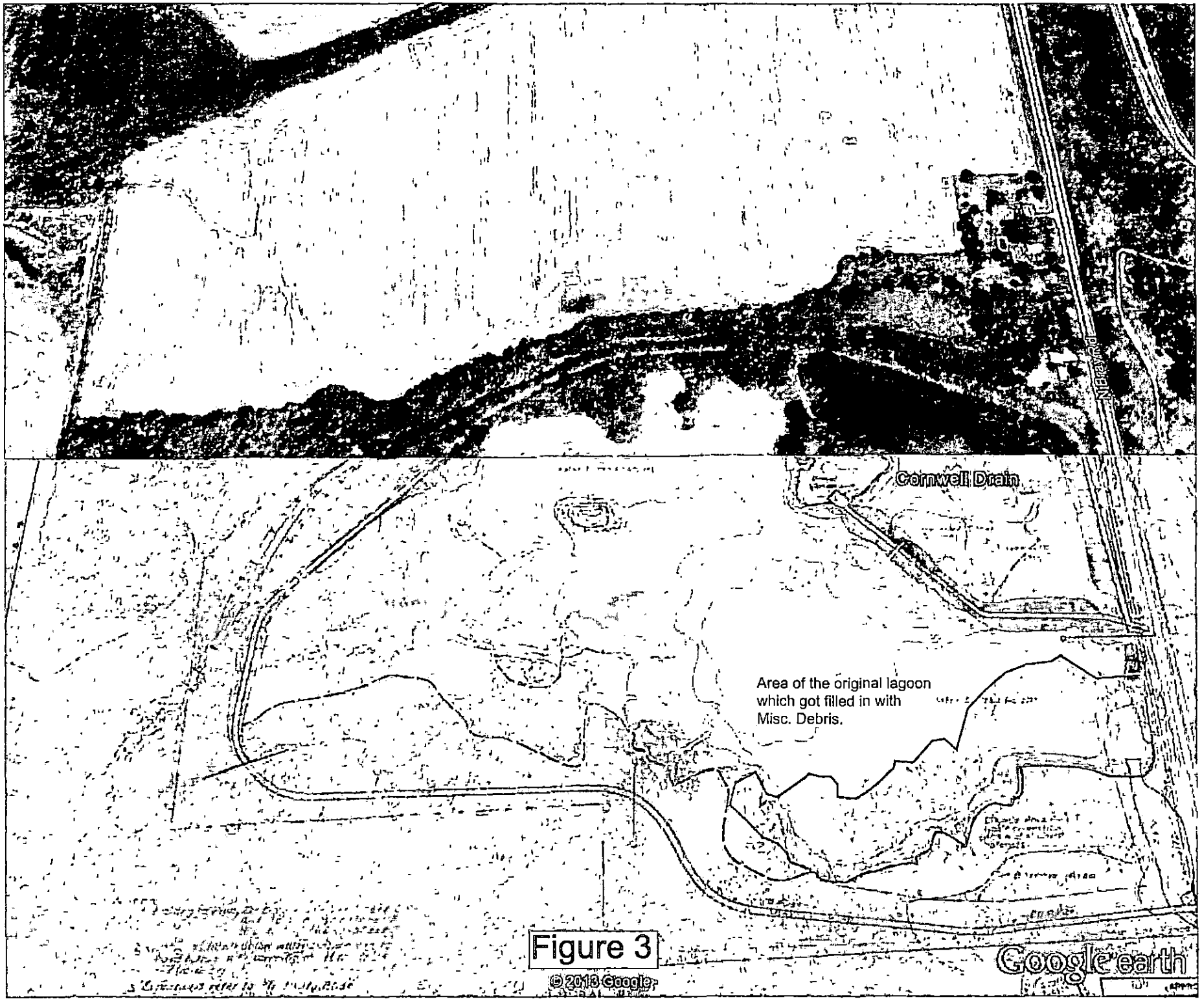
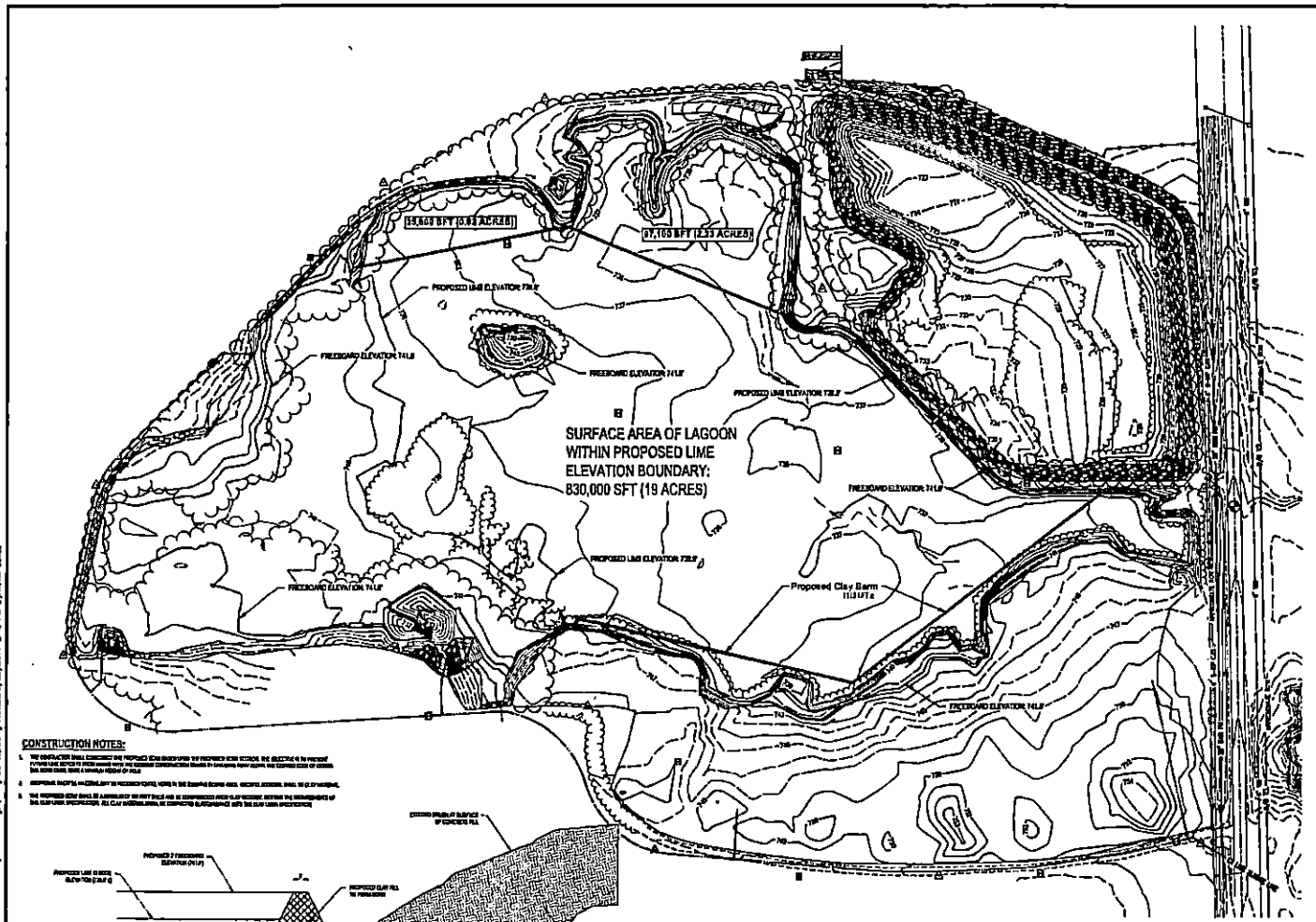

Cornwell Drain
Area of the original lagoon which got filled in with Misc. Debris.
© 2013 Google
Google earth

Figure 3



1 PROPOSED BERM SECTION

Figure 4

Flint WTP
Phase II, Segment II
Lime Residual Disposal
Flint MI, 48505

Lockwood, Andrews & Newnam, Inc.
A LAN A RAIN COMPANY
1311 South Linden Road, Suite B
Flint, MI 48532
Tel 810-820-2582 Fax 810-820-2703

ROWE PROFESSIONAL SERVICES COMPANY

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

Project No. 130-10701-001
Date: February 26, 2014

Prysby, Mike (DEQ)

From:	Matta, Samir <SFMatta@lan-inc.com>
Sent:	Wednesday, March 26, 2014 2:22 PM
To:	Prysby, Mike (DEQ); Busch, Stephen (DEQ); Arduin, Jim (DEQ)
Cc:	Daugherty Johnson; Brent Wright (bwright@cityofflint.com)
Subject:	Bray Road Alternative Separation Concepts.
Attachments:	Piling Concept 3-24-14 (2).pdf - Adobe Acrobat.pdf; MC-3500 Chamber from ADS StormTech System.pdf

Hi All,

As requested, the following two concepts are being discussed with the City and ultimately with the contractor to see which one is more in line with the project budget and can be accomplished in a timely matter. The attached concept shows sheet piling being proposed which will be terminated at the designated height needed to achieve a 2' freeboard along the alignment highlighted in RED.

The other concept which we discussed on the phone will entail using a light weight storm chamber (see attachment) fastened to a 4x8 plywood sheeting, attached together, with a geotextile fabric along the back side to follow the same alignment as the sheet piling option. It will be placed directly on the existing lime sludge in front of the disposal area for separation.

Please review, let me know if you have any questions and we can further discuss on Monday.

Thanks.

Samir F. Matta, PE
Senior Project Manager

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
2121 University Park Dr, Suite 100 • Okemos, MI 48864-6901
T 517.203.5437 **D** 517.203.5437 **C** 517.819.2367
www.lan-inc.com • SFMatta@lan-inc.com

Flint WTP Improvements
Bray Road Lime Sludge Lagoon
MDEQ Comments
March 21, 2014

1. The placement of the proposed liner and berm fails to establish physical separation between the lime sludge collection area and concrete fill area. For complete separation of these areas, the berm needs to be constructed down to native soil.

   As proposed, this appears to constitute the first step towards a "cap-in-place" of the existing materials. If waste is left in place within the berm, the city will be required to construct the berm to meet Part 115 cap requirements. In addition, long term groundwater monitoring, financial assurance, closure and post closure plans will be required.

2. Please provide a residuals management plan for the lime sludge collection area. In additional to removal of new lime sludge produced, the plan must also include the gradual removal of existing lime sludge.

3. The working depth of the lime sludge collection area does not appear to meet 10-States Standard's minimum depth of 5 feet. The available volume appears to be 60,000 cubic yards based on 2.6 feet of working depth. Please confirm this. What is the surface area of the lagoon? Please provide a basis of design that includes the amount of lime sludge produced at average day demand and the available days of storage at this production rate. These parameters will need to be used towards developing the residuals management plan. Finally, an acceptable residuals management plan is needed for us to consider a deviation from the 10-State Standards guidelines.

4. An effluent sampling point needs to be provided for decant water.

Total Hardness 292 mg/l use 300 mg/l as $CaCO_3$ 9/13/13 LAN Report

Iron: 100 mg/l as $CaCO_3$

250 mg/l removed

10 stalos .7 Acres/1 MGAL/100 mg/l removed

Size:

.7A * 10 MGD * 200 mg/l removed / 100 = 14A

Based on 5 Ft depth

we have 2.6 Ft depth — 19 A

SA = 830,000 Ft^2 = 19A

Rem 150 mg/l

.7A * 10 MGD * 150/100 =

LAN Report

@ 14 MGD

@ 12% solids → 73,924 gpd = 366 yd^3/day

@ 25% → 183 yd^3/day

25% @ 10 mgd → 131 yd^3/day

12 mgd → 157 yd^3/day

60000 yd^3 / 131 yd^3/day = 458 days @ 10 MGD 1.25 yrs

382 DAY @ 12 MGD 1 YR

3 Months = 50,000 yd^3 3% wet drying

@ 10 MGD

455 yd^3

@ 10 MGD 60,000 yd^3 / 55 yd^3/DAY = 1091 DAYS 3.0 yrs

@ 12 MGD 60,000 yd^3 / 66 yd^3/DAY = 909 DAYS 2.5 yrs

BASIS OF DESIGN
BRAY ROAD LIME SLUDGE DECANT WATER TREATMENT SYSTEM
CITY OF FLINT

1. GENERAL DATA

The City of Flint (City) proposes to use the existing lime sludge storage lagoon facility at Bray Road for the next 2.5 years on a continuous basis while the Karegnondi Water Authority (KWA) water system is being constructed. After which, the facility will only be used should the Flint WTP have to treat Flint River water on an emergency basis. In order to maximize storage volume of the facility, the City proposes to construct a decant tower structure, pump station and forcemain to transport the decanted water from the lagoon to a nearby sanitary sewer for final disposal. A CO_2 feed system is also proposed to neutralize the high pH decant waste stream prior to pumping to the sanitary sewer.

The existing lime sludge storage lagoon facility at Bray Road does not have multiple cells; therefore, the sludge will be continuously wetted and will only consolidate to approximately 25% solids. The lime sludge and decant waste stream flows are summarized in the table below:

Lime Sludge Quantities Summary

	WTP Flow [MGD]	Sludge Produced (3% Solids) [gpd]	Sludge Stored (25% Solids) [cy/day]	Decant Waste to Sewer [gpd]	Decant Waste to Sewer [gpm]
Average Day	10 @ 10 MGD	92,000	55 @ 66 yd³/DAY	80,700	56
Current Max Day	18	165,000	98	145,200	100
Prop. Max Day	24	220,000	131	193,600	135

2. CO_2 FEED SYSTEM

a. Process Description

A gaseous carbon dioxide feed system will be installed on the Bray Road site near the decant pump station. The system will include a liquid storage tank, vaporizer, vapor heater, pressure regulator, pH control panel and a gas diffuser. Liquid CO_2 will be stored in a 6-ton tank and regulated through a vaporizer. The gaseous CO_2 will be sent through diffuser piping and released into the decant tower through two (2) 7" diameter disk ceramic diffusers. A pH probe will be located in the decant tower to monitor pH downstream of the CO_2 injection point. The pH probe will transmit the pH reading to the pH control panel, which will regulate the CO_2 feed rate for set point control of the pH in the decant water waste stream.

b. Design Criteria

- Max CO_2 feed – 200 mg/L
- Max decant flow rate – 140 gpm

- CO_2 feed system capacity @ Max Day (140 gpm)

$$\frac{140gpm}{694.4\frac{gpm}{MGD}} * 200ppm\ CO_2 * \frac{8.34lb}{gal} = 336\ lb/day$$

- CO_2 feed system capacity @ Average Day (60 gpm)

$$\frac{60gpm}{694.4\frac{gpm}{MGD}} * 200ppm\ CO_2 * \frac{8.34lb}{gal} = 144\ lb/day$$

- CO_2 storage for minimum 30 days at Average Day per 10 States Standards

$$144\frac{lb}{day} * 30\ days = 4{,}320\ lbs = 2.16\ tons$$

c. Equipment

- One (1) 6 ton capacity Liquid Carbon Dioxide storage tank system complete with refrigeration unit (6 ton is minimum for CO_2 delivery by tanker truck)
- One (1) 12 kW electric vaporizer
- One (1) vapor heater
- One (1) First stage CO_2 pressure regulator
- One (1) Carbon Dioxide pH control panel
- One (1) Carbon Dioxide gas diffuser assembly
- One (1) pH Transducer
- Two (2) 7" Diameter Ceramic Disk-type diffusers

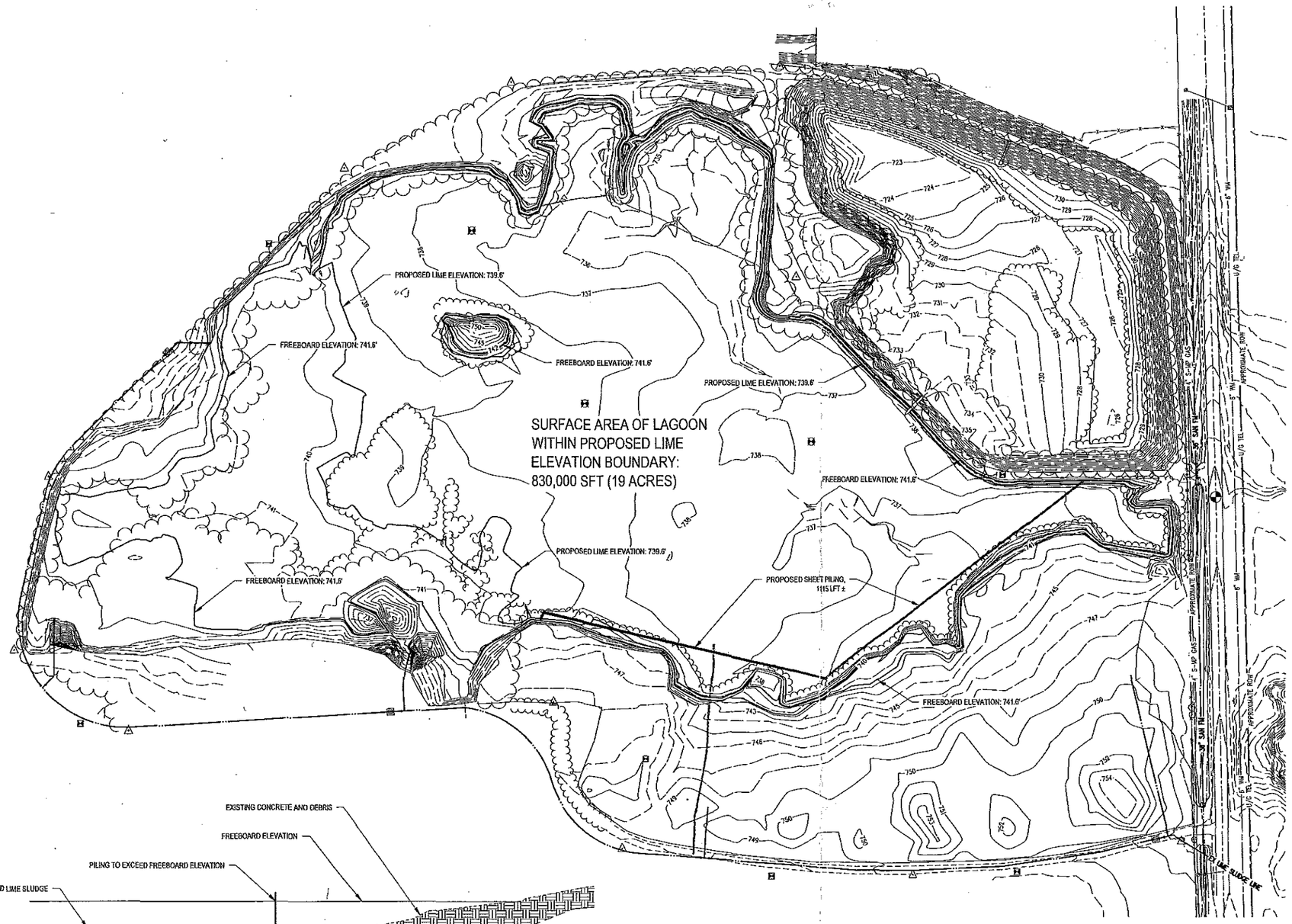
3. DECANT TOWER

a. Process Description

The decant tower is a 6'x6' precast manhole with three (3) 12"W x 36"H staggered openings that will provide 9' of total operating depth for decanting. Each opening has an interior wall-mounted inverted slide gate with a manual operator and an external stoplog channel to allow maintenance on the slide gate when necessary. An under-flow baffle wall will be installed to promote CO_2 transfer into the decant waste stream and prevent short circuiting. A pH probe will be installed just below the invert of the 8" gravity pipe to the decant pump station.

b. Design Criteria

- Average day flow rate = 60 gpm
- Peak day flow rate = 140 gpm



Flint WTP
Phase II, Segment II
Lime Residual Disposal
Flint MI, 48505

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
PLANNING
ENGINEERING
PROGRAM MANAGEMENT
1311 South Linden Road, Suite B
Flint, MI 48532
Tel 810-820-2682 Fax 810-820-2703

ROWE PROFESSIONAL SERVICES COMPANY
The Rowe Building
540 S. Saginaw St., Ste. 200;
PO Box 3748
Flint, MI 48502
O: (810) 341-7500
F: (810) 341-7573
www.roweps.com

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

Manager	SFM
Design	SFM
Draw	KPJ
Check	DAS

STAMP

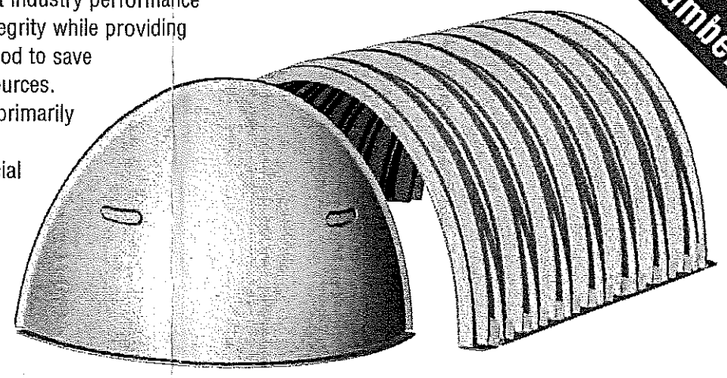
Project No. 130-10701-001
Date: February 28, 2014

ProjectWise: PW:\\LADPW.LADCO.INT:PROJECTWISE\DOCUMENTS\PROJECTS\130-10701-001\4-O-PRODUCTION\4-01-DRAWINGS\
Files:R:\Projects\13C0111\dwg\Construction Drawings\Bray Road Lime Lagoon Drawings\Piling Concept.dwg Plotted:3/25/2014 2:49 PM By:Kevin Jones

StormTech MC-3500 Chamber

MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.



StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90" (2286 mm) x 77" (1956 mm) x 45" (1143 mm)
Chamber Storage	109.9 ft³ (3.11 m³)
Min. Installed Storage*	178.9 ft³ (5.06 m³)
Weight	134 lbs (60.8 kg)

* This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below chambers, 9" (229 mm) of stone between chambers/end caps and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

Size (L x W x H)	26.5" (673 mm) x 71" (1803 mm) x 45.1" (1145 mm)
End Cap Storage	15.6 ft³ (0.44 m³)
Min. Installed Storage*	46.9 ft³ (1.33 m³)
Weight	43 lbs (19.5 kg)

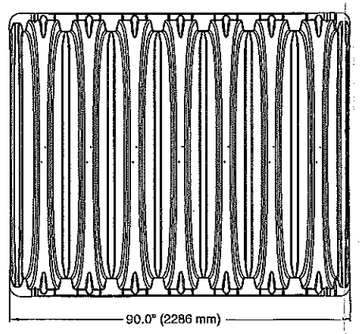
*This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below, 6" (152 mm) of stone perimeter, 9" (229 mm) of stone between chambers/end caps and 40% stone porosity.

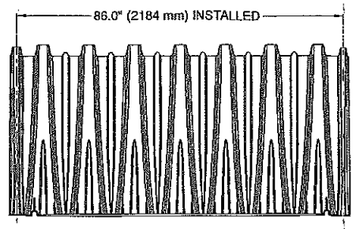
Shipping

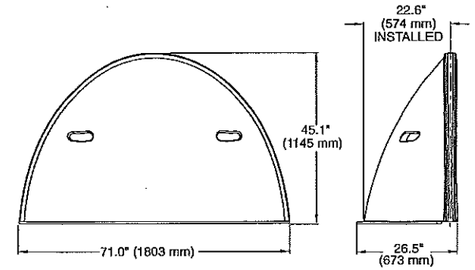
15 chambers/pallet

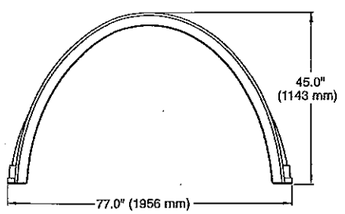
16 end caps/pallet

7 pallets/truck









231C

IIGAN DEPARTMENT OF ENVIRONMENTAL QUA

PERMIT APPLICATION FOR WATER SUPPLY SYSTEMS

(CONSTRUCTION - ALTERATION - ADDITION OR IMPROVEMENT) AS DESCRIBED HEREIN

Required under the Authority of 1976 PA 399, as amended

This application becomes an Act 399 Permit only when signed and issued by authorized Michigan Department of Environmental Quality (DEQ) Staff. See instructions below for completion of this application.

1. Municipality or Organization, Address and WSSN that will own or control the water facilities to be constructed. This permit is to be issued to:

City of Flint
4500 North Dort Highway
Flint, MI 48505

WSSN: 02310

2. Owner's Contact Person (provide name for questions):

Contact: Brent Wright
Title: Plant Supervisor
Phone: 810-787-6537

Permit Stamp Area (DEQ use only)

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT NO. W 140025 APR 09 2014

EXAMINED AND APPROVED FOR COMPLIANCE WITH ACT 399, P.A. 1976

3. Project Name (Provide phase number if project is segmented):

1) Flint WTP Phase II, Sement I - Initial Watermain Cut-In / Rehabilitation; 2) Flint WTP Phase II, Segment II - Lime Residual Disposal; 3) Flint WTP Phase II, Segment III - Electrical Improvements

4. Project Location (City, Village, Township):
City of Flint

5. County (location of project):
Genesee County

ISSUED UNDER THE AUTHORITY OF THE DIRECTOR OF THE DEPARTMENT OF ENVIRONMENT QUALITY

cc:

Issued by: _____

Reviewed by: Robert Cook for MFP
for Mike Prysby

☐ **If this box is marked see attached special conditions.**

Instructions: Complete items 1 through 5 above and 6 through 21 on the following pages of this application. Print or type all information except for signatures. Mail completed application, plans and specifications, and any attachments to the DEQ District Office having jurisdiction in the area of the proposed construction.

Please Note:

a. This **PERMIT** only authorizes the construction, alteration, addition or improvement of the water system described herein and is issued solely under the authority of 1976 PA 399, as amended.
b. The issuance of this **PERMIT** does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other DEQ permits, or approvals from other units of government as may be required by law.
c. This **PERMIT** expires two (2) years after the date of issuance in accordance with R 325.11306, 1976 PA 399, administrative rules, unless construction has been initiated prior to expiration.
d. Noncompliance with the conditions of this permit and the requirements of the Act constitutes a violation of the Act.
e. Applicant must give notice to public utilities in accordance with 1974 PA 53; (MISS DIG), being Section 460.701 to 460.718 of the Michigan Compiled Laws, and comply with each of the requirements of that Act.
f. All earth changing activities must be conducted in accordance with the requirements of the Soil Erosion and Sedimentation Control Act, Part 91, 1994 PA 451, as amended.
g. All construction activity impacting wetlands must be conducted in accordance with the Wetland Protection Act, Part 303, 1994 PA 451, as amended.
h. Intentionally providing false information in this application constitutes fraud which is punishable by fine and/or imprisonment.
i. Where applicable for water withdrawals, the issuance of this permit indicates compliance with the requirements of Part 327 of Act 451, Great Lakes Preservation Act.

6. **Facilities Description** – In the space below provide a detailed description of the proposed project. Applications without adequate facilities descriptions **will be returned.** SEE EXAMPLES BELOW. Use additional sheets if needed.

Improvements to the City of Flint WTP to enable treatment of Flint River water on an interim basis until the KWA Lake Huron Water Supply is available for connection and use by the City of Flint:

PHASE II, SEGMENT I - INITIAL WATERMAIN CUT-IN / REHABILITATION (@WTP):
* Replace existing 25 MGD HSP #1 at Pump Station No. 4 with a new 700 HP, vertically mounted, split-case centrifugal pump rated for 15 MGD at 185' TDH. New pump suction and discharge piping, valves and supports will also be provided.
* Construction of new ozone system LOX/LIN storage facility to provide system redundancy and a minimum of 30 days chemical storage. A new concrete containment structure will be constructed adjacent to the existing LOX/LIN storage facility. The new LOX and LIN tanks will have nominal capacities of 9000 gal. and 525 gal., respectively.
* Installation of Midpoint Chlorination. A 3"x6" dual walled chlorine solution line, approx. 665 LF, will be installed from the existing chlorine room at Pump Station No. 4 to a diffuser in the filter influent channel at Plant 2. The chlorine gas feed system shall consist of four 500 ppd feed systems (total 2000 ppd) to be installed by City personnel. Each 500 ppd system consists of a ton cylinder mounted vacuum regulator, control panel, ejector, and misc. piping, tubing & valves.
* Approx. 850 LF 42" raw watermain connection from existing 48" and 36" mains that feed the plant to convey KWA raw water to the Ozone Building. Work includes a 54x48 cross to make the initial connection at the Ozone Building, buried yard butterfly valves, access and air release manholes, and cathodic protection test stations.

PHASE II, SEGMENT III - ELECTRICAL IMPROVEMENTS (@WTP):
* Plant substation improvements, including two new 2500 kW transformers and switchgear. The substation switchgear has been fabricated with two utility main breakers, one generator breaker and two tie breakers. So provisions are in place for a future permanent generator. If a temporary generator is needed in the event of an outage to both independent utility services, provisions are in place to temporary cable a large portable generator through a manhole, duct bank and cable tray system to the generator breaker in the substation switchgear
* Plant 2 electrical improvements, including two new 500 kW transformers and switchgear.
* Pump Station No. 4 improvements, including new switchgear and VFD for HSP #1.

EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES	
Water Mains	500 feet of 8-inch water main in First Street from Main Street north to State Street. OR 250 feet of 12-inch water main in Clark Road from an existing 8-inch main in Third Avenue north to a hydrant.
Booster Stations	A booster station located at the southwest corner of Third Avenue and Main Street, and equipped with two, 15 Hp pumps each rated 150 gpm @ 200 feet TDH. Station includes backup power and all other equipment as required for proper operation.
Elevated Storage Tank	A 300,000 gallon elevated storage tank located in City Park. The proposed tank shall be spherical, all welded construction and supported on a single pedestal. The tank shall be 150 feet in height, 40 feet in diameter with a normal operating range of 130 – 145 feet. The interior coating system shall be ANSI/NSF Standard 61 approved or equivalent. The tank will be equipped with a cathodic protection system, and includes a tank level control system with telemetry.
Chemical Feed	A positive displacement chemical feed pump, rated at 24 gpd @ 110 psi to apply a chlorine solution for Well No. 1. Chlorine is 12.5% NaOCL, ANSI/NSF Standard 60 approved and will be applied at a rate of 1.0 mg/l of actual chlorine.
Water Supply Well	Well No. 3, a 200 foot deep well with 170 feet of 8-inch casing and 30 feet of 8-inch, 10 slot screen. The well will be equipped with a 20 Hp submersible pump and motor rated 200 gpm @ 225 feet TDH, set at 160 feet below land surface.
Treatment Facilities	A 5 million gpd water treatment plant located at the north end of Second Avenue. The facility will include 6 low service pumps, 2 rapid mix basins, 4 flocculation/sedimentation basins, 8 dual media filters, 3 million gallon water storage reservoir and 6 high service pumps. Also included are chemical feed pumps and related appurtenances for the addition of alum, fluoride, phosphate and chlorine.

General Project Information – Complete all boxes below.

7. Design engineer's name, engineering firm, address, phone number, and email address:	8. Indicate who will provide project construction inspection:
Jeremy N. Nakashima, PE Lockwood, Andrews & Newnam, Inc. 1 Oakbrook Terrace, Suite 207 Oakbrook Terrace, IL 60181 630-495-4123 / jnnakashima@lan-inc.com	☒Organization listed in Box 1. ☒Engineering firm listed in Box 7. ☐Other - name, address, and phone number listed below.

9. Is a basis of design attached?
☒YES ☐NO

If no, briefly explain why a basis of design is not needed. Submitted previously under separate cover.

10. Are sealed and signed engineering plans attached?
☒YES ☐NO

If no, briefly explain why engineering plans are not needed. Plans and specs submitted previously under separate cover.

11. Are sealed and signed construction specifications attached?
☒YES ☐NO

If specifications are not attached, they need to be on file at DEQ.

12. Were Recommended Standards for Water Works, Suggested Practice for Water Works, AWWA guidelines, and the requirements of Act 399 and its administrative rules followed?
☒YES ☐NO

If no, explain which deviations were made and why.

13. Are all coatings, chemical additives and construction materials ANSI/NSF or other adequate 3rd party approved?
☒YES ☐NO

If no, describe what coatings, additives or materials did not meet the applicable standard and why.

14. Are all water system facilities being installed in the public right-of-way or a dedicated utility easement? (For projects not located in the public right-of-way, utility easements must be shown on the plans.)
☐YES ☒NO

If no, explain how access will be obtained. Most work will be on City owned property, except forcemain.

15. Is the project construction activity within a wetland (as defined by Section 324.30301(d)) of Part 303, 1994 PA 451?
☐YES ☒NO

If yes, a wetland permit must be obtained.

16. Is the project construction activity within a 100-year floodplain (as defined by R 323.1311(e)) of Part 31, 1994 PA 451, administrative rules?
☐YES ☒NO

If yes, a flood plain permit must be obtained.

17. Is the project construction activity within 500 feet of a lake, reservoir, or stream?
☒YES ☐NO

If yes, a Soil and Erosion Control Permit must be obtained or indicate if the owner listed in box 2 of this application is an Authorized Public Agency (Section 10 of Part 91, 1994 PA 451) ☐ Owner is APA.

18. Will the proposed construction activity be part of a project involving the disturbance of five (5) or more acres of land?
☐YES ☒NO
If yes, is this activity regulated by the National Pollutant Discharge Elimination System storm water regulations?
☐YES: NPDES Authorization to discharge storm water from construction activities must be obtained.

☐NO: Describe why activity is not regulated:
Please call 517-241-8993 with questions regarding the applicability of the storm water regulations.

19. Is the project in or adjacent to a site of suspected or known soil or groundwater contamination?
☐YES ☒NO

If yes, attach a copy of a plan acceptable to the DEQ for handling contaminated soils and/or groundwater disturbed during construction. Contact the local DEQ district office for listings of Michigan sites of environmental contamination.

20. IF YOU ARE A CUSTOMER/WHOLESALE/BULK PURCHASER, COMPLETE THE FOLLOWING

1) Name and WSSN of source water supply system (seller) _____

2) Does the water service contract require water producer/seller to review and approve customer/wholesale/bulk purchaser water system construction plans?
☐YES ☐NO

If yes to #2, the producer/seller approval letter must be attached when submitted to DEQ.

21. **Owner's Certification** The owner of the proposed facilities or the owner's authorized representative shall complete the owner's certification. It is anticipated that the owner will either be a governmental agency (city, village, township, county, etc.) or a private owner (individual, company, association, etc.) of a Type I public water supply.

OWNER'S CERTIFICATION

I, BRENT F. WRIGHT (print) (name), acting as the WATER PLANT SUPERVISOR (print) (title/position) for

CITY OF FLINT (print) (entity owning proposed facilities) certify that this project has been reviewed and approved as detailed by the Plans and Specifications submitted under this application, and is in compliance with the requirements of 1976 PA 399, as amended, and its administrative rules.

Signature* 3-31-2014 Date (810)787-6537 Phone

*Original signature only, no photocopies will be accepted.

PROJECT BASIS OF DESIGN – FOR WATER MAIN PROJECTS

PROJECT NAME: _____

For this PROJECT the following information must be provided per Act 399 unless waived by the Department. For projects other than water main installation, or if additional space is needed, attach separate sheet(s) with detailed Basis of Design calculations.

A. A general map of the initial and ultimate service areas
☐ Included on engineering plans ☐ Attached separately

B. Number of service connections served by this permit application _____

C. Total number of service connections ultimately served by entire project _____

D. Residential Equivalent Units (REUs) served by this permit application _____

E. Total Residential Equivalent Units (REUs) ultimately served by entire project _____

F. Water flow rates for proposed project based on REUs listed in "D' and "E" above

1. Initial design average day flow (mgd) _____
2. Initial design maximum day flow (mgd) _____
3. Total design average day flow (mgd) _____
4. Total design maximum day flow (mgd) _____
5. Required fire flows: (1) _____ gpm for _____ hours

G. Actual flows and pressures of existing system at the connection point(s) (2)
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi

H. Estimated minimum flows and pressures within the proposed water main system (3) _____ gpm at _____ psi

(1) Every water system must decide what levels of fire fighting flows they wish to provide. Fire flow should be appropriate for the area (residential, commercial, industrial) being served by the project. Typical fire flow rates can be obtained from the water supply, local fire dept., ISO or AWWA. The water system must then be designed to be able to provide the required fire flows while maintaining at least 20 psi in all portions of the distribution system.

(2) Flows and pressures at the connection points must be given to determine if the existing water main(s) are able to deliver water to the new service area. These numbers can be obtained from a properly modeled and calibrated distribution system hydraulic analysis or hydrant flow tests performed in the field. If more than one connection is proposed, list as needed.

(3) List what the estimated minimum flows can be expected in the proposed water mains based on estimated water demands, head losses, elevation changes and other factors that may affect flows, such as dead end mains.

Lockwood, Andrews & Newnam, Inc.

PLANNING

ENGINEERING

PROGRAM MANAGEMENT

Est. 1935

AUSTIN, TX
CHICAGO, IL
CLEARWATER, FL
COLLEGE STATION, TX
DALLAS, TX
FLINT, MI
FORT WORTH, TX
HOUSTON, TX
HUNTINGTON BEACH, CA
LAS VEGAS, NV
LOS ANGELES, CA
MIAMI, FL
MILPITAS, CA
PHOENIX, AZ
SACRAMENTO, CA
SAN ANTONIO, TX
SAN MARCOS, TX
WACO, TX

TRANSMITTAL

Filing Data Code 1-07

☐ UPS ☐ FEDEX ☒ DELIVERY SERVICE ☐ HAND DELIVER ☐ OVERNIGHT ☐ REGULAR MAIL ☐ PICK-UP ☐ OTHER Extranet(To PM)

To: Mr. Steve Busch, PE	**Date** 4-8-14
	Project Number 130-10701-001
Company: MDEQ	**Routing:**
Address: 525 WEST ALLEGAN STREET Lansing, MI 48933	
Project: City of Flint Water Treatment Plant Improvements.	

We Are Sending You:		These Are Transmitted:
☐ Shop Drawings	☐ Reports	☐ As Requested
☐ Original Drawings	☐ Submittal Data	☒ For Your Use
☒ Prints	☐ Proposal	☒ For Review and Comment
☐ Specifications	☐ As Noted	☐ For Your Signature

Quantity	Description
2	22x34 Plans - Phase II, Segment 1 – Rehabilitation
2	22x34 Plans - Phase II, Segment 1 – Initial Watermain Cut-In
2	22x34 Plans - Phase II, Segment II – Lime Residual Disposal
2	Final Bray Road Lime sludge management Plan
1	Updated page 2 for permit applications
1	LAN Team Response to MDEQ Review comments

Remarks

These plans are being submitted for permit issuance as discussed.

DEQ
RESOURCE MANAGEMENT DIVISION
APR 08 2014
LANSING DISTRICT

Distribution	Prepared By
1- Daugherty Johnson 2- Brent Wright 3- File	Samir Matta, PE

1311 SOUTH LINDEN ROAD
SUITE B
FLINT, MI 48532
TEL 810.820.2682
FAX 810.820.2703
www.lan-inc.com

If enclosures are not as noted, kindly notify us at once.

Flint WTP Improvements – Phase II, Segments I, II, and III
Responses to MDEQ Review Comments dated 4-3-2014

The MDEQ review comments dated 4-3-14 have been addressed as noted in the responses below. Revised drawings have also been prepared in conjunction with these responses and have been included in the attached revised drawing sets for Phase II, Segments I, II, and III.

Phase II – Segment 1 - Watermain Cut-in Plans

- **Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.**

  Response: The anti-siphon/ball valve is shown on revised Sheet C-104, dated 4-7-14.

- **Include a full-sized mid-point chlorination system schematic with the updated plans.**

  Response: The mid-point chlorination system schematic has been included in the Phase II, Segment I – Initial Watermain Cut-in drawings as Sheet C-509, dated 4-7-14.

- **It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.**

  Response: The above description of the midpoint chlorination system is essentially correct. As shown on Sheet C-509, the mid-point chlorination system is a vacuum system. The vacuum regulators are mounted directly to the chlorine storage cylinders. Vacuum lines run from the regulators to the chlorinator control panels where feed rate is controlled. Vacuum lines are then connected from the control panel to ejectors, where water supply flowing through the ejectors creates the vacuum required to pull gas from the storage tanks. While the ejectors are not located in the control panel, it is common to have the ejectors remotely mounted from the control panels. A review of the 10 State Standards requirement for Schedule 80 seamless steel tubing appears to be for pressure gas feed systems, and not vacuum gas feed systems as proposed for Flint. As such, the recommended vacuum line material for a 500

ppd system is 5/8" O.D. flexible polyethylene plastic tubing (see attached information from Hydro Instruments).

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- **LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.**

  Response: Revised drawings D2-101, D2-102, D2-301, D2-502, and D2-601 have been included in the updated plan set.

- **The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days storage is maintained in the LOX tank at all times.**

  Response: The City will provide MDEQ a copy of the contract between the City and their LOX supplier under separate cover. LOX can be supplied within 24 hours of when a purchase order is issued.

- **Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.**

  Response: Sheets C5-105, C5-508, and EP6-101, which are all specific to the chlorine scrubber work only, have been deleted in their entirety from the updated plan set.

- **Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.**

  Response: This intake duct detail is no longer applicable as it is for the chlorine scrubber system, which has been deleted. As noted in the previous MDEQ review comment responses, the City will extend the existing ventilation intake ductwork in the existing Chlorine Storage Room to finished floor level. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 7 of revised drawing Sheet C-103.

- **Add panic hardware to chlorinator room door (east and west exits).**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 8 of revised drawing Sheet C-103.

- **The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see notes on revised drawing Sheet C-103.

- **Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.**

  Response: The Contractor is required to field verify the elevation of the existing 54" pipeline. The City or the City's representative onsite observing construction will coordinate with the Contractor to ensure that the clearance between the 42" and 54" pipelines is increased to the maximum extent practical.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Response: 2 full sized sets of construction plans of proposed work at the Bray Road Sludge Lagoon are included for your review and file. The separation barrier between the concrete disposal area and the lime sludge disposal area will be accomplished by

establishing a clay barrier that extends to the bottom of the original lagoon bottom as shown in the detail on sheet C-501. The separation barrier will be constructed within the lime sludge lagoon away from the concrete disposal area as to provide complete separation as discussed.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

Response: A final version of the Bray Road Lime Sludge Management Plan is being included with this final submittal. A level working surface of 738.5' has been designated within the sludge lagoon after the pump station is operational. All debris or vegetation growth within the 742' elevation within the sludge lagoon is intended to be removed and cleared by the contractor.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Response: Sheet piling is no longer being used as the separation barrier based on further discussion with the contractor and availability. A clay berm will be constructed for the full depth within the lime sludge lagoon using the original bottom of the sludge lagoon as a base using the proposed alignment proposed for the sheet piling.

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

MDEQ Comments & LAN's Responses

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
April 3, 2014

Phase II – Segment 1 - Watermain Cut-in Plans

- Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.

- Include a full-sized mid-point chlorination system schematic with the updated plans.

- It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.

- The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

storage is maintained in the LOX tank at all times.

- Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.

- Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.

- Add panic hardware to chlorinator room door (east and west exits).

- The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.

- Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
March 19 , 2014

Segment 1 - Cut –in Piping

The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?

Written response needed.....

Segment 1 – WTP Rehab

1. **Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102**

   54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?

   Air-release manhole – same as Cut-in piping

   Current yard piping diagram?

Written response needed on the first 3 items. Yard piping diagram will be a work in progress.

2. **Mid-Point CL2 - Basis of design provided**

   - **Scale – use existing or proposed? If poposed - type, capacity**
   - **Scrubber?**
   - **Room air-exchange rate ?**
   - **Pipe penetrations – discuss protective seal**
   - **Floor drains – discuss**
   - **Door sweep - discuss**
   - **Scrubber piping – lower intake**

FIN SIG 6793

- **Check valve/anti-siphon at influent channel - include in final**

3. **High Service Pump**

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   TDH of current pump and proposed pump?
   Conformance of proposed pump TDH with system head curve?

   Written response needed.....

4. **LOX/LN Storage**

   Piping configuration clarified
   The LN calculation (71 ppd) is not clear. Is there a % concentration or transfer efficiency?

5. **Electrical improvements**

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

   Written response needed.....

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
February 27, 2014

Segment 1 - Cut –in Piping

✓ **The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?** ↳ (Pump em down)

Segment 1 – WTP Rehab

1. ✓ **Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102** [illegible]

   ✓ **54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?** ↳ [illegible]

   ✓ **Air-release manhole – same as Cut-in piping** ↳ same design

   Current yard piping diagram? – work in progress

2. **Mid-Point CL2 - Basis of design needed**

   - **Application rate (both mid-pt & post for CT)**
   - **CL2 gas max dosage LBs/Day**
   - **Scale – type, capacity** ✓ 4 new scaletrons Ind.
   - **Rotometer (lbs/day)**
   - **Vacc reg, injector, educator (size)**
   - **Scrubber capacity** – not being installed
   - **Room air-exchange rate** 1/3.3 min
   - **Pipe penetrations – Sheet C-103 – linkseal – gas resistant?** – will inspect & seal
   - **Floor drains** – to be plugged
   - **Door sweep** – new better sealing sweeps to be provided
   - **Safety features – obs window, fan, lights, switches, panic bar**
   - **Scrubber piping – lower intake** → will extend to floor w. 90° bend
   - **Check valve/anti-siphon at influent channel** – yes

hydraulic check will close on system failure/shut-down

3. **High Service Pump**

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   TDH of current pump and proposed pump? 185' will match w. small pump
   Conformance of proposed pump TDH with system head curve?

4. **LOX/LN Storage**

   LOX & LN piping clarification – Sheet D2-102 & D2-601
   BOD for storage
   Ozone was designed at 4.0 mg/l max dose @ 36 MGD (Sec. 3.5 WTP BOD)

   Ozone max dose at 18.0 MGD is 650 Lbs/day

   How many GPD does this equate to?

5. **Electrical improvements**

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

One switchgear – dual feed
&
Two breakers – redundancy

Flint WTP Improvements – Phase II, Segments I, II and III

Responses to MDEQ Review Comments dated 3/19/2014

Segment I – Initial Watermain Cut-in

1. Detail 2, Sheet C-504, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.

Segment 1 – Rehabilitation

1. Raw Water Piping
   a. Maintain back up supply from Genesee County during interim operation at C.S. #2. Installation of the 42" raw water piping has been delayed until the KWA project is closer to being ready to supply water to the City. This will allow the City to maintain the backup supply from Genesee County during interim operation.
   b. The crossing of the new 42" steel pipe over the existing 54" concrete pipe is shown in plan on drawing sheet C5-101, with Detail 5, Sheet C5-501 showing how the 42-inch line will be supported. As shown on Detail 5, Sheet C5-501, the new 42-inch line will have concrete pipe cradles constructed on either side of the existing 54" pipe, maintaining a minimum clearance of 12" on either side of the 54" pipe. Pipe loads from the 42" line will then be transferred to the pipe cradles and into the soil, and not the 54" pipe. The 6" clearance between the two pipes will be backfilled with CLSM material as it will be impossible to compact typical granular bedding material under the 42" pipe.
   c. Detail 2, Sheet C5-505, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.
   d. See attached color coded yard piping diagram.

2. Midpoint Chlorination
   a. Four (4) new scales will be provided for monitoring chlorine usage from ton containers. Scales shall be as manufactured by Scaletron Industries Ltd. with a load range of 0 to 4000 lbs.
   b. The City has not been able to determine that the chlorine scrubber is a requirement of any applicable code. At this time, the City will not be installing the chlorine scrubber shown on the design drawings and will rely on the existing ventilation system to exhaust air from the Chlorine Storage Room.
   c. The existing ventilation in the Chlorine Storage Room was tested to have a capacity of 18.3 air changes per hour, or 0.305 air changes per minute. Therefore, one room volume air

change would take approximately 3.3 minutes with the current ventilation system. See attached test results. Due to the size of the existing Chlorine Storage Room, a ventilation system of 1 air change per minute is not practical. While the existing ventilation system capacity is less than 1 air change per minute, it appears to be in compliance with 10 State Standards as lesser rates may be considered in cases where 1 air change per minute is not appropriate due to the size of the room.

d. WTP staff will identify and inspect all proposed and existing piping and conduit wall penetrations in the Chlorine Storage Room and seal as necessary to prevent gas leakage into other parts of Pump Station No. 4.
e. Existing floor drains in the Chlorine Storage Room were for condensate from the old chlorine evaporator system. These drains will no longer be used and will be plugged by WTP staff.
f. WTP staff will attach new door sweeps with better seals at existing doors as required.
g. WTP staff will extend existing ventilation intake ductwork to finished floor level with 90-degree bends.
h. Per Addendum No. 1, an Anti-siphon / Back Pressure Valve and additional ball valve shall be added just prior to the trough wall penetration. The anti-siphon / back pressure valve shall be PVC and designed for use with chlorine systems. The valve shall be a LMI #35856, Walchem E90422, or engineer approved equivalent. The valve shall be installed between the two ball valves to allow for isolation during servicing. The valve shall be located above the high water level in the trough. The Contractor shall install a 1" drain line from the relief port to the finished floor elevation of the pipe gallery.

3. High Service Pump
   a. The new 16" pump control ball valve for HSP #1 replaces the existing pump control ball valve in kind and will operate in the same manner as the existing valve. The valve will act like a check valve upon emergency shutdown of the pump through the use of a hydraulic cylinder actuator that will automatically close the valve. The cylinder actuator uses hydraulic water system pressure to supply the energy required to close the valve.
   b. The existing HSP #1 is rated for 25 MGD at 185' TDH. The proposed replacement HSP #1 is rated for 15 MGD at 185' TDH, matching the head condition of the existing pump.
   c. Results from the City's hydraulic model were used to develop system curves for max day and average day, which were used to confirm pump selection. The proposed HSP #1 will operate on a VFD which can be adjusted during operation to meet various duty points depending on demand.

4. LOX/LIN Storage
   a. Nitrogen usage is calculated based on 2.5 % of the oxygen usage:

      2,833 ppd O_2 x 0.025 = 71 ppd N_2

5. Electrical Improvements
   a. The operation of the pumps is contained within a single switchgear at Pump Station No. 4. However, there will be a dual feed coming into the main plant switchgear that will supply redundant power to the plant, including Pump Station No. 4. There will also be two breakers

at the main plant switchgear that feed two different breakers at Pump Station No. 4. Therefore, any one point of failure will not take the system down.

Proposed Scope of Upgrades to Flint WTP

Phase II - Segments I & II

1. Introduction

The City of Flint plans to utilize their existing WTP to provide water on a continuous basis. The city plans to treat water from the Flint River until construction of the proposed KWA supply is complete and the WTP can then be used to treat water from Lake Huron. The following proposed improvements are needed to place the WTP into service next spring. These improvements will remain in service once the KWA is in service.

2. Scope of Work

The proposed upgrades have been categorized into Phase II – Segment I and are to be completed as soon as practical so that the WTP can be utilized to treat water from the river in the spring of 2014. Engineering services will include final design, plans, contract documents, bidding assistance. Since time is of importance, specifications and schematic drawings will also be provided for pre-procurement of long lead item equipment and are outlined within each section below. Contract administration and construction phase services are not included within the initial scope of services.

- Design Progress Meetings: Meet with City staff to provide project status updates and to discuss specific design issues and details in order to facilitate timely design decisions. Meetings will include design team personnel from each discipline as required, City operations staff and administrative staff. Five (5) design progress meetings are included.
- Prepare and update opinion of probable construction cost at for each project bidding document submittal (40%, 80% and Final Draft). Prepare final opinion of probable construction cost prior to bidding.
- Quality Assurance/Quality Control: A Quality Control Plan (QCP) will be developed and implemented specifically for this project. At each project submittal stage, the document deliverables will be checked and reviewed by experienced personnel to ensure that the design meets applicable standards and normal engineering practice.
- Deliverables:
  40% Bidding Documents (Drawings and Technical Specification Outline)
  80% Bidding Documents (Drawings and Technical Specifications)
  Final Draft Bidding Documents (Drawings and Technical Specifications)
  Final Bidding Documents (One printed and one electronic set of Drawings and Technical Specifications
- Bidding Phase
  Conduct pre-bid meeting.
  Respond to contractor inquiries.
  Prepare construction document addenda, as necessary.

Review bids and supporting bid documentation. Prepare bid report summarizing bids, contractor references, and contractor qualifications; make recommendation for contract award.

- Construction Phase
  Review and respond to contractor submittals (First two reviews are included in level of effort, subsequent review cost will be paid for by contractor)
  Respond to contractor's request for information
  Prepare monthly payment documents
  Negotiate and prepare change orders for client review and approval
  Attend monthly project meetings
  Provide periodic onsite technical observer (have included two weeks per month in level of effort)
  Develop record documents (provide one hard and one electronic copy to owner)

Specific Work Tasks:

Item 1 – Chemical Systems / Ozone

The Michigan Department of Environmental Quality (MDEQ) requires 30 days of redundant storage of the chemical used in this treatment process. To bring the rehabilitated plant into regulatory compliance with the chemical storage requirements for primary use, additional storage facilities will need to be constructed for liquid oxygen and nitrogen.

One liquid oxygen and one liquid nitrogen storage tanks and unloading stations identical to the existing units will be installed north of the existing facilities. Details are listed as follows:

- Liquid Oxygen
  Capacity – 9000 gallons
  Diameter – 10 ft (maximum)

  Liquid Nitrogen
  Capacity – 540 gallons
  Diameter –5.5 ft (maximum)

Pre-procurement documents for the liquid oxygen and nitrogen tanks will be provided.

Item 2 – Electrical

The City of Flint Water Treatment Plant (WTP) represents a combination of administrative, process, and maintenance facilities which all require electrical power. At the completion of Phase I of the water treatment plant rehabilitation projects, much of the electrical distribution equipment such as motor control centers (MCCs), power/lighting panels, transformers, and electrical power feeders will have been upgraded. There is, however, significant additional work required to address remaining electrical equipment that has reached a point of obsolescence.

Switchgear in the sub-station was installed around 1960. It is antiquated and difficult to maintain. Very little work has been done to the station since its original installation. The plant has two 46 kV primary feeds into the sub-station. Replacement of the distribution switchgear with current technology

equipment would allow a higher degree of load protection, be serviceable by numerous sources, and have replacement parts availability. When the switchgear is replaced, the plant will have to stay in operation. Brief interruptions of power of selected plant processes could be accommodated during cut over to new equipment.

Proposed Substation Upgrade

- Coordinate upgrades to Consumers 46kV primary feeders to provide a single overhead 46KV primary service
- Replace the two Consumers 2.5kVA substation transformers and overhead structure with two 2.0 to 2.5 kVA 46KV pad-mounted transformers.
- Replace the City's substation switchgear in the substation building.

Pre-procurement documents for the pad mounted transformers and switchgear will be provided.

Pump Station No.4 contains the largest electrical loads in the plant. Four low service pumps and five high service pumps represent a combined total of approximately 4000 horsepower. Additional loads from HVAC, lighting, controls, and chemical feed are about 60 kVA. This represents a total load of 531 amps @ 2400 volts. The existing switchgear in Pump Station No.4 is antiquated and difficult to maintain. Current technology equipment will allow a higher degree of load protection.

Proposed Pump Station No. 4 Improvements

- Replace 2400V switchgear
- Provide one 15 MGD medium voltage VFD

Pre-procurement documents for the medium voltage VFD and switchgear will be provided.

As a base load facility capable of producing water at any time the Flint WTP must have the ability to deal with power outages. In order to meet these electrical need in the event of a loss of power to the plant site or the loss of one of the substation transformers a new standby diesel generator is proposed to be located adjacent to the new substation.

Proposed Standby Power Improvements

- One 2.0 to 2.5 mVA generators and fuel tank. – Provisions, but no actual generator

Pre-procurement documents for the generator set will be provided.

There are four 2400V to 480V transformers in Plant 2 that are antiquated and difficult to maintain. Replacement parts are no longer available and reliability is questionable.

Proposed Plant 2 Improvements

- Replace two 300kVA 2.4KV transformer/switchgear.
- Replace two 100kVA 2.4KV transformer/switchgear.

Pre-procurement documents for the transformers and switchgear will be provided.

Item 3 – Mid-Point Chlorination

Mid-point chlorination facilities are proposed to increase reliability of the disinfection process and improve Ct. For this initial stage the existing chlorine equipment in Pump Station No. 4 will be used and a new chlorine solution line will be installed from Pump Station No. 4 to the filter influent channel in Plant 2. A chlorine scrubber system will be installed in Pump Station No.4 to protect against a leaking chlorine ton container.

Proposed Chlorine Improvements

- New chlorine solution line to filter gallery.
- Chlorine system improvements.
- Dry scrubber system.

Item 4 – Low and High Service Pump Station No. 4

As a result of decreased demands, pumps at Pump Station No. 4 are "over-sized" and do not efficiently operate. Some of the pumps experience vibrations in the shafts and steady bearings. The existing pump station will be rehabilitated to replace "over-sized" pumps and obsolete equipment and provide needed maintenance.

Proposed Pump Station No. 4 Improvements

- Install one new High Service Pump (15 MGD @190 feet TH; vertically mounted pumps with 800 HP 2400/4160 V inverter duty motors, with 20 feet of shaft and steady bearings)
- Replacement of existing piping, valves, supports, and bearings
- New intermediate platforms, ladders, & stairs
- New ventilation (for exhausting heat from VFD's)
- Demolition of existing equipment to accommodate new equipment

Pre-procurement documents for the pump, motor, control valves and isolation valves will be provided.

Item 5 – Raw Water Piping Connection

The proposed KWA raw water pipeline will connect to the existing 72" PCCP finished water supply line near Center and Pierson Roads. (East of this connection, the 72" PCCP will be utilized by GCDC-WWS for distribution of finished water in the GCDC-WWS service area.) Raw water from Lake Huron will be conveyed to the WTP site via the 72" PCCP pipeline. On the WTP site, the 72" pipeline will be tapped for a 42" pipe and for a 36" pipe to convey raw water for treatment. Connections to the existing pipe will be made at this time to avoid future plant shutdowns for connections.

Proposed Pump Station No. 4 Improvements

- 48-inch pipe connections
- 36-inch pipe connection
- 54-inch pipe connection

Pre-procurement documents for the valves and connection fittings will be provided.

Phase II – Segment II:

The proposed upgrade for item 6 has been categorized as Phase II – Segment II and is to be completed with the same urgency as the rest of the work so that the WTP can be utilized to treat water from the river in the spring of 2014. However, the use of the Bray Road lagoon for other disposal activities will require that this issue be addressed independently to certain extent as to isolate the problem areas while working with MDEQ to permit its use for lime sludge disposal.

Item 6 – Softening Residuals Disposal

Develop, evaluate, design and implement a lime residuals disposal plan to handle softening sludge for the interim period of operation using the Flint River as a water source. These options may include the use of Bray Road lagoon, construction of temporary dewatering and loading facilities, and other temporary storage options.

The use of Bray Road Lagoon will require additional survey, geotechnical and environmental testing at the site in order to assess the condition of the lime sludge in the basin and to verify the capacity of the lagoon system. Based on the findings of this evaluation, proposed improvements will be designed to accommodate the use of the facility in the interim basis while addressing some of the MDEQ concerns about the site and any unauthorized discharges into the nearby stream. Permitting for site use will be incorporated as part of the overall design improvements at the WTP and submitted to the MDEQ at the 80% design stage for their pre-permit review and comments. A final package will be submitted to the MDEQ at the 100% design stage for permit issuance and approval of work plan.

Pre-procurement documents for specific equipment may be provided as needed.

3. Schedule

The work included in this work authorization is anticipated to be performed in accordance with the following schedule, based on the Notice-To-Proceed (NTP) date of November 1, 2013. For the purposes of this proposal, we anticipate a 3 month design phase and 1 month bid phase. Schedule revisions may be necessary as information becomes available and work priorities change.

Project Milestone	Date
Project Kickoff Meeting	November 6, 2013
Equipment Procurement Documents	December 6, 2013
Submit 40% Bidding Documents	December 18, 2013
Submit 80% Bidding Documents	January 10, 2014
Submit Final Draft Bidding Documents	January 31, 2013
Submit Final Bidding Documents	February 7, 2014
Bid Advertising	February 10, 2014
Pre-Bid Meeting	February 17, 2014
Bid Opening	TBD by City
Recommendation of Contract	TBD by City
Contract Award issued by City	TBD by City

4. Compensation

The Reimbursable Compensation method with a maximum not-to-exceed limit will be used for this contract. Labor rates shall be based on personnel classifications according to the existing rate sheet. Reimbursable expenses shall be invoiced at the actual cost times a factor of 1.0 for processing and handling. The estimated maximum not-to-exceed fee for this project is $962,800 which includes a $15,000 allowance for surveying and $15,000 allowance for geotechnical services.

Description	Fee
Design and Bidding Assistance	$ 752,800
Surveying Allowance	$ 15,000
Geotechnical Allowance	$ 15,000
Construction Phase Services	$ 180,000
Total Maximum Not to Exceed Fee	**$ 962,800**

Any other work beyond the Scope of Services herein will require a subsequent Work Authorization with prior approval from the City.

May 21, 2013

TO: Brent Wright, Supervisor
Water Plant

FROM: Derrick F. Jones,
Purchasing Manager

SUBJECT: SEALED BIDS

Attached are the sealed bids that were received for the annual supply of LOX-l.iquid Oxygen for your review. These copies are yours to keep. The proposals were opened on May 14, 2013 under proposals #14-513.

Your review and recommendation are needed as soon as possible. Attach a staff resolution form when you send back your recommendation and make sure that your requisition has been updated and pre-encumbered with the correct price. If your recommendation is under $10,000.00, you do not need to include a staff resolution form.

Please note: if your project is being funded by any grants issued by the federal government, you must go to www.sam.gov to ensure that the selected vendor has not been debarred.

Attachment

AIR LIQUIDE

Mr. Brent Wright

City of Flint, Water Treatment Plant

4500 N. Dort Highway

Flint, MI 48505

Mr. Wright,

Air Liquide Industrial U.S. LP appreciates your business and the opportunity to provide the City of Flint with a reliable and economic supply of bulk liquid oxygen. Air Liquide strives for quick and reasonable turn-around time for your oxygen deliveries when your order is placed with the National Scheduling Center. Air Liquide's typical standard delivery time frame is within 24 to 48 hours upon order.

Thank you and please call me directly at 708-579-7977.

Sincerely,

Amy Waszczak

National Municipal Business Coordinator

Air Liquide Industrial U.S. LP

REQUIREMENTS / TABULATION

Treatment Chemical Specifications

Flint Water Plant

- Product to meet or exceed AWWA Standard B510-00 Column H of Table 1 and ANSI/NSF 60, see attached table.
- Delivery to be by pressurized vessel tanker truck, not to exceed 20 ton deliverable product and conforming to all applicable local, state and federal regulations.
- Trailer must have proper DOT markings, including the nomenclature "Guaranteed by VENDOR to meet the requirements of AWWA B510 Standard for".
- Weight Certificate from certified weigher, supplied by selected vendor for each delivery. Certified liquid meter tickets may be acceptable substitute.
- Purity Standards with certification for every load. Affadavit of certified analysis. 02 Purity must be 99.5%
- Copy to owner of selected vendor's QC/QA program.
- Water Plant Staff training for the initial load to bulk storage.
- The vendor shall contact the Water Plant Supervisor 24 hours prior to delivery to confirm: 810-787-6537.

LOX-LIQUID OXYGEN 99.5% FOR USE IN STATE MANDATED PLANT TEST RUNS CONTACT PHONE#: 810.785.7877 FURNISH AS REQUESTED FOR THE PERIOD 7/1/13 - 6/30/14. APPROXIMATE QUANTITIES, NOT GUARANTEED FOR MORE INFORMATION CONTACT: BRENT WRIGHT @810.787.6537 EXT# 3510 LIQUID OXYGEN TO BE USED IN OZONE PROCESS. $0.381 /cu ft. *
Only the specifier has the responsibility and judgment for determining whether a proposed substitution is an "or equal or exceeding" specification. Mfg., model #, and supporting documentation of specifications for alternates must be provided.

* Amendment Number 2 to the existing Bulk Product Agreement is made a part of Air Liquides bid for bulk liquid oxygen.

THIS PAGE MUST BE COMPLETED AND INCLUDED WITH SUBMITTAL:
The undersigned herby certifies, on behalf of the respondent named in this Certification (the "Respondent"), that the information provided in this offer submitted to the City of Flint is accurate and complete, and that I am duly authorized to submit same. I hereby certify that the Respondent has reviewed all documents and requirements included in this offer and accept its terms and conditions.

Cash Discounts will be computed from the date of receipt of invoice. Prices firm unless stated otherwise by bidder. Delivery can be made in ( ) days ARO (after receipt of order).

Payment Terms: 30 Delivery Dest.: F.O.B. Fed. ID #: 90 0186946
(All Freight Terms are considered F.O.B., Prepaid unless otherwise noted by seller)

COMPANY NAME (Respondent): Air Liquide Industrial US LP
(Printed)
ADDRESS : 5220 East Avenue
CITY/STATE/ZIP : Countryside IL 60525
PHONE : 708-579-7977 FAX: 708 579 7933
EMAIL : amy.waszczak@airliquide.com
PRINT NAME and Title : Amy Waszczak, Municipal Business Coordinator
(Authorized Representative)
SIGNED : Amy Waszczak DATE: 5/13/2013
(Authorized Representative)

Please submit original documents plus one copy.

New vendors are required to complete and submit an IRS W-9 Form and Vendor ACH Form with the City of Flint. Link is available at www.cityofflint.com/finance/purchasing.

Bid results may be viewed next business day online at www.cityofflint.com/finance/purchasing

Technical Bulletin
Vacuum Tubing & Piping

Vacuum Tubing / Piping Sizing Guide for Chlorine & Sulfur Dioxide

Gas Feed Rate	100 ft.	200 ft.	300 ft.	500 ft.	1000 ft.	1500 ft.
50 PPD / 1 kg/h	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"
100 PPD / 2 kg/h	3/8"	1/2"	5/8"	5/8"	3/4"	3/4"
250 PPD / 5 kg/h	1/2"	5/8"	3/4"	3/4"	1"	1"
500 PPD / 10 kg/h	5/8"	3/4"	1"	1"	1-1/2"	1-1/2"
1000 PPD / 20 kg/h	1"	1"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
2000 PPD / 40 kg/h	1"	1-1/2"	1-1/2"	2"	2"	2"
4000 PPD / 80 kg/h	1-1/2"	1-1/2"	2"	2"	2"	3"
6000 PPD / 120 kg/h	1-1/2"	2"	2"	2"	3"	3"

NOTES:

1. In the above table:
   a. 3/8", 1/2" and 5/8" refer to the OD (outer diameter) of flexible polyethylene plastic tubing.
   b. 3/4", 1", 1-1/2", 2" and 3" refer to Schedule 80 PVC rigid piping.

2. The above recommendations are based on calculations limiting friction loss to 0.5" Hg or less.

Hydro Instruments 600 Emlen Way Telford, PA 18969 Phone: 215.799.0980 Fax: 215.799.0984 Email: sales@hydroinstruments.com Web Address: www.hydroinstruments.com

City of Flint
Water Treatment Plant Improvements
Midpoint Chlorination System Basis of Design

Basis of Design for Midpoint Chlorination:

Q, Design Max Day = 18 MGD
Cl_2 Dosage, Max = 5.5 mg/L [per City of Flint plant staff]
Cl_2 Usage, Max = 18 x 5.5 x 8.34 = 826 ppd Cl_2
Provide minimum 1,000 ppd gas chlorination system.

assume 3.0 mg/L demand
leaves 2.5 mg/L Avail
→ meets 10 states of 4.4.1.2 of 2.0 mg/l M.C

prov. adequate stand-By — 4.4.1.3

Proposed Gas Chlorination System:

1. Four (4) 500 ppd Cl_2 vacuum gas feed systems with chlorine solution piping manifold for total installed capacity of 2,000 ppd Cl_2.
2. Each 500 ppd Cl_2 vacuum gas feed system shall consist of the following:
    a. One (1) 500 ppd vacuum regulator (direct mounted to chlorine ton containers or remote mounted). Each unit shall include an actuator for emergency closure of the chlorine container valve. Vacuum regulators shall be Hydro Instruments Series 700 with integral drip leg and heater.
    b. One (1) wall mounted control panel with the following equipment:
        i. One (1) automatic valve for feed rate control, Hydro Instruments Omni-Valve Model OV-110.
        ii. One (1) 500 ppd rotameter, Hydro Instruments Model RM-701.
        iii. One (1) vacuum monitor, Hydro Instruments Model VM-150.
        iv. One (1) 500 ppd differential pressure regulator, Hydro Instruments Model DP-500.
        v. PVC bypass piping.
    c. One (1) 500 ppd ejector nozzle/check valve assembly, Hydro Instruments Model EJ-5000
3. One (1) existing chlorine gas leak detector as manufactured by MSA.
4. Four (4) existing ton container load cells.

Note: All new equipment shall be as manufactured by Hydro Instruments of Telford, PA. Catalog cutsheets for all new equipment are attached.

Description of Operation:

Each 500 ppd Cl_2 gas feed system will operate based on signals from the plant PLC. Based on operator set dosage, the PLC will send a signal to open the water supply solenoid valve(s) that will allow supply water to flow through the ejector(s) to create the vacuum necessary for gas flow from the ton container(s). If the set point is less than 500 ppd, only one solenoid valve will open. If the set point is greater than 500 ppd, two solenoid valves will open, and the other two 500 ppd systems will remain as standby units. Initially, the dosage will be controlled by the operator manually adjusting the setpoint at the PLC. However, the system has the capability of automatically controlling the feed rate through a flow pacing signal or through a chlorine residual analyzer compound feedback loop.

→ Auto proportioning 4.4.1.5

Each 500 ppd system will be fed from a single one ton chlorine container with its own load cell to monitor chlorine usage. The PLC will monitor each load cell and will signal an alarm when the container is empty; the PLC will automatically close the solenoid valve for the 500 ppd system with the empty container and will start one of the standby units so that the empty ton container can be changed out.

auto switch yes

meets 4.4.1.4

Estimated Chlorine Feed Rates - lbs./day

Examination of previous chlorine demand tests and past plant operation data using Flint River water, shows a chlorine demand around 3.0 mg/L on average. The chart below shows the pounds per day of chlorine that will need to be applied for different flows and different chlorine dosages that may be encountered.

Flow (MG)	Chlorine dosage (mg/L)						
	3	4	4.5	5	5.5	6	6.5
12	300.2	400.3	450.4	500.4	550.4	600.5	650.5
18	450.4	600.5	675.5	750.6	825.7	900.7	975.8
24	600.5	800.6	900.7	1000.8	1100.9	1201.0	1301.0

In order to produce a 1.5 mg/L chlorine residual in finished water to meet Ct requirements, the dosage will most likely be between 4.5 & 5.5 mg/L. The demand may increase if ozone production decreases, or if the source water contains large amounts of turbidity during spring runoff, or heavy rains.

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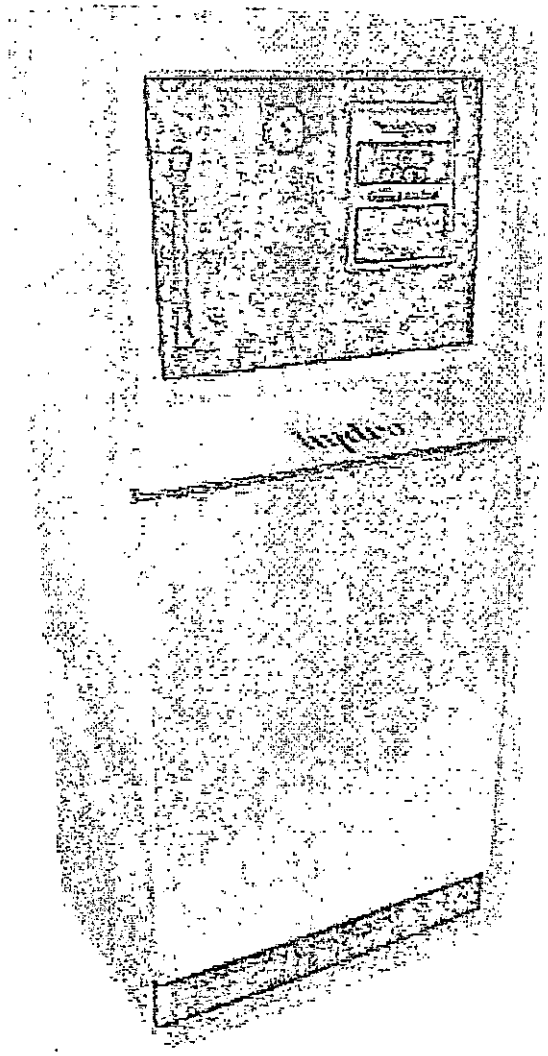
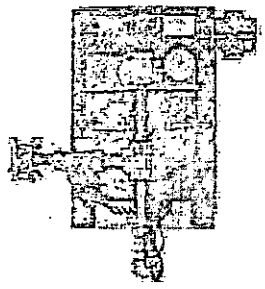
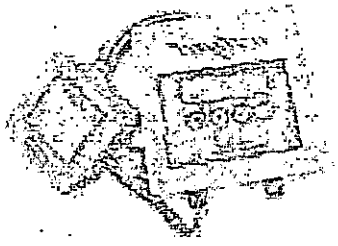
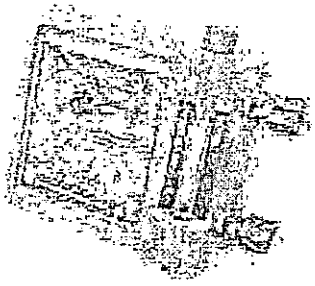
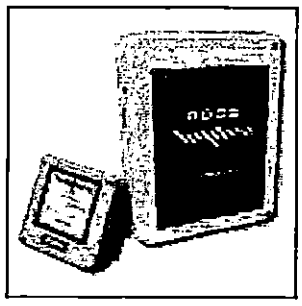
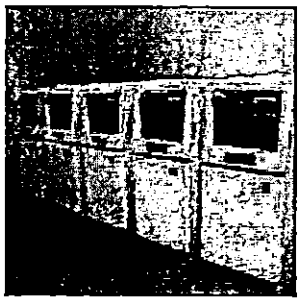


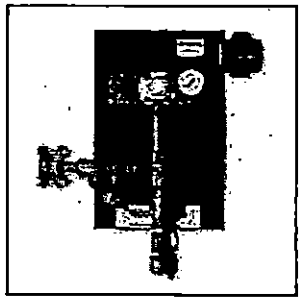


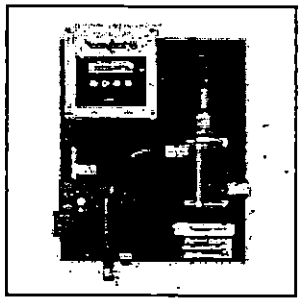












Application: Gas chlorination systems are used for water disinfection and other purposes in a variety of applications. Compared to other disinfection methods, chlorine offers the advantage of a stable and long lasting residual that can remain in the water protecting it from recontamination after treatment. Among chlorination methods, chlorine gas is the most economical and the equipment is also the most reliable and easy to operate. Some of the most common applications for large scale gas chlorination systems are surface water treatment plants, waste water treatment plants, and cooling towers for power plants, oil refineries, etc...Gas chlorination systems are also used in a variety of industrial, mining, and agricultural applications.

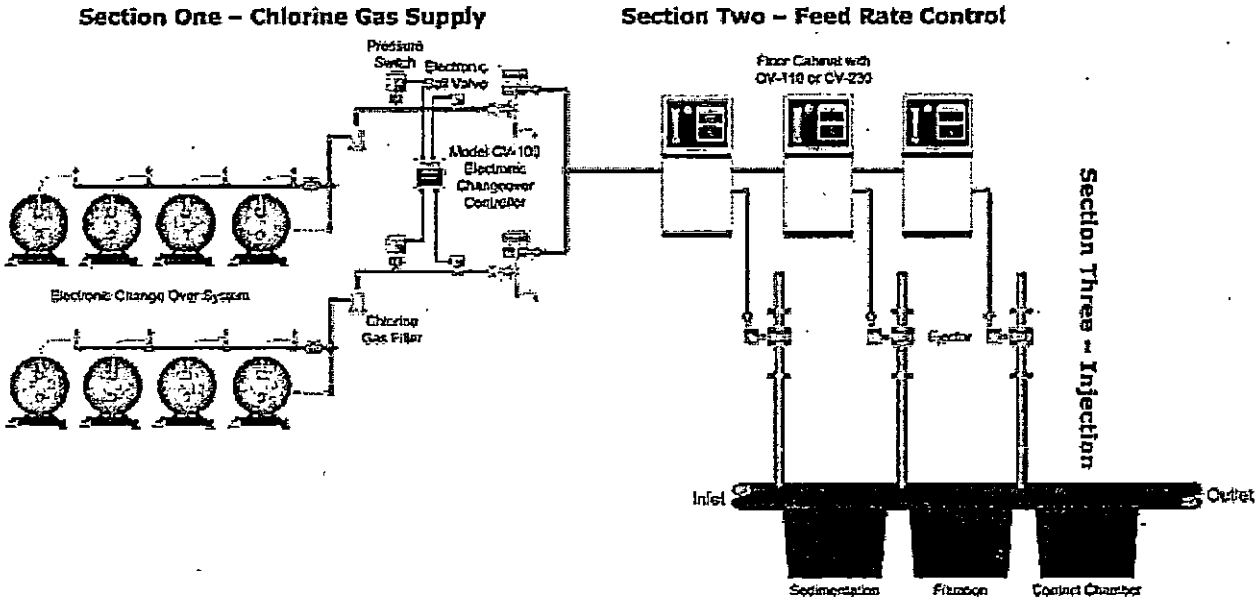
Purpose: Regardless of the application, the gas chlorination system will be required to inject chlorine gas into the process water at one or more locations (with the goal of achieving a desired level of residual chlorine to the process water). Different applications have different requirements for the residual chlorine concentration depending on the water quality and the application. Chlorine residual is quantified in units of parts per million (PPM or mg/L). In order to maintain a constant residual in the water, as the process water flow rate increases and decreases the chlorine feed rate should proportionally increase and decrease. It also must be realized that a certain amount of chlorine will be consumed in reactions upon entering the process water and that this amount of chlorine will not be available as chlorine residual. The amount of chlorine residual consumed in this way is sometimes referred to as the chlorine demand of the water (in units of PPM). The chlorine demand is different for every process water and can range from close to zero to over 20 PPM. Keeping the above points in mind, the following equation is used to determine the required chlorine gas feed rate for each chlorine gas injection point:

[Process Water Flow (m^3/hr)] x [Dosage (PPM)] = Chlorine Gas Feed Rate (gr/hr)

NOTES:
Water Flow (m^3/hr) = Process water flow rate in cubic meters per hour
Dosage (PPM) = [chlorine demand] + [desired chlorine residual]

System Example (Surface Water Treatment Plant): Figure 1 shows a very basic schematic of a surface water treatment plant. The diagram shows three chlorine gas injection points. One gas chlorination system with three injection points is shown in the diagram. The gas chlorination system can be broken down into three sections as indicated in Figure 1.

Figure 1: Surface Water Treatment Plant (Example)



Typical: Gas chlorination systems follow a modular design principle. As seen in Figure 1 above, the gas chlorination equipment can be divided into three sections starting from the chlorine gas containers and ending at the ejectors as follows:

(1) **Chlorine Gas Supply** – This part of the system is designed to provide an uninterupted supply of chlorine gas flowing under vacuum.

(2) **Feed Rate Control** – In this section, equipment is provided to monitor and control the feed rate of chlorine gas to each injection point. The feed rate control can be manual or automatic based on 4-20mA input signals from water flow meters or residual chlorine analyzers. (Step feed control based on switch inputs is also available.)

(3) **Ejector System** – The ejectors create the vacuum that operates the system in an on-off fashion. The chlorine gas enters the water inside the ejector and then the chlorinated water solution is piped to the injection point where it is delivered to the main process water flow.

Safety and monitoring equipment such as gas leak detectors, residual chlorine analyzers, container scales, emergency valve closure systems, emergency repair kits, and chlorine leak absorption systems (scrubber systems) are also available from Hydro Instruments and our sales representatives.

There are many options available for designers to select. This document will review general options for each stage of the system. Please also refer to additional Hydro Instruments product literature for additional details.

Figure 2 is a diagram depicting several of the more common equipment configurations for each part of the gas chlorination system. This figure shows three different options for the chlorine gas supply section and four different options for the feed rate measurement and control section of a system.

Note that one chlorine gas supply section is frequently used to supply chlorine gas to multiple injection points.

Figure 2: System Layout Options

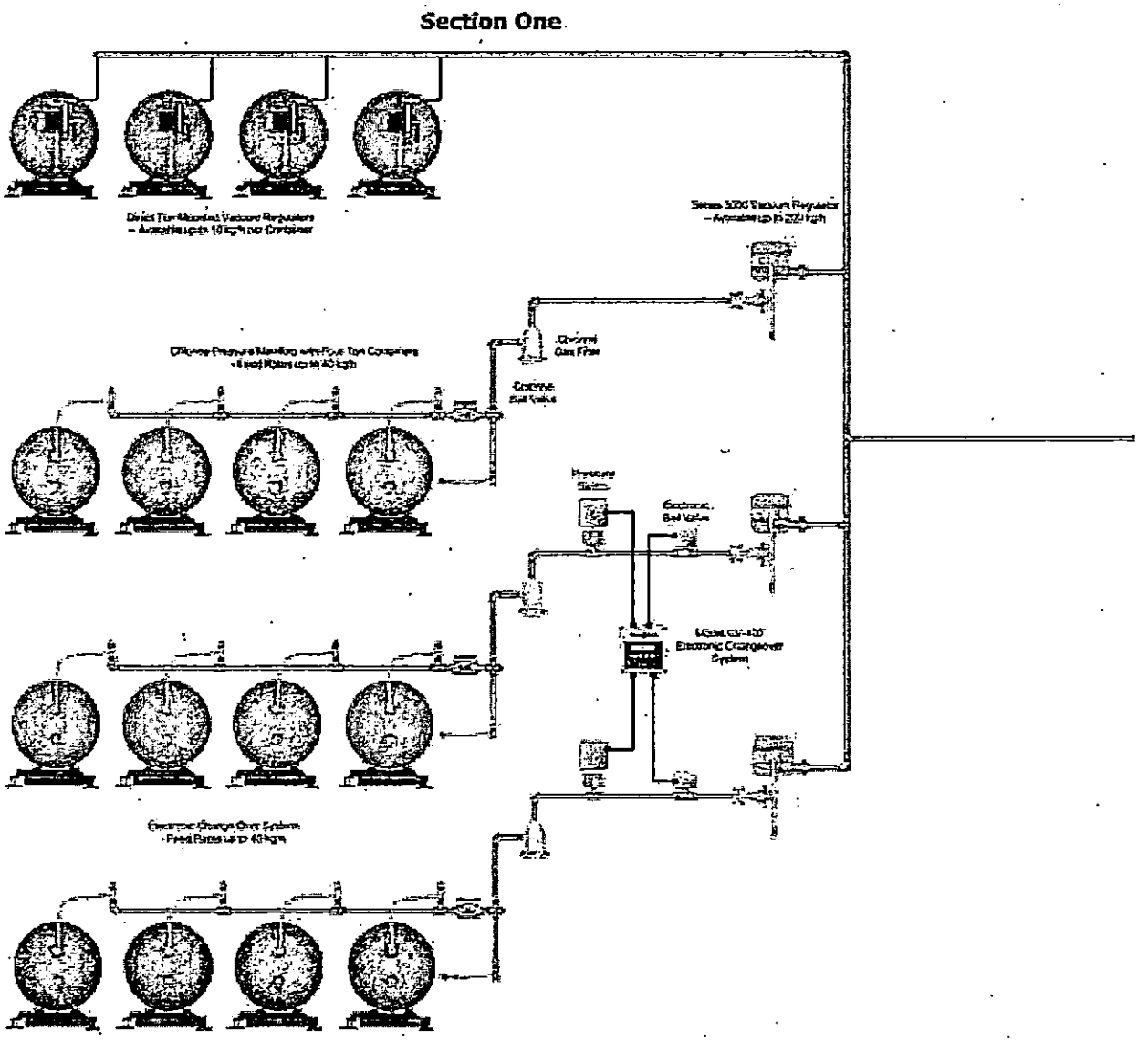
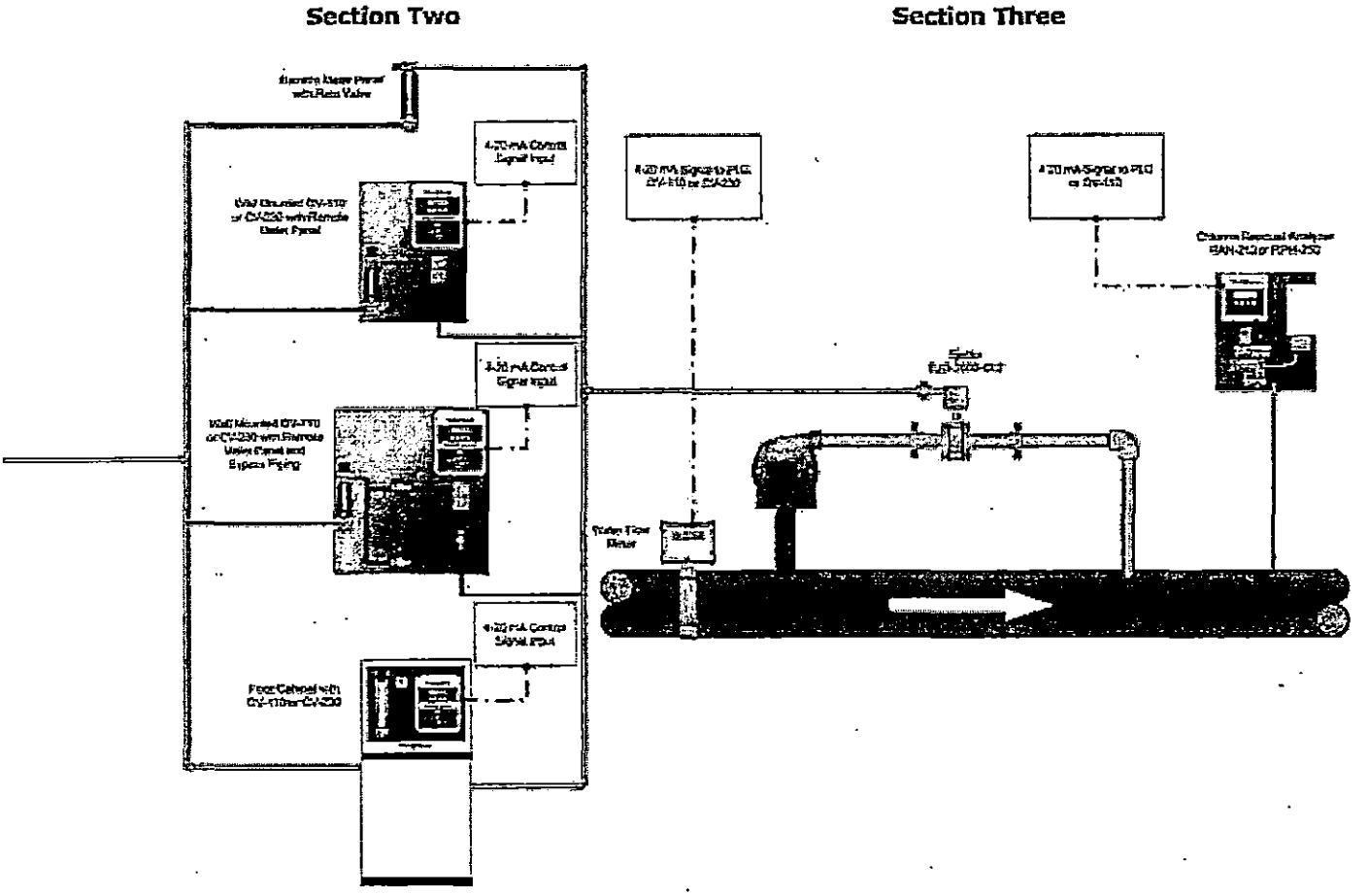


Figure 2: System Layout Options

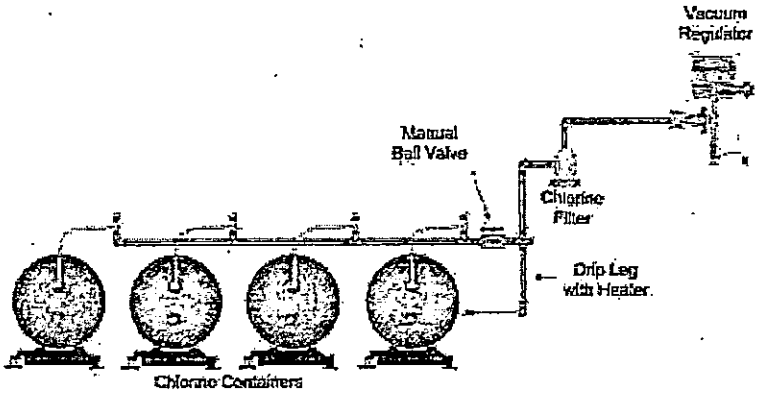


Section 1 – Chlorine Supply: This section of the equipment consists of the chlorine containers, manifolds, vacuum regulators and changeover system.

1a. Ton Containers & Chlorine Manifolds: NOTE: For more detailed technical information, please refer to the latest copy of Hydro Instruments TCM-DC design guide for ton container mounted manifolds.

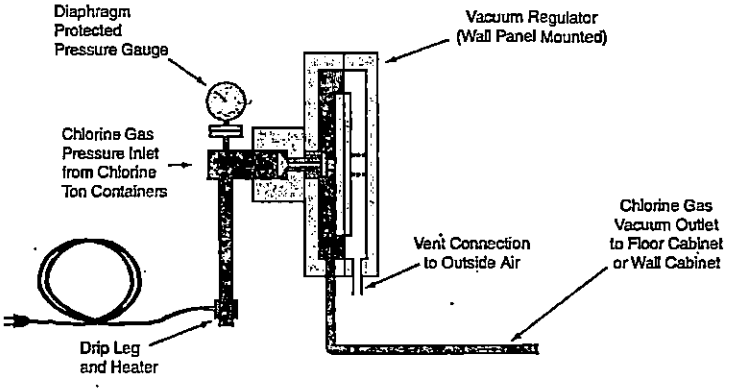
Evaporation cooling limits the chlorine gas withdrawal rate for a single chlorine ton container to approximately 10 kg/hr (500 PPD). Therefore, a 40 kg/hr (2000 PPD) system should be designed so that four ton containers are feeding simultaneously. This can be accomplished by mounting a vacuum regulator on each ton container or by connecting four ton containers together with a pressurized manifold. Pressurized chlorine manifolds are used to collect chlorine gas from one or more chlorine ton containers. The manifold must trap and evaporate liquid chlorine to prevent it from entering and damaging the vacuum section of the equipment.

Figure 3: Chlorine Pressure Manifold



1b. Vacuum Regulators: Chlorine gas enters the vacuum regulator under pressure. When the ejector is in operation it creates a vacuum (that vacuum extends to the rear cavity of the vacuum regulator) that causes the diaphragm assembly to press back against the spring loaded normally closed inlet valve, causing it to open and allow chlorine gas to flow in under vacuum conditions. When vacuum is lost for any reason, the inlet valve spring will close the valve and stop the flow of chlorine immediately.

Figure 4: Vacuum Regulator



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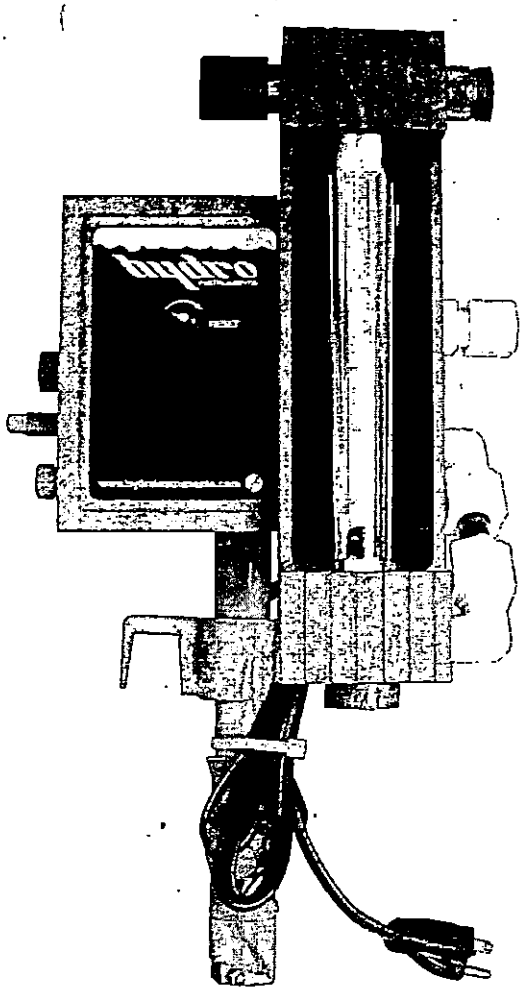

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GAS CHLORINATORS

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EASY INSTALLATION: Advanced product design eliminates the probability of troublesome installations.

FEWER PARTS: Proven product engineering results in fewer parts for exceptional operating reliability, lower cost, and longer life.

TOTAL RELIABILITY: Every part is optimally designed and manufactured using materials proven to be chemically resistant to chlorine gas. Therefore, Hydro Instruments' Series 700 and 750 components can be used to handle chlorine gas with safety and complete control at capacities up to 500 lbs/day (10,000 grams/hour).

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BULLETIN 700/750 Rev. 6/10

Prysby, Mike (DEQ)

From:	Matta, Samir <SFMatta@lan-inc.com>
Sent:	Wednesday, March 19, 2014 6:49 PM
To:	Prysby, Mike (DEQ)
Subject:	FW: City of Flint WTP Improvements Phase II - MDEQ Comments.
Attachments:	Flint WTP 2013 Site Plan.pdf

Hi Mike,

Does this address your needs for the "current yard piping diagram"?

The language below was also used for the addendum that the City issued to the contractor for the Mid-Point Clorination

1. Sheet C-104 – Construction Notes: Add the following Note 6 – A 1" Anti-syphon / Back Pressure Valve and additional 1" ball valve shall be added just prior to the trough wall penetration. The anti-syphon / back pressure valve shall be PVC and designed for use with chlorine systems. The valve shall be a LMI #35856, Walchem E90422, or engineer approved equivalent. The valve shall be installed between the two 1" ball valves to allow for isolation during servicing. The valve shall be located above the high water level in the trough. The Contractor shall install a 1" drain line from the relief port to the finished floor elevation of the pipe gallery.

Jeremy will provide written responses for your file on the other questions as requested.

Thanks.

Samir F. Matta
Senior Project Manager

Lockwood, Andrews & Newnam, Inc.
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GAS CHLORINATORS

Principle of Operation

For a particular ejector back pressure, a minimum water supply is required at the ejector inlet to create vacuum at a level strong enough to operate the chlorinator. This vacuum originates in the throat of the ejector's Venturi nozzle and after opening the ejector check valve, extends into the body of the chlorinator. There it causes the regulating diaphragm to open the inlet safety valve, allowing gas under pressure to pass into the drip leg where the initial liquid is collected. A heater attached to the drip leg evaporates the liquid that is in the eduction tube of the gas valve on startup of a new ton container. This heater remains on constantly, permitting only gas to flow to the vacuum regulator. As it flows across the inlet safety valve assembly, it is filtered and reduced to a vacuum.

The gas then enters a chamber where the vacuum level is maintained by a spring-opposed, sealed regulating diaphragm. It is then drawn through the chlorine flow meter, across the rate control valve and on to the ejector where it dissolves in water. The resultant, highly concentrated solution exits at the ejector outlet and flows to the desired point of application.

Accuracy

Flow meter accuracy is within 4% of the meter's maximum capacity.

Capacities Available

Maximum total operating rate is 500 pounds per day (10,000 grams per hour). Minimum feed rate is 5% of maximum.

Installation of Hydro Gas Chlorinators

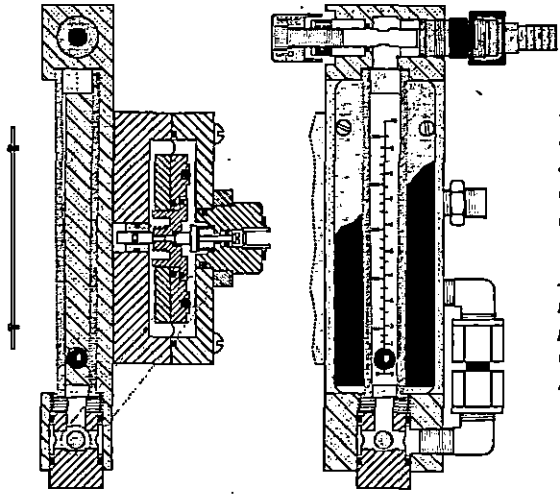
Units of the **Hydro Gas Chlorinator System** can be used for practically any requirement. The schematics show various types of installations using single or multiple containers as well as application of chlorine to pool, basin or pipeline...direct or remote. Basic **Hydro** gas chlorinator units are simply combined to cover all applications.

CHLORINATOR SIZE SHOULD BE BASED ON MAXIMUM POSSIBLE FLOW.

GPM x 0.012 x (PPM) Dosage = PPD

Example:
600 GPM x 0.012 x 3 PPM = 21.6 PPD

In this example a **Hydro** 50 PPD chlorinator would be adequate.



***Hydro Series 700* ton-container mounted gas chlorinators** are designed for manual or semi-automatic operation to meet the highest standards of reliability. They incorporate advanced design features gained through years of research and in-the-field experience. Simplified design and fewer parts mean less maintenance, lower cost with better performance, reliability and long life.*

HYDRO Series 700 Chlorinator

A ton ironwork* is used to mount the **Hydro** chlorinator directly to the container. **This eliminates all pressure lines.** Chlorine gas is taken under vacuum to the point of injection. **This eliminates pressurized solution lines.**

Operator Indicator

During operation the indicator window remains gray; red indicates depletion of the chlorine source.

Inlet Safety Valve

Spring opposed safety valve seals off chlorine in container upon loss of vacuum. Safety valve is encapsulated to permit quick disassembly and cleaning without special tools.

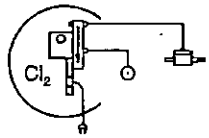
Inlet Sealing Valve

A sealing valve at the chlorinator inlet closes if chlorine supply is interrupted or depleted, sealing the entire vacuum system. Dirt or moisture cannot enter the system when containers are changed.

Regulating Diaphragm

Constant vacuum level is maintained inside the chlorinator by the diaphragm which is O-ring sealed along its entire inner and outer surface to prevent leakage or warping of parts from excessive tightening of the body bolts.

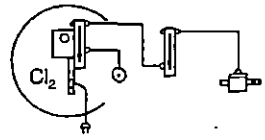
500 PPD systems with one or more wall mounted remote meter(s) (701, 701-2, 702, 702-2, etc.) are standard with chlorinat chlorinator body(ies). The price is reduced if the customer wishes to receive chlorinator(s) with no meter assembly(ies) ("blank at the source (only at the wall mounted remote meter) and on automatic standby systems one will not be able to visually deter



Hydro Model 700
Single-Point Application

Hydro chlorinator mounted on a single container with direct ejector to pipeline or basin. Chlorine capacity to 500 PPD (10,000 grams/hr).

⊙ Vent to safe outside location

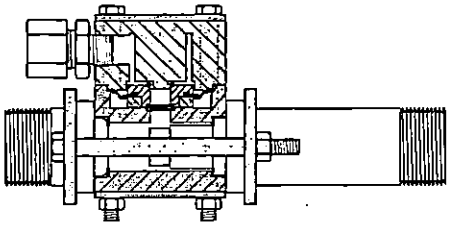


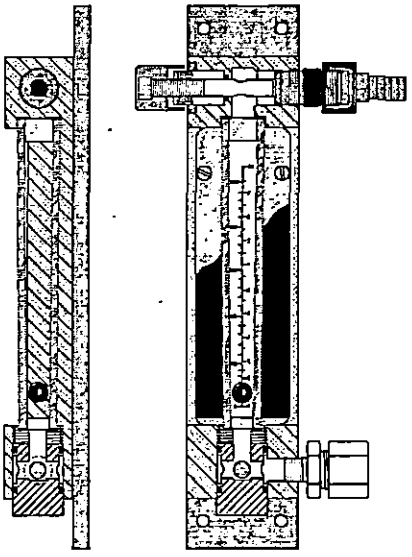
Hydro Model 701
Remote Meter for Single Point of Application

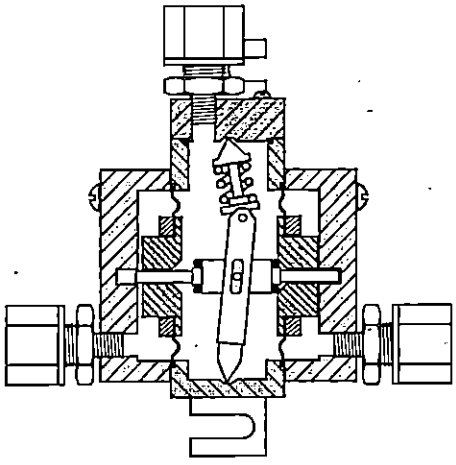
Hydro chlorinator mounted on a single container feeding a remote wall mounted meter with rate valve supplying a single ejector. Chlorine capacity to 500 PPD (10,000 grams/hr).

***The Series 750 is the same as the Series 700 but without the ton ironwork. The Series 750**

A complete system for totally reliable control







HYDRO EJ-5000 Ejector

The **Hydro** ejector utilizes a specially designed O-ring seal check valve which prevents the backflow of water into the chlorinator. The ejector operates on a venturi created by water passing through the ejector nozzle causing the spring opposed diaphragm check valve to open and mix the chlorine gas with the water. The ejector should be supplied with reasonably clean water at temperatures below 80°F (27°C). The **Hydro** ejector is made of durable materials that are resistant to wet and dry chlorine gas use.

HYDRO RM-701 Remote Meter

Any number of **Hydro** Remote Meters may be used in an installation if required. Only the vacuum line is required to the individual ejector which it supplies. Chlorine gas can then be precisely metered at each remote location. If more (or less) is required at one location the meter is simply set at the desired level for that location. By this control of metering at remote locations a perfectly balanced system can be maintained. **Hydro** Remote Meters are practically maintenance free. **Hydro** Remote Meters use a solid silver rate valve. Flow meters are accurate to ±4%.

HYDRO SW-500 Automatic Switchover

Multiple chlorine containers, which prolong the time span before depletion, are easily installed and automatically switch over from a depleted container to the unused container. A **Hydro** Chlorinator is installed on each container and only one Automatic Switchover is required to handle the two containers. The **Hydro** Automatic Switchover can be used with either one remote meter or with two or more remote meters. Use of this switchover module is a great time saver and is a great aid in assuring a more constant supply of chlorine. Once installed, the **Hydro** Automatic Switchover is completely automatic and needs no adjustment or setting.

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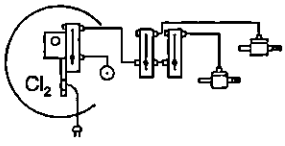
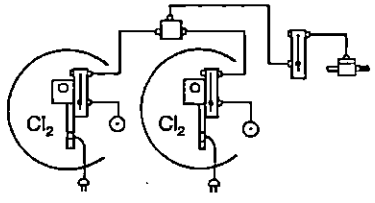
rs that have a remote meter without a rate valve ("plugged") on the
d"), however it will not be possible to measure the chlorine feed rate
nine which unit is regulating the chlorine supply.



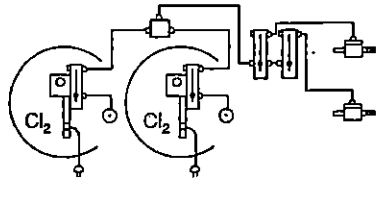
Hydro Model 701-2
Multi-Point Application

Hydro chlorinator mounted on a single container feeding two remote meters for two points of injection using two ejectors. Each meter and ejector operates independently. Chlorine capacity to 500 PPD (10,000 grams/hr).



Hydro Model 702
Automatic Stand-By

Hydro chlorinators – two chlorinators mounted on two containers with switchover module feeding one remote meter with rate valve feeding a single ejector. Capacity to 500 PPD (10,000 grams/hr) maximum.



Hydro Model 702-2
Automatic Stand-By with Multi-Point Feeding

Hydro chlorinators – two chlorinators mounted on two containers with switchover module feeding two or more remote meters with rate valves supplying two ejectors. Capacity to 500 PPD (10,000 grams/hr) maximum.

chlorinator comes complete with a yoke assembly and is used for manifold mounting.

Series 700 and 750
GAS CHLORINATORS

The installation of **Hydro Gas Chlorinators** is easily accomplished. The following will be useful information.

System Operating Temperatures

For best operation and safety, the chlorinator and chlorine supply should be protected from the elements and from direct sunlight.

Methods of Control

Manual

Adjustment of rate valve and start/stop of water to ejector.

Semi-Automatic

- Shutting off booster pump to ejector.
- Using solenoid valve to close vacuum line to ejector.

Step-Feed to multiple flow meters is available using solenoid valves in the vacuum line or water line to the ejector.

STANDARD TUBING CONNECTIONS

Vacuum Tubing Size				Vent
Feed Rate		Length of Tubing		
PPD	Gr/Hr	100 Feet (30m)	200 Feet (60m)	25 Feet (7.5m)
50	1000	3/8" (9.52mm)	3/8" (9.52mm)	3/8" (9.52mm)
100	2000	3/8" (9.52mm)	1/2" (12.7mm)	3/8" (9.52mm)
200	4000	1/2" (12.7mm)	5/8" (15.8mm)	3/8" (9.52mm)
500	10,000	5/8" (15.8mm)	3/4" (19mm)	3/8" (9.52mm)

ACCESSORY EQUIPMENT AVAILABLE

- Loss of Chlorine Alarm
- Multiple Remote Flow Meters and Ejectors
- Inlet Water Assemblies
- Automatic Switchover System
- Booster Pumps
- Gas Masks
- Analyzers
- Leak Detectors

CHLORINE WITHDRAWAL RATE from Horizontal Ton Container

Maximum Chlorinator Withdrawal Capacity		Minimum Ambient Temperature	
PPD	gr/hr	°F	°C
500	10,000	40	4
250	5000	16	-9
150	3000	0	-18
100	2000	-6	-21
50	1000	-20	-29

Ejector Installation

1. Ejector connections must be kept above freezing temperatures.
2. At point of application maximum back pressure for standard ejector is 100 psig. (High pressure ejectors are available.)
3. Long solution lines from ejector should be avoided and if not, solution lines must be of adequate ID to reduce friction loss.
4. To create a vacuum the water supply to the ejector inlet must be higher than the pressure at the point of application (approximately 40 psig differential).
5. Maximum ejector operating temperature is 110° F (43° C).
6. Ejector may be wall mounted for remote applications.

Series No.	(PPD) Maximum Capacity	Mounting
500 Series	100 PPD (2000 gr/hr)	150 lb. cylinder, manifold*, or ton container
200 Series	200 PPD (4000 gr/hr)	150 lb. cylinder, manifold*, or ton container
700 Series	500 PPD (10,000 gr/hr)	Ton container
750 Series	500 PPD (10,000 gr/hr)	Manifold

* For manifold units there is the additional cost of wall mounting manifolds.

Hydro Model EJ-5000 (500 PPD) Ejector Connections

	Standard	Options
Ejector Water Inlet (Nozzle)	EN-296 Nozzle for 1 1/4" NPT	EN-275 Nozzle for 1 1/4" NPT
Ejector Water Outlet (Diffuser)	EDH-560 Diffuser for 1 1/2" ID Hose	EDT-560 Diffuser for 1 1/4" NPT

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PROUDLY MADE IN USA ISO 9001 Certified

600 Emlen Way, Telford, PA 18969 • Telephone: (215) 799-0980 • Fax: (215) 799-0984
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BULLETIN 700/750 Rev. 6/10

Vacuum Regulators

Hydro Instruments manufactures many different designs of vacuum regulators. Some of the most common configurations are shown in the following table. Other designs and configurations are available. Please review our website for more information.

750

- 10 kg/hr
- Optional flow meter
- Optional direct ton container mounting

750W-DL

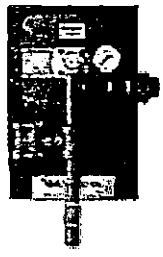
- 10 kg/hr
- Optional flow meter
- Wall-mounted
- Optional drip leg and heater
- Diaphragm protected pressure gauge

SVR-500-CL2

- 10 kg/hr
- Integral vacuum switchover design
- Optional flow meter (5 kg/hr maximum)
- Wall-mounted
- Optional direct ton container mounting

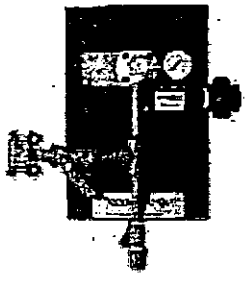
VRH-2000-CL2

- 40 kg/hr
- Drip leg and heater
- 3/4" Steel Union Inlet
- 1" PVC Union Outlet
- Diaphragm protected pressure gauge
- Optional flow indication tube



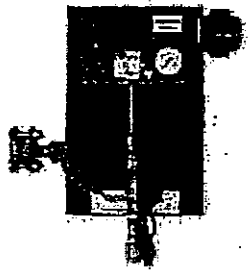
VRH-8000-CL2

- 150 kg/hr
- Drip leg and heater
- 3/4" Steel Union Inlet
- Y-Strainer Inlet Filter
- 1.5" PVC Union Outlet
- Diaphragm protected pressure gauge
- Optional flow indication tube



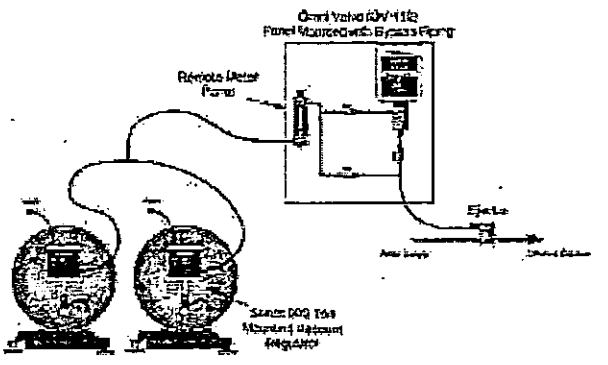
VRH-10000-CL2

- 200 kg/hr
- Drip leg and heater
- 3/4" Steel Union Inlet
- Y-Strainer Inlet Filter
- 2" PVC Union Outlet
- Diaphragm protected pressure gauge
- Optional flow indication tube

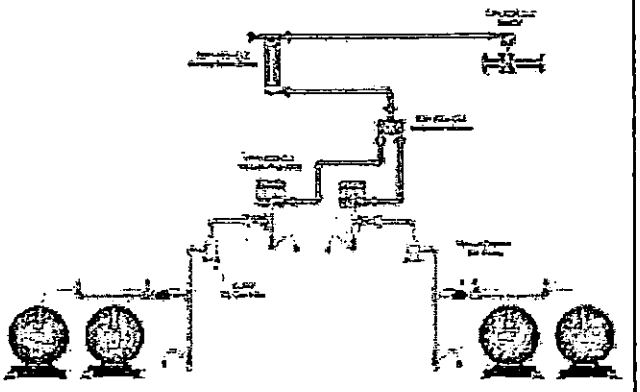
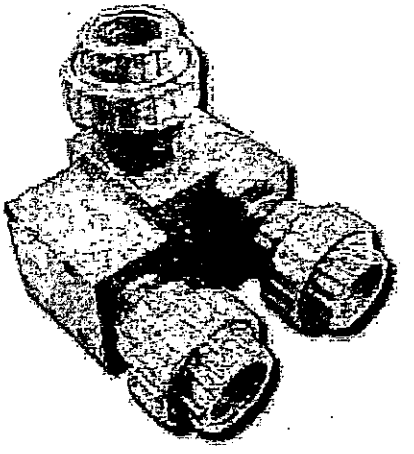


1c. Changeover Equipment: Hydro Instruments offers three types of automatic changeover equipment. The function of this equipment is to automatically switch the chlorine gas supply to the standby manifold when the duty manifold containers are empty.

i. **Vacuum Switchover by integral switchover vacuum regulators (Series 900):** This equipment is only available for feed rates up to 10 kg/hr (500 PPD). The Series 900 vacuum regulator design offers automatic switchover based on the high vacuum condition that occurs when the duty chlorine containers are going empty. Once the duty containers are nearly empty, the vacuum level in the system will increase and cause the standby vacuum regulator to switch automatically into the feeding position. The advantage of this system is its simplicity and low cost.

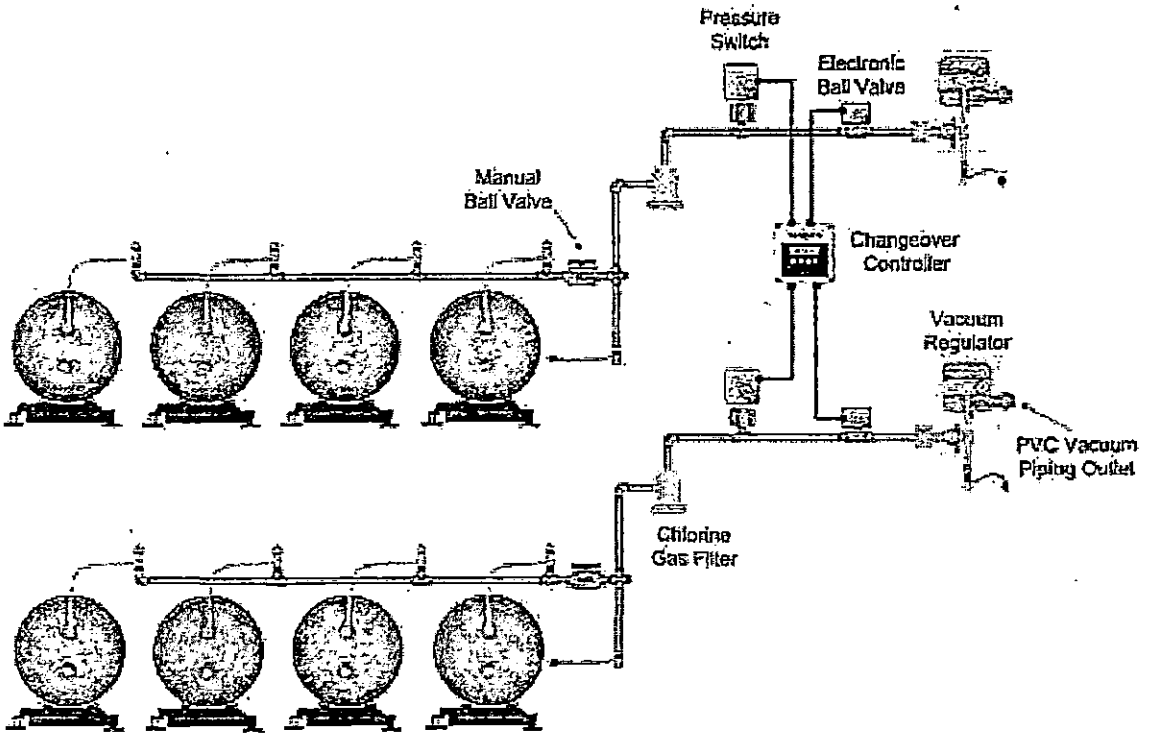
Series 900 System (10 kg/hr)	Series 900 Vacuum Regulator
	

ii. **Vacuum Switchover Modules:** The operation of the vacuum switchover is also based on the rising vacuum level that accompanies the duty manifold ton containers going empty. The switchover module includes a spring loaded mechanism and two diaphragm assemblies. The advantage of this type of switchover mechanism is again the simplicity and relatively low cost.

Model 3105C System (20 kg/hr)	SOH-4000-CL2 (80 kg/hr max.)
	

iii. **Electronic Changeover System (Series CV-100):** The Hydro Instruments Series CV-100 automatic changeover system is designed to allow continuous supply of chlorine gas when using a duty/standby gas container system layout.

Figure 5: Series CV-100 Electronic Changeover System



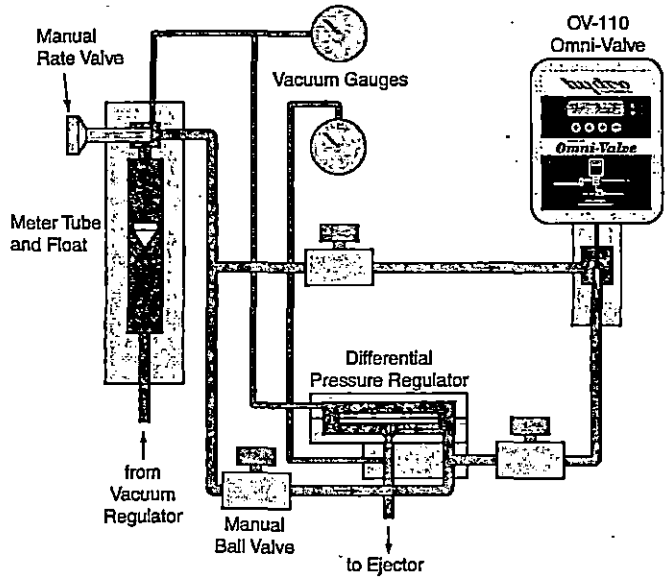
The system consists of a dedicated controller Model CV-100 designed for this application, two pressure switches, and two electronically actuated ball valves. In normal operation, the Model CV-100 controller will keep one of the ball valves open (duty) and the other closed (standby). Upon receiving a low pressure alarm relay signal indicating that the duty gas supply source is nearly depleted, the controller will close the duty ball valve and open the standby ball valve. After such a changeover event, the operator will be required to silence the changeover alarm, change the empty containers, and then acknowledge the container empty alarm.

The Model CV-100 controller also can be used to manually change which ball valve is in operation and to shut down both valves simultaneously. The Model CV-100 controller records the time that each ball valve has been in the duty condition and displays the time of day, day of the week and date of the year on the screen. LEDs on the controller also indicate operation and container empty status for both sides.

Section 2 – Feed Rate Control: This section of the equipment consists of a rotameter type flow meter, manual control valve, automatic control valves and other optional equipment.

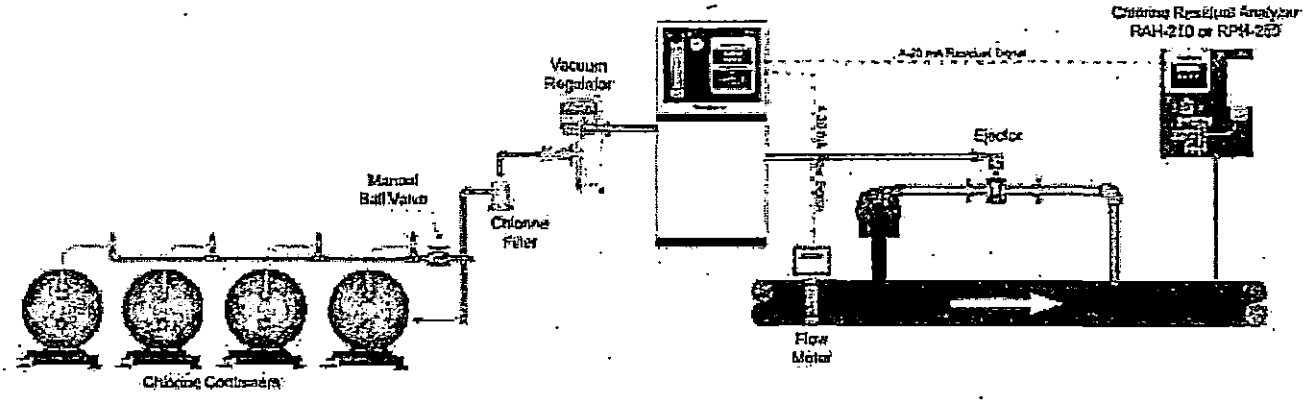
Between the vacuum regulator and the ejector, the chlorine gas flows under vacuum. A chlorine gas flow meter is installed in this section of the system to give a visual indication of the chlorine gas feed rate. Each gas chlorination system will have a manual rate control valve installed after the flow meter tube. An automatic control valve can also be installed in between the flow meter tube and the ejector. Differential pressure regulators, vacuum gauges, vacuum alarms etc. are optional.

Figure 6: Feed Rate Control Equipment



Control Type: The goal of a chlorine gas system is to inject chlorine into the water at a rate that will maintain a desired residual level in the treated process water. Therefore, as the water flow rate and the water quality change, the chlorine feed rate must also be adjusted accordingly to maintain the desired residual in the treated process water. Manual feed rate control can be used in systems where the process water flow and the water quality are both constant. If the water flow rate or water quality are variable, then it is best to use an automatic control system.

Figure 7: Automatic Control System (Compound Loop Control)

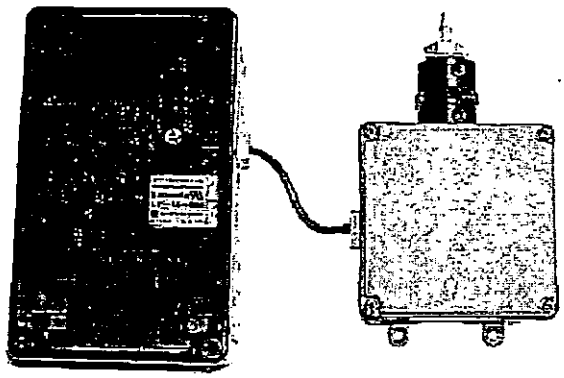


VM-150 Vacuum Monitor

The VM-150 vacuum monitor is 100% electronic, full featured monitoring system with a three digit digital readout. The system utilizes the latest in integrated sensor technology that results in improved accuracy, reliability, versatility , and chemical compatibility. All monitors come standard with an analog output for connection to local monitoring equipment.

The VM-150 comes standard with an oil based protection device that allows direct contact with many gases and liquids including chlorine and sulfur dioxide.

This unit has three alarm relays. One low alarm, one high alarm and one latch relay. All relays are general purpose NO/NC type. These relays give the end user many options on how to respond to an alarm condition.



Specifications & Features

- Input Voltage
  - 115V 60 Hz, 0.1 AMPS
  - 230V 50 Hz, 0.1 AMPS
- Alarm Relays
  - 120V @ 5 AMPS
  - 240V @ 5 AMPS
- NEMA 4X Enclosure
- 1 - 100 Second Alarm Delay
- Temperature Range: -20 - 50 C
- Three Digit LED Digital Readout
- Analog Output: 0 - 30V DC, 0 - 3.0 mA
- One Year Warranty
- Water Tight Fittings
- Three Alarm Relay Outputs:
  1. One NO/NC High
  2. One NO/NC Low
  3. One NO/NC Latch
- Independently Adjustable High/Low Trip Points
- LED Indicator for High/Low Latch Alarm
- IP65 External Latch Alarm Reset Switch

Ordering Information

Model #	Range	Low Alarm	High Alarm	Pressure	Gauge Guard
VM-150-115	0-30 in. Hg	0-15 in. Hg	15-30 in. Hg	30 PSI	Oil
VM-150-230	0-30 in. Hg	0-15 in. Hg	15-30 in. Hg	30 PSI	Oil

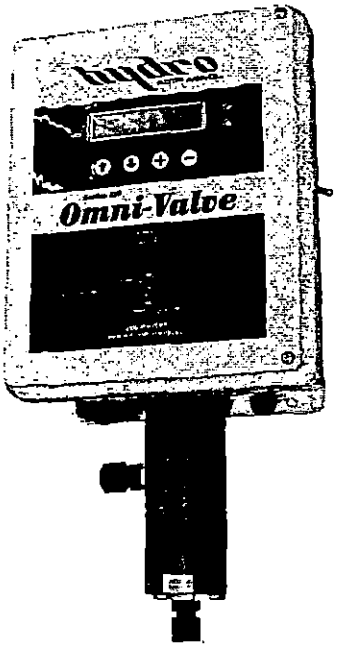
Hydro Instruments 600 Emlen Way Telford, PA 18969 Phone: 215.799.0980 Fax: 215.799.0984 Email: sales@hydroinstruments.com Web Address: www.hydroinstruments.com

Series 110
Omni-Valve

The valve that does it all...

- **Excellent Accuracy and Repeatability**
- **Maximum Versatility**
- **Remote adjustment and monitoring**
- **Gas or Liquid Metering**
- **Designed for Minimal Wear and Long Life**

With the capability of operating in eight different control modes, handling a wide range of chemicals, covering a wide range of capacities and having a multitude of control options, adjustable features and settings, the Hydro Instruments Omni-Valve is truly an all-in-one automatic control valve for chemical feed.



Control Options (all standard)

Manual Control
Proportional (Flow) Control
Set Point (Residual) Control
Set Point (ORP) Control
Compound Loop (PID) Control
Step Feed Rate Control
Dual Input Feed Forward Control
Dual Set Point Control

Control modes are field selectable and can be changed at any time.

Highlighted Features

2 x 20 Character Liquid Crystal Display
Modbus Communication (RS-485)
3 Analog Inputs
(Flow, Residual and Remote Dosage)
Adjustable: Dosage, Set Points, Lag Time, Signal Filters, Display Ranges, Alarms & More
Linear Operation Eliminates Rotary Drive Gears & All Rotating Motion
Broad Range of Chemicals & Capacities
Two 4-20 mA Outputs
Password Protected Settings

Because of Hydro Instruments' innovative approach to manufacturing, the ***Omni-Valve*** is the industry's first true directly linear drive control valve design. This linear design provides vast improvements over problematic rotary-driven valves. The ***Omni-Valve*** is the industry leader in terms of offering 8 different control modes (all standard) and a wealth of flexible settings and features. Our state-of-the-art microprocessor technology, highest quality materials of construction, precision machining and a minimal number of moving parts combine to make the ***Omni-Valve*** extremely reliable over long periods of continuous operation and truly the best automatic control valve available on the market.

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BULLETIN OV-110 Rev. 5/13

Series 110 Omni-Valve

OV-110 Ordering Information

Model: OV-110 - ____ - ____ - ____ - ____ - ____ - ____ - ____ - ____

MAXIMUM CAPACITY
1. 500 ppd (10 kg/hr)
2. 2000 ppd (40 kg/hr)
3. 6000 ppd (120 kg/hr)

GAS OR LIQUID
A. Ammonia (NH_3)
B. Sodium Bisulfite ($NaHSO_3$)
C. Chlorine (Cl_2)
S. Sulfur Dioxide (SO_2)
H. Sodium Hypochlorite (NaOCl)
Other: Consult Factory

RANGE
1. 10 ppd (200 gr/hr)
2. 25 ppd (500 gr/hr)
3. 50 ppd (1 kg/hr)
4. 100 ppd (2 kg/hr)
5. 250 ppd (5 kg/hr)
6. 500 ppd (10 kg/hr)
7. 1000 ppd (20 kg/hr)
8. 2000 ppd (40 kg/hr)
9. 3000 ppd (60 kg/hr)
10. 4000 ppd (80 kg/hr)
11. 6000 ppd (120 kg/hr)

Note: For liquid use please specify the desired max capacity.

POWER REQUIREMENTS
1. 120V 60Hz
2. 240V 50Hz

CONTROL CONFIGURATION
1. Flow Pacing
2. Residual
3. ORP
4. Compound Loop (Residual)
5. Compound Loop (ORP)
6. Step Feed
7. Dual Input Feed Forward
8. Dual Set Point

POWER CABLE LENGTH
1. 6 feet (1.5 m) standard
2. Other (consult factory)

SIGNAL CABLE LENGTH
1. 25 feet (8 m) per input channel
2. Specify length required

POWER LINE ISOLATOR
1. None (standard)
2. Included

Capacity Ranges	
Gas Feed	10, 25, 50, 100, 250, 500, 1000, 2000, 3000, 4000, & 6000 PPD
Liquid Feed	4 GPH through 10 GPM

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BULLETIN OV-110 Rev. 5/13

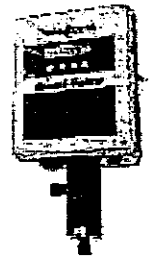
Automatic Control Valves

Hydro Instruments offers two different automatic control valves with the below listed general specifications. The Model 0V-110 offers complete Compound Loop (PID) control capabilities, while the CV-230 is more economical in price for applications that only require proportional control. Both valves use the same 10 point linearization process and automatic self calibration checking. These valves can be provided on wall panels or in floor cabinets.

CV-230

- Flow Pacing Control Only
- One 4-20mA Input Channel
- One Relay Alarm Output
- Two 4-20mA Output Channels
- 120 kg/hr maximum capacity (Cl_2)
- 2 line, 20 character LCD Display
- Linear Stepper Motor

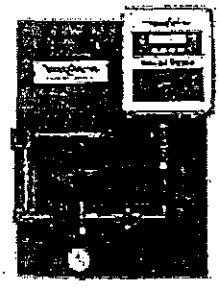
OV-110



- Flow, Residual, Compound Loop & Step Feed
- Three 4-20mA Input Channels
- Four Relay Input Channels (step feed)
- One Relay Alarm Output
- Two 4-20mA Output Channels
- 120 kg/hr maximum capacity (Cl_2)
- 2 line, 20 character LCD Display
- Linear Stepper Motor

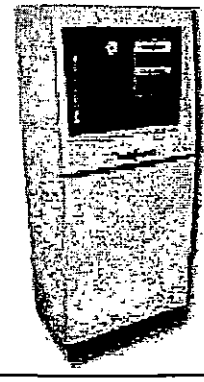
Wall Panel

Hydro Instruments offers prefabricated and tested wall panel mounted chlorine gas feed rate control panels in a variety of configurations. An example of the most common configuration with Model 0V-110 Omni-Valve, bypass piping with true union ball valves, and remote meter with rate valve is shown here. Such wall panels can be provided with vacuum gauges, differential pressure regulators, high/low vacuum alarms, etc.



Floor Cabinet

Hydro Instruments offers prefabricated and tested free standing floor cabinets with a variety of optional features to chose from. Floor cabinets offer a convenient and aesthetic appearance for mounting the control and indication equipment for each chlorine gas feed point. Floor cabinets house the automatic control valve (CV-230 or OV-110), the flow meter tube and manual rate valve, and at least one vacuum gauge with diaphragm protection. Optional equipment includes a second vacuum gauge, high/low vacuum alarm, and differential pressure regulator.



Differential Pressure Regulators

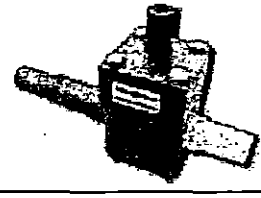
Recommended for feed rates 40 kg/hr and higher
Not necessary for 10 kg/hr and below
Used for stabilizing rotameter indicator float

Will install DP-500

Section 3 – Ejectors: This section creates the vacuum that operates the system and mixes the chlorine gas with the water.

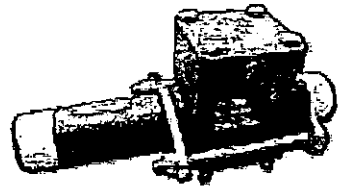
High velocity water flow through the ejector venturi nozzle creates the vacuum that operates the gas chlorination system. Chlorine gas feed is stopped by stopping the water flow to the ejector. When the system is not operating and there is no water flow through the ejector nozzle, there will be no vacuum. Each ejector includes at least one check valve to prevent water from flowing back into the gas chlorination equipment when the system is turned off. Hydro Instruments manufactures a variety of different ejector designs. Refer to the nozzle performance charts and curves that can be found in the Hydro Instruments instruction manuals to consider the water flow and pressure requirements for each ejector. In general, several nozzles are available for each ejector. A list of common ejectors is given here.

EJH-142-CL2, EJH-242-CL2, EJH-542-CL2



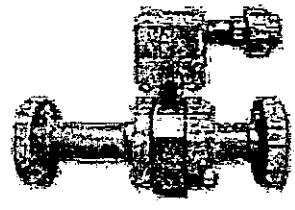
- 10 kg/hr Maximum Capacity
- ¾" NPT (2 kg/hr)
- 1¼" NPT (5 & 10 kg/hr)
- 10 kg/cm² (standard b.p.)
- 20 kg/cm² (high b.p. option)
- Check Valve without diaphragm

EJ-1000, EJ-2000, EJ-5000



- 10 kg/hr Maximum Capacity
- ¾" NPT (2 kg/hr)
- 1¼" NPT (5 & 10 kg/hr)
- Double Check Valve option available
- 10 kg/cm² (standard b.p.)
- 20 kg/cm² (high b.p. option)
- Diaphragm Check Valve

EJH-2000-CL2 and EJH-3000-CL2

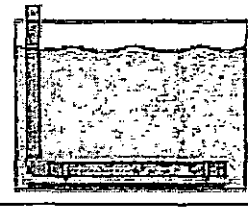


- 120 kg/hr Maximum Capacity
- 2" Flanged and 3" Flanged sizes
- 10 kg/cm² (maximum b.p.)
- Diaphragm Check Valve

The water exiting the ejector contains highly concentrated chlorine solution. Hydro Instruments manufactures a variety of diffusers and corporation stop assemblies that can be used to conveniently and safely inject this solution into the process stream. Secondary check valves are also available for greater protection against water backflow during system stop conditions.

Open Channel Diffusers

Provides more effective mixing in open channels and contact chambers ½" through 4" pipe diameter. Every unit is custom-built: pipe size, length, hole diameter, hole quantity, hole spacing and inlet connection.



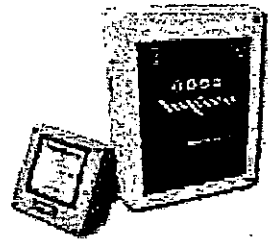
Spray Diffusers and Corporation Stops

Prevents corrosion of the solution & process piping and provides better mixing in the process line. Corporation stops are designed to allow removal of the diffuser while the process pipe remains pressurized. Available in a range of sizes and materials.

Gas Leak Detectors

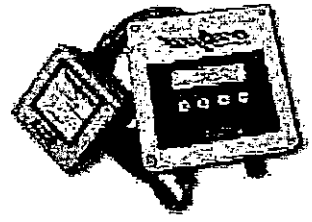
Hydro Instruments manufactures two series of gas leak detection equipment. Both series use the same sensors and therefore offer detection of the same set of gases. Sensors are available for Cl_2, SO_2, NH_3, O_3, ClO_2, H_2S, CO_2, H_2, O_2, NO, NO_2, & HCl. The general specifications are shown here below.

GA-170



- 1 to 4 sensors per monitor
- 2 line, 16 character display
- Integral 90 dB audible alarm
- Optional battery backup
- 6 adjustable relay outputs
- 2 LED indicators per sensor
- RS-232 and 4-20mA outputs

GA-171

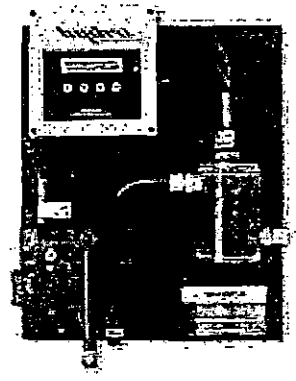


- 1 to 2 sensors per monitor
- 2 line, 16 character display
- 1 adjustable common relay output
- 2 LED indicators per sensor
- RS-232 and 4-20mA outputs

Residual Analyzers

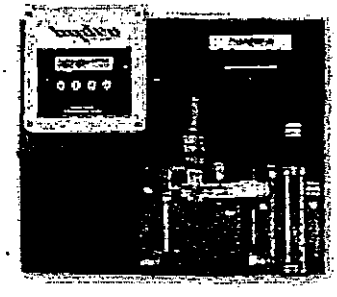
Hydro Instruments produces two series of residual analyzers for online measurement. Both instruments utilize the amperometric method of measurement. The Series RAH-210 incorporates an open flow cell design with large electrode surface area and continuous motor driven cleaning for rugged operation. The Series RPH-250 incorporates a semipermiable membrane and electrolyte design.

RAH-210



- Free Chlorine, Total Chlorine, & ClO_2
- Continuous Self Cleaning
- PID controller included
- One 4-20mA input channel
- Two 4-20mA output channels
- One alarm relay output
- 2 line, 20 character display
- 2 LED indicators
- RS-232 output
- Temperature Sensor
- Optional pH probe
- Optional Buffer Chemical Feed Systems
- Optional pH Compensation in software

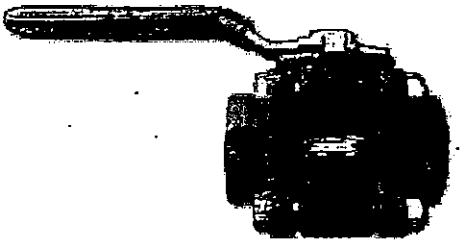
RPH-250



- Free Chlorine & ClO_2
- PID controller included
- One 4-20mA input channel
- Two 4-20mA output channels
- One alarm relay output
- 2 line, 20 character display
- 2 LED indicators
- RS-232 output
- Temperature Sensor
- Optional pH probe
- Optional pH Compensation in software

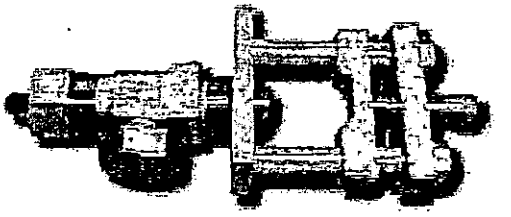
Additional Gas Chlorination Equipment

Chlorine Service Ball Valves



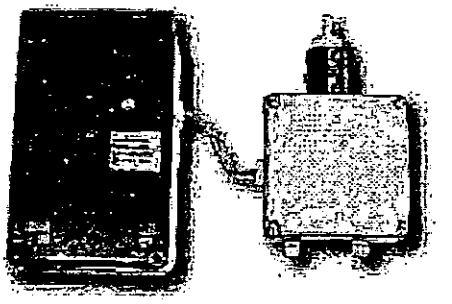
- Manual and electronic with a range of connection sizes. Teflon seals and Carbon Steel housings. Optional Monel or Hastelloy C ball and stem.

Isolation Valve Assemblies



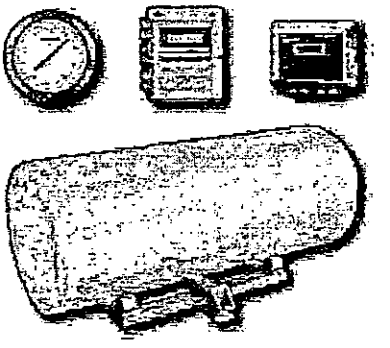
- Eliminate the stress on flexible connectors during cylinder changes. Increase the safety and convenience of changing chlorine containers.

Vacuum Monitor



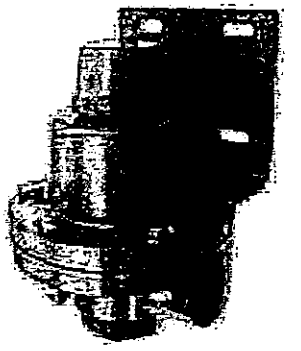
- Continuously monitor the chlorine gas vacuum level with digitial display. Adjustable high and low alarm relays. Specifically designed for chlorine gas application.

Chlorine Container Scales



- Used for monitoring and recording chlorine supply and usage. Electronic and hydraulic scales are available from Hydro Instruments in a variety of configurations. Scale sets are available for weighing the contents of one, two or more chlorine containers simultaneously.

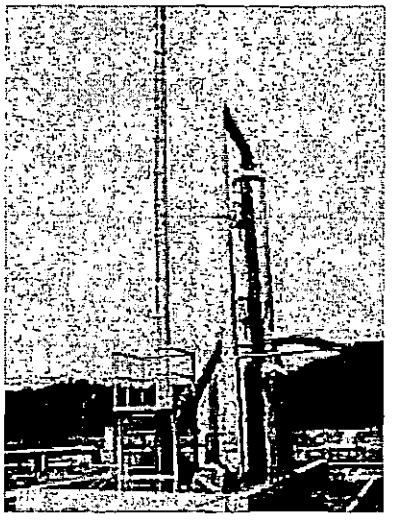
Pressure Reducing Valve



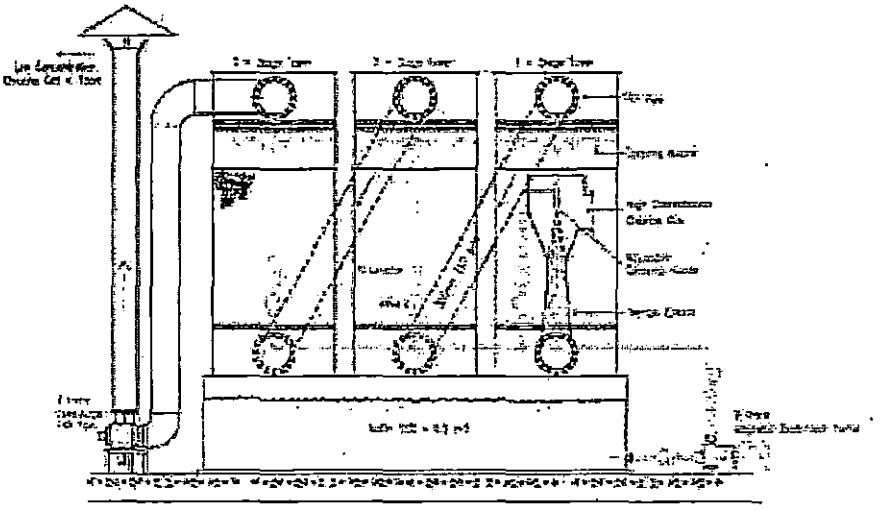
- The Hydro Instruments Series PRV-71H Pressure Reducing Valve is used to reduce and control the gas pressure downstream of the valve. The PRV-71H is designed for chlorine or sulfur dioxide gas service.

Chlorine Leak Absorption Systems

The chlorine scrubber system operation is activated by an alarm relay signal from a gas leak detector. Chlorine storage room air is drawn into the scrubber system where the chlorine is chemically extracted before exhausting the cleaned air to the outside environment. Chlorine scrubber systems are available from Hydro Instruments and our sales representatives in a variety of configurations and sizes.



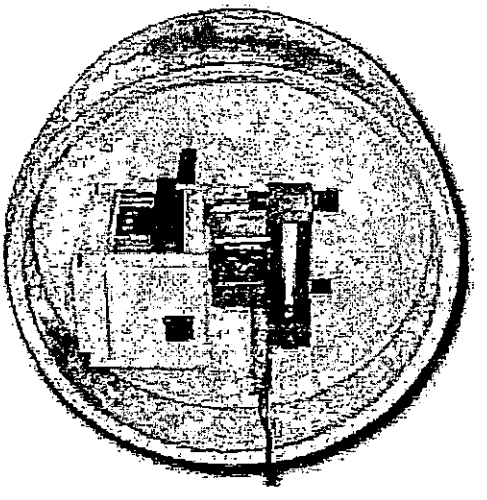
SINGLE STAGE SCRUBBER



3 STAGE SCRUBBER

Emergency Shut-Off Systems

These systems are activated by an alarm relay signal from a gas leak detector. A valve closure acutator (shut-off device) is mounted directly on the chlorine container valve. In the event of a leak, the device will close all of the chlorine container valves immediately to stop the leak. Emergency shut-off systems are available from Hydro Instruments and our sales representatives in a variety of configurations and sizes.

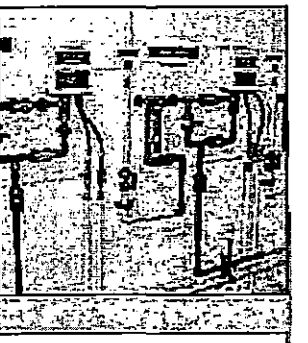


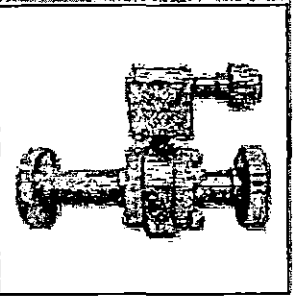
Contact us:

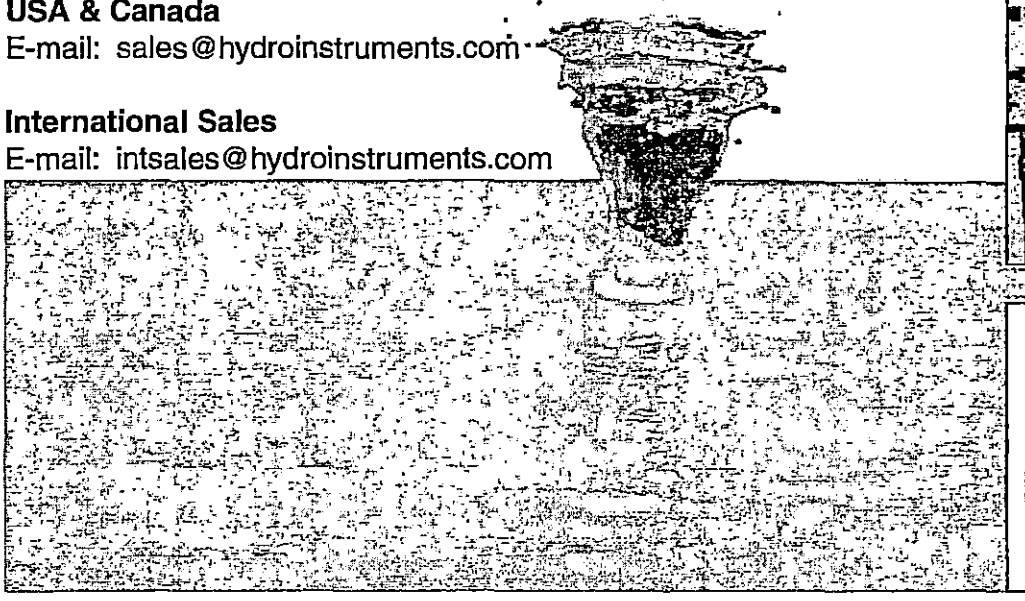
Hydro Instruments
600 Emlen Way
P.O. Box 387
Telford, PA 18969 USA
TEL: 215-799-0980
FAX: 215-799-0984
Website: http://www.hydroinstruments.com/

USA & Canada
E-mail: sales@hydroinstruments.com

International Sales
E-mail: intsales@hydroinstruments.com







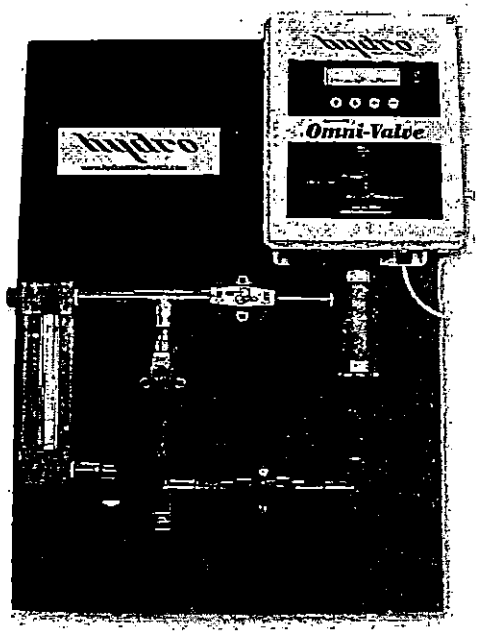
Represented by:

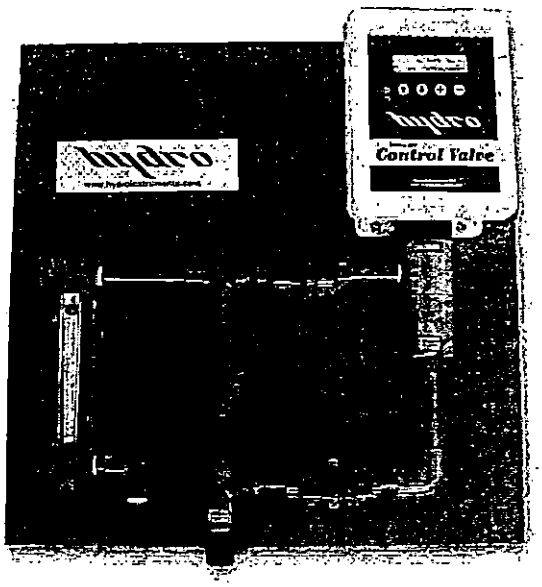
Wall Panel Series
Panel Mounted Products

Wall Panel Series

The Wall Panel Series offers the ability to panel mount the OV-110 and CV-230 automatic feed rate control valves offered by Hydro Instruments.

- Wall panel mounting simplifies the installation process providing easy access to the equipment for operation and maintenance. Panel mounting minimizes the equipments footprint which conserves space and eliminates the use of cabinets.
- Every panel is constructed from the highest quality "high density polyethylene" plastic and schedule 80 PVC piping. Panels are available in standard sizing for the most common configurations. Custom panels are also available. The bypass piping and valve arrangements allows for simple manual feed control whenever maintenance or calibrations are needed on the control valve.





OV-110 Control Options (all standard)

Manual Control
Proportional (Flow) Control
Set Point (Residual) Control
Set Point (ORP) Control
Compound Loop (PID) Control
Step Feed Rate Control
Dual Input Feed Forward
Dual Set Point Control

Control modes are field selectable and can be changed at any time.

OV-110 Highlighted Features

2 x 20 Character Liquid Crystal Display
Modbus Communication (RS-485)
3 Analog Inputs (Flow, Residual and Remote Dosage)
Adjustable: Dosage, Set Points, Lag Time, Signal Filters, Display Ranges, Alarms & More
Linear Operation Eliminates Rotary Drive Gears & All Rotating Motion
Broad Range of Chemicals & Capacities
Two 4-20 mA Outputs
Password Protected Settings
External control of: Duty/Standby & Auto/Manual

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BULLETIN WP Rev. 5/13

Custom Configurations and Options

Wall Panel Series 110 Omni-Valve Order Information

Model: WPOV-110 – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____ – ____
A B C D E F G H I J K

Position	Feature	Description
A. MAXIMUM CAPACITY	1	500 ppd (10 kg/hr):
	2	2000 ppd (40 kg/hr):
	3	6000 ppd (120 kg/hr):
B. GAS OR LIQUID	A	Ammonia (NH_3)
	B	Sodium Bisulfite ($NaHSO_3$)
	C	Chlorine (Cl_2)
	S	Sulfur Dioxide (SO_2)
	H	Sodium Hypochlorite (NaOCl)
	Other	Consult Factory
C. FLOW METER CAPACITY *Note: For liquid use please specify the desired max capacity.*	1	10 ppd (200 gr/hr)
	2	25 ppd (500 gr/hr)
	3	50 ppd (1 kg/hr)
	4	100 ppd (2 kg/hr)
	5	250 ppd (5 kg/hr)
	6	500 PPD (10 kg/hr)
	6A	500 PPD (10 kg/hr) RM-702 *RM-702 Rate Valve Knob protrudes from front of meter*
	7	1000 ppd (20 kg/hr)
	8	2000 ppd (40 kg/hr)
	9	3000 ppd (60 kg/hr)
	10	4000 ppd (80 kg/hr)
	11	6000 ppd (120 kg/hr)
D. POWER REQUIREMENTS	1	120V 60Hz
	2	240V 50Hz
E. CONTROL CONFIGURATION	1	Flow Pacing
	2	Residual
	3	ORP
	4	Compound Loop (Residual)
	5	Compound Loop (ORP)
	6	Step Feed
	7	Dual Input Feed Forward
	8	Dual Set Point
F. POWER CABLE LENGTH	1	6 feet (1.5 m) standard
	2	Other (consult factory)
G. SIGNAL CABLE LENGTH	1	25 feet (8 m) per input channel
	2	Specify length required
H. 4-20 mA OUTPUT	1	Not Included
	2	Included
I. POWER LINE ISOLATOR	1	None (standard)
	2	Included
J. BYPASS PIPING ARRANGEMENT	1	None
	2	Up to 500 ppd (10 kg/hr)
	3	2000 ppd (40 kg/hr)
	4	3000 ppd (60 kg/hr)
	5	6000 ppd (80 kg/hr)
K. DIFFERENTIAL PRESSURE REGULATOR	1	None
	2	Up to 250 ppd (5 kg/hr)
	3	500 ppd (10 kg/hr)
	4	2000 ppd (40 kg/hr)
	5	3000 ppd (60 kg/hr)
	6	4000 ppd (80 kg/hr)
	7	6000 ppd (120 kg/hr)

NOTES:

1. Standard flow tubes for up to 250 PPD (5 kg/hr) are 3" length. For 6" flow tubes on Item C=1-5, add an "A" after this number (i.e., 3 becomes 3A).
2. Port sizes are as follows:
   - up to 250 PPD (5 kg/hr) has ¼" NPT
   - 500 PPD (10 kg/hr) has ½" NPT
   - 1000 & 2000 PPD (20 & 40 kg/hr) has 1" NPT
   - 3000, 4000, & 6000 PPD (60, 80, & 120 kg/hr) has 1:5" Socket

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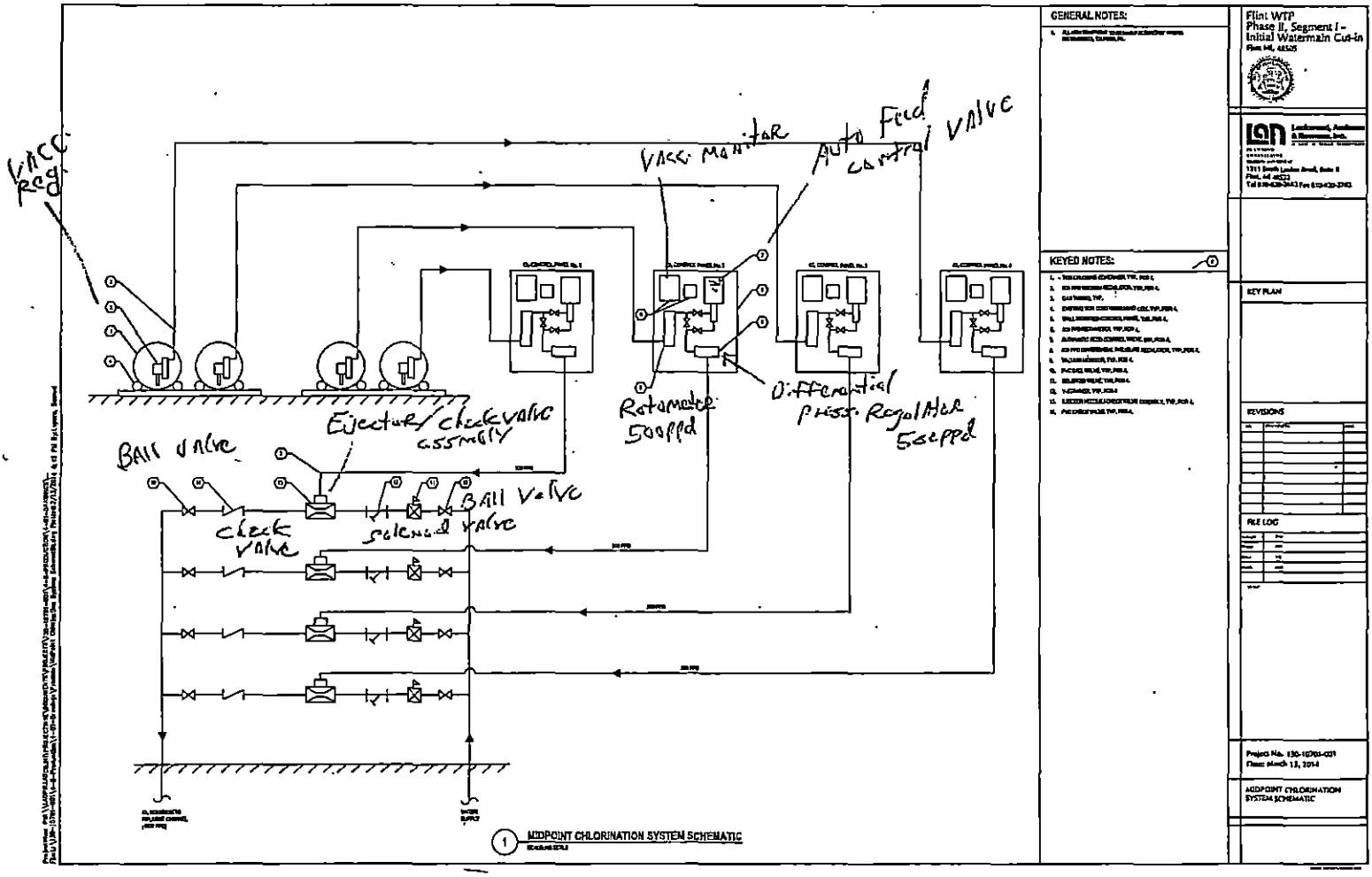
Affects that feeder
feed rate control - not make-up water
— piping not from tank to feeder?
— then from feed to make-up line?



Provide Full Size

OZONE CALCULATIONS

Flint WTP

OXYGEN AND NITROGEN SYSTEMS CAPACITIES

DATA LEGEND

REQUIRED DATA
FIXED DATA - DO NOT CHANGE UNLESS EQUIPMENT IS REPLACED
DATA SHOULD NOT CHANGE (MAY BE TWEAKED BASED ON OPERATIONAL RESULTS)
CALCULATION RESULTS

LOX SYSTEM (AVG DAY - AVG DOSE)	
PRESSURE RATING (psig)	175
OPERATING WT (lbs)	119,600
TARE WT (lbs)	33,000
EFFECTIVE VOLUME (lbs)	86,600
EFFECTIVE VOLUME (gals)	9,084
OXYGEN USAGE (ppd)	2833
OXYGEN GAS FLOW (scfm)	23.8
EFFECTIVE STORAGE (days)	30.6

9.53 LBS/GAL

LN SYSTEM (AVG DAY - AVG DOSE)	
PRESSURE RATING (psig)	250
OPERATING WT (lbs)	7,100
TARE WT (lbs)	3,800
EFFECTIVE VOLUME (lbs)	3,300
EFFECTIVE VOLUME (gals)	540
NITROGEN USAGE (ppd)	71
NITROGEN GAS FLOW (scfm)	0.7
EFFECTIVE STORAGE (days)	46.6

6.11 LBS/GAL

OPERATING CONDITIONS (AVG DAY)	
WATER PLANT FLOW (MGD)	10
OZONE DOSE (mg/l)	2.5
OZONE CONCENTRATION (%)	8
TRANSFER EFFICIENCY (%)	92
OZONE FEED RATE (ppd)	227

2833 ok

OPERATING CONDITIONS (MAX DAY)	
WATER PLANT FLOW (MGD)	18
OZONE DOSE (mg/l)	4
OZONE CONCENTRATION (%)	8
TRANSFER EFFICIENCY (%)	92
OZONE FEED RATE (ppd)	653

8159

STORAGE REQUIREMENTS		
DAYS @ AVG DAY - AVG DOSE	30	
LIQUID OXYGEN (lbs)	84986	
LIQUID NITROGEN (lbs)	2125	Use
NUMBER OF LOX TANKS	0.98	1
NUMBER OF LN TANKS	0.64	1

SUMMARY OF RESULTS

Based on Average Day Demand of 10 MGD and Average Dosage of 2.5 mg/L ozone at 8% concentration, a single 9,084 gallon LOX tank and a single 540 gallon LIN tank will provide the 30 days of storage. Two LOX tanks and two LIN tanks are provided for redundancy.

LOX AVG DAY FEED RATE: 2.5 mg/l * 10 * 8.34 = 208.5 ppd * 10 LBS CAP / 8 LBS LOX * 100/92 = 2833 LBS/DAY = 30.5 DAY

at 12 MGD → 340 LB/DAY OR 25 DAYS

NTP BOD MAX DAY FEED RATE: 3.5 * 18 * 8.34 * 100/8 * 100/92 = 8159 LBS/DAY

~~LIN → AVG DAY ... LBS/DAY~~

LN → 2833 * 0.025 = 71 ppd LN → 46 DAYS

@ 12 MGD → 85.2 PPD → 39 DAYS

at 12 MGD MAX 4.0 mg/l = 5440 LB/DAY

OR 16 DAYS

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT APPLICATION FOR WATER SUPPLY SYSTEMS

(CONSTRUCTION - ALTERATION - ADDITION OR IMPROVEMENT) AS DESCRIBED HEREIN

Required under the Authority of 1976 PA 399, as amended

This application becomes an Act 399 Permit only when signed and issued by authorized Michigan Department of Environmental Quality (DEQ) Staff. See instructions below for completion of this application.

1. **Municipality or Organization, Address and WSSN** that will own or control the water facilities to be constructed. This permit is to be issued to: City of Flint 4500 North Dort Highway Flint, MI 48505 **WSSN:** 02310	Permit Stamp Area (DEQ use only) MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY PERMIT NO. W 140026 APR 09 2014 EXAMINED AND APPROVED FOR COMPLIANCE WITH ACT 399, P.A. 1976	
2. **Owner's Contact Person** (provide name for questions): Contact: Brent Wright Title: Plant Supervisor Phone: 810-787-6537		
3. **Project Name** (Provide phase number if project is segmented): Flint WTP Phase II, Segment II - Lime Residual Disposal	4. **Project Location** (City, Village, Township): City of Flint	5. **County** (location of project): Genesee County

ISSUED UNDER THE AUTHORITY OF THE DIRECTOR OF THE DEPARTMENT OF ENVIRONMENT QUALITY

cc:

Issued by: _____

Reviewed by: Patrick Cook for MFP for Mike Prysby

☐ **If this box is marked see attached special conditions.**

Instructions: Complete items 1 through 5 above and 6 through 21 on the following pages of this application. Print or type all information except for signatures. Mail completed application, plans and specifications, and any attachments to the DEQ District Office having jurisdiction in the area of the proposed construction.

Please Note:

a. This **PERMIT** only authorizes the construction, alteration, addition or improvement of the water system described herein and is issued solely under the authority of 1976 PA 399, as amended.
b. The issuance of this **PERMIT** does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other DEQ permits, or approvals from other units of government as may be required by law.
c. This **PERMIT** expires two (2) years after the date of issuance in accordance with R 325.11306, 1976 PA 399, administrative rules, unless construction has been initiated prior to expiration.
d. Noncompliance with the conditions of this permit and the requirements of the Act constitutes a violation of the Act.
e. Applicant must give notice to public utilities in accordance with 1974 PA 53, (MISS DIG), being Section 460.701 to 460.718 of the Michigan Compiled Laws, and comply with each of the requirements of that Act.
f. All earth changing activities must be conducted in accordance with the requirements of the Soil Erosion and Sedimentation Control Act, Part 91, 1994 PA 451, as amended.
g. All construction activity impacting wetlands must be conducted in accordance with the Wetland Protection Act, Part 303, 1994 PA 451, as amended.
h. Intentionally providing false information in this application constitutes fraud which is punishable by fine and/or imprisonment.
i. Where applicable for water withdrawals, the issuance of this permit indicates compliance with the requirements of Part 327 of Act 451, Great Lakes Preservation Act.

6. **Facilities Description** – In the space below provide a detailed description of the proposed project. Applications without adequate facilities descriptions **will be returned.** SEE EXAMPLES BELOW. Use additional sheets if needed.

Improvements to the City of Flint Lime Sludge Lagoons at Bray Road to allow lime sludge from the the Flint WTP to be stored during the interim period when the plant will be treating Flint River water. The lagoons will not be needed for continuous use when the plant switches to treatment of raw water from the KWA Lake Huron Water Supply:

PHASE II, SEGMENT II - LIME RESIDUAL DISPOSAL (@BRAY ROAD):
* Plugging and abandonment of 8" inlet piping; construction of 306 LF of new 10" inlet piping; installation of bulkhead on existing outlet structure to prevent discharge to surface water.
* Clay Berm barrier improvements to separate concrete debris pile from lime sludge.
* Construction of new decant tower structure, 8" gravity sewer, and decant pump station (duplex submersible) with CO2 feed system for pH adjustment. Vortex impeller pumps (2) shall each be rated at 140 gpm at 22' TDH; CO2 feed consists of 6 ton storage tank, 15 pph pH controlled feed system, SS gas piping, and diffusers installed in the decant tower.
* Construction of approx. 3,800 LF of 6" HDPE decant forcemain and connection to existing City santiary sewer system.

EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES – EXAMPLES	
Water Mains	500 feet of 8-inch water main in First Street from Main Street north to State Street. **OR** 250 feet of 12-inch water main in Clark Road from an existing 8-inch main in Third Avenue north to a hydrant.
Booster Stations	A booster station located at the southwest corner of Third Avenue and Main Street, and equipped with two, 15 Hp pumps each rated 150 gpm @ 200 feet TDH. Station includes backup power and all other equipment as required for proper operation.
Elevated Storage Tank	A 300,000 gallon elevated storage tank located in City Park. The proposed tank shall be spherical, all welded construction and supported on a single pedestal. The tank shall be 150 feet in height, 40 feet in diameter with a normal operating range of 130 – 145 feet. The interior coating system shall be ANSI/NSF Standard 61 approved or equivalent. The tank will be equipped with a cathodic protection system, and includes a tank level control system with telemetry.
Chemical Feed	A positive displacement chemical feed pump, rated at 24 gpd @ 110 psi to apply a chlorine solution for Well No. 1. Chlorine is 12.5% NaOCL, ANSI/NSF Standard 60 approved and will be applied at a rate of 1.0 mg/l of actual chlorine.
Water Supply Well	Well No. 3, a 200 foot deep well with 170 feet of 8-inch casing and 30 feet of 8-inch, 10 slot screen. The well will be equipped with a 20 Hp submersible pump and motor rated 200 gpm @ 225 feet TDH, set at 160 feet below land surface.
Treatment Facilities	A 5 million gpd water treatment plant located at the north end of Second Avenue. The facility will include 6 low service pumps, 2 rapid mix basins, 4 flocculation/sedimentation basins, 8 dual media filters, 3 million gallon water storage reservoir and 6 high service pumps. Also included are chemical feed pumps and related appurtenances for the addition of alum, fluoride, phosphate and chlorine.

General Project Information – Complete all boxes below.

7. Design engineer's name, engineering firm, address, phone number, and email address:

Jeremy N. Nakashima, PE
Lockwood, Andrews & Newnam, Inc.
1 Oakbrook Terrace, Suite 207
Oakbrook Terrace, IL 60181
630-495-4123 / jnnakashima@lan-inc.com

8. Indicate who will provide project construction inspection:
☒Organization listed in Box 1.
☒Engineering firm listed in Box 7.
☐Other - name, address, and phone number listed below.

9. Is a basis of design attached?
☒YES ☐NO

If no, briefly explain why a basis of design is not needed. Submitted previously under separate cover.

10. Are sealed and signed engineering plans attached?
☒YES ☐NO

If no, briefly explain why engineering plans are not needed. Plans and specs submitted previously under separate cover.

11. Are sealed and signed construction specifications attached?
☒YES ☐NO

If specifications are not attached, they need to be on file at DEQ.

12. Were Recommended Standards for Water Works, Suggested Practice for Water Works, AWWA guidelines, and the requirements of Act 399 and its administrative rules followed?
☒YES ☐NO

If no, explain which deviations were made and why.

13. Are all coatings, chemical additives and construction materials ANSI/NSF or other adequate 3rd party approved?
☒YES ☐NO

If no, describe what coatings, additives or materials did not meet the applicable standard and why.

14. Are all water system facilities being installed in the public right-of-way or a dedicated utility easement? (For projects not located in the public right-of-way, utility easements must be shown on the plans.)
☐YES ☒NO

If no, explain how access will be obtained. Most work will be on City owned property, except forcemain.

15. Is the project construction activity within a wetland (as defined by Section 324.30301(d)) of Part 303, 1994 PA 451?
☐YES ☒NO

If yes, a wetland permit must be obtained.

16. Is the project construction activity within a 100-year floodplain (as defined by R 323.1311(e)) of Part 31, 1994 PA 451, administrative rules?
☐YES ☒NO

If yes, a flood plain permit must be obtained.

17. Is the project construction activity within 500 feet of a lake, reservoir, or stream?
☒YES ☐NO

If yes, a Soil and Erosion Control Permit must be obtained or indicate if the owner listed in box 2 of this application is an Authorized Public Agency (Section 10 of Part 91, 1994 PA 451) ☐ Owner is APA.

18. Will the proposed construction activity be part of a project involving the disturbance of five (5) or more acres of land?
☐YES ☒NO
If yes, is this activity regulated by the National Pollutant Discharge Elimination System storm water regulations?
☐YES: NPDES Authorization to discharge storm water from construction activities must be obtained.

☐NO: Describe why activity is not regulated:
Please call 517-241-8993 with questions regarding the applicability of the storm water regulations.

19. Is the project in or adjacent to a site of suspected or known soil or groundwater contamination?
☐YES ☒NO

If yes, attach a copy of a plan acceptable to the DEQ for handling contaminated soils and/or groundwater disturbed during construction. Contact the local DEQ district office for listings of Michigan sites of environmental contamination.

20. IF YOU ARE A CUSTOMER/WHOLESALE/BULK PURCHASER, COMPLETE THE FOLLOWING

1) Name and WSSN of source water supply system (seller) _____

2) Does the water service contract require water producer/seller to review and approve customer/wholesale/bulk purchaser water system construction plans?
☐YES ☐NO

If yes to #2, the producer/seller approval letter must be attached when submitted to DEQ.

21. **Owner's Certification** The owner of the proposed facilities or the owner's authorized representative shall complete the owner's certification. It is anticipated that the owner will either be a governmental agency (city, village, township, county, etc.) or a private owner (individual, company, association, etc.) of a Type I public water supply.

OWNER'S CERTIFICATION

I, BRENT F. WRIGHT (print) (name), acting as the WATER PLANT SUPERVISOR (print) (title/position) for

CITY OF FLINT (print) (entity owning proposed facilities) certify that this project has been reviewed and approved as detailed by the Plans and Specifications submitted under this application, and is in compliance with the requirements of 1976 PA 399, as amended, and its administrative rules.

Signature* 3-31-2014 Date (810)787-6537 Phone

*Original signature only, no photocopies will be accepted.

PROJECT BASIS OF DESIGN – FOR WATER MAIN PROJECTS

PROJECT NAME: _____

For this PROJECT the following information must be provided per Act 399 unless waived by the Department. For projects other than water main installation, or if additional space is needed, attach separate sheet(s) with detailed Basis of Design calculations.

A. A general map of the initial and ultimate service areas
☐Included on engineering plans ☐Attached separately

B. Number of service connections served by this permit application _____

C. Total number of service connections ultimately served by entire project _____

D. Residential Equivalent Units (REUs) served by this permit application _____

E. Total Residential Equivalent Units (REUs) ultimately served by entire project _____

F. Water flow rates for proposed project based on REUs listed in "D' and "E" above

1. Initial design average day flow (mgd) _____
2. Initial design maximum day flow (mgd) _____
3. Total design average day flow (mgd) _____
4. Total design maximum day flow (mgd) _____
5. Required fire flows: (1) _____ gpm for _____ hours

G. Actual flows and pressures of existing system at the connection point(s) (2)
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi
_____ gpm at _____ psi

H. Estimated minimum flows and pressures within the proposed water main system (3) _____ gpm at _____ psi

(1) Every water system must decide what levels of fire fighting flows they wish to provide. Fire flow should be appropriate for the area (residential, commercial, industrial) being served by the project. Typical fire flow rates can be obtained from the water supply, local fire dept., ISO or AWWA. The water system must then be designed to be able to provide the required fire flows while maintaining at least 20 psi in all portions of the distribution system.

(2) Flows and pressures at the connection points must be given to determine if the existing water main(s) are able to deliver water to the new service area. These numbers can be obtained from a properly modeled and calibrated distribution system hydraulic analysis or hydrant flow tests performed in the field. If more than one connection is proposed, list as needed.

(3) List what the estimated minimum flows can be expected in the proposed water mains based on estimated water demands, head losses, elevation changes and other factors that may affect flows, such as dead end mains.

Flint WTP Improvements
Bray Road Lime Sludge Lagoon
MDEQ Comments
March 21, 2014

1. The placement of the proposed liner and berm fails to establish physical separation between the lime sludge collection area and concrete fill area. For complete separation of these areas, the berm needs to be constructed down to native soil.

   As proposed, this appears to constitute the first step towards a "cap-in-place" of the existing materials. If waste is left in place within the berm, the city will be required to construct the berm to meet Part 115 cap requirements. In addition, long term groundwater monitoring, financial assurance, closure and post closure plans will be required.

2. Please provide a residuals management plan for the lime sludge collection area. In additional to removal of new lime sludge produced, the plan must also include the gradual removal of existing lime sludge.

3. The working depth of the lime sludge collection area does not appear to meet 10-States Standard's minimum depth of 5 feet. The available volume appears to be 60,000 cubic yards based on 2.6 feet of working depth. Please confirm this. What is the surface area of the lagoon? Please provide a basis of design that includes the amount of lime sludge produced at average day demand and the available days of storage at this production rate. These parameters will need to be used towards developing the residuals management plan. Finally, an acceptable residuals management plan is needed for us to consider a deviation from the 10-State Standards guidelines.

4. An effluent sampling point needs to be provided for decant water.

Flint WTP Improvements – Phase II, Segments I, II, and III
Responses to MDEQ Review Comments dated 4-3-2014

The MDEQ review comments dated 4-3-14 have been addressed as noted in the responses below. Revised drawings have also been prepared in conjunction with these responses and have been included in the attached revised drawing sets for Phase II, Segments I, II, and III.

Phase II – Segment 1 - Watermain Cut-in Plans

- **Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.**

  Response: The anti-siphon/ball valve is shown on revised Sheet C-104, dated 4-7-14.

- **Include a full-sized mid-point chlorination system schematic with the updated plans.**

  Response: The mid-point chlorination system schematic has been included in the Phase II, Segment I – Initial Watermain Cut-in drawings as Sheet C-509, dated 4-7-14.

- **It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.**

  Response: The above description of the midpoint chlorination system is essentially correct. As shown on Sheet C-509, the mid-point chlorination system is a vacuum system. The vacuum regulators are mounted directly to the chlorine storage cylinders. Vacuum lines run from the regulators to the chlorinator control panels where feed rate is controlled. Vacuum lines are then connected from the control panel to ejectors, where water supply flowing through the ejectors creates the vacuum required to pull gas from the storage tanks. While the ejectors are not located in the control panel, it is common to have the ejectors remotely mounted from the control panels. A review of the 10 State Standards requirement for Schedule 80 seamless steel tubing appears to be for pressure gas feed systems, and not vacuum gas feed systems as proposed for Flint. As such, the recommended vacuum line material for a 500

ppd system is 5/8" O.D. flexible polyethylene plastic tubing (see attached information from Hydro Instruments).

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- **LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.**

  Response: Revised drawings D2-101, D2-102, D2-301, D2-502, and D2-601 have been included in the updated plan set.

- **The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days storage is maintained in the LOX tank at all times.**

  Response: The City will provide MDEQ a copy of the contract between the City and their LOX supplier under separate cover. LOX can be supplied within 24 hours of when a purchase order is issued.

- **Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.**

  Response: Sheets C5-105, C5-508, and EP6-101, which are all specific to the chlorine scrubber work only, have been deleted in their entirety from the updated plan set.

- **Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.**

  Response: This intake duct detail is no longer applicable as it is for the chlorine scrubber system, which has been deleted. As noted in the previous MDEQ review comment responses, the City will extend the existing ventilation intake ductwork in the existing Chlorine Storage Room to finished floor level. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 7 of revised drawing Sheet C-103.

- **Add panic hardware to chlorinator room door (east and west exits).**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see Note 8 of revised drawing Sheet C-103.

- **The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.**

  Response: The City will perform this work. This work has been added to the Phase II, Segment I – Initial Watermain Cut-in plan set, see notes on revised drawing Sheet C-103.

- **Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.**

  Response: The Contractor is required to field verify the elevation of the existing 54" pipeline. The City or the City's representative onsite observing construction will coordinate with the Contractor to ensure that the clearance between the 42" and 54" pipelines is increased to the maximum extent practical.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Response: 2 full sized sets of construction plans of proposed work at the Bray Road Sludge Lagoon are included for your review and file. The separation barrier between the concrete disposal area and the lime sludge disposal area will be accomplished by

establishing a clay barrier that extends to the bottom of the original lagoon bottom as shown in the detail on sheet C-501. The separation barrier will be constructed within the lime sludge lagoon away from the concrete disposal area as to provide complete separation as discussed.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

Response: A final version of the Bray Road Lime Sludge Management Plan is being included with this final submittal. A level working surface of 738.5' has been designated within the sludge lagoon after the pump station is operational. All debris or vegetation growth within the 742' elevation within the sludge lagoon is intended to be removed and cleared by the contractor.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Response: Sheet piling is no longer being used as the separation barrier based on further discussion with the contractor and availability. A clay berm will be constructed for the full depth within the lime sludge lagoon using the original bottom of the sludge lagoon as a base using the proposed alignment proposed for the sheet piling.

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

Response: See attached revised Part 6 of the Act 399 Permit Application forms.

Lockwood, Andrews & Newnam, Inc.

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PROGRAM MANAGEMENT

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To: Mr. Steve Busch, PE	**Date** 4-8-14
Company: MDEQ	**Project Number** 130-10701-001
Address: 525 WEST ALLEGAN STREET Lansing, MI 48933	**Routing:**
Project: City of Flint Water Treatment Plant Improvements.	

We Are Sending You:		These Are Transmitted:	
☐ Shop Drawings	☐ Reports	☐ As Requested	
☐ Original Drawings	☐ Submittal Data	☒ For Your Use	
☒ Prints	☐ Proposal	☒ For Review and Comment	
☐ Specifications	☐ As Noted	☐ For Your Signature	

Quantity	Description
2	22x34 Plans - Phase II, Segment 1 – Rehabilitation
2	22x34 Plans - Phase II, Segment 1 – Initial Watermain Cut-In
2	22x34 Plans - Phase II, Segment II – Lime Residual Disposal
2	Final Bray Road Lime sludge management Plan
1	Updated page 2 for permit applications
1	LAN Team Response to MDEQ Review comments

Remarks

These plans are being submitted for permit issuance as discussed.

DEQ
RESOURCE MANAGEMENT DIVISION
APR 08 2014
LANSING DISTRICT

Distribution	Prepared By
1- Daugherty Johnson 2- Brent Wright 3- File	Samir Matta, PE

1311 SOUTH LINDEN ROAD
SUITE B
FLINT, MI 48532
TEL 810.820.2682
FAX 810.820.2703
www.lan-inc.com

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
April 3, 2014

Phase II – Segment 1 - Watermain Cut-in Plans

- Mid-Pt Chlorination - update plans to depict the additional anti-siphon/ball valve as described in your response to our March 19, 2014 comments. Most likely to be added to Sheet C-508.

- Include a full-sized mid-point chlorination system schematic with the updated plans.

- It appears that make-up water and chlorine gas are not combined at the chlorine feeder (panel w. rotometer, vacc. monitor, auto. feed control valve, etc.) for production of liquid chlorine. Instead, this appears to take place at the ejector/check valve assembly on the plant supply line. Please confirm. If gas under vacuum is conveyed to the ejector at the plant supply line, the gas piping must be Schedule 80 seamless steel tubing. Please confirm. This can be included on the chlorination system schematic.

Please provide 2 full-sized sets of Watermain Cut-in Plans that include the requested information and revisions.

Phase II - Segment 1 - WTP Rehabilitation Plans

- LOX/LN Storage & Piping – update plans to depict revised sheets D2-102 and D2-601. The revisions were made to clarify the gas piping configuration.

- The existing LOX storage tank will provide approximately 16 days storage at max design rate at 12.0 MGD until the second tank is installed. The Act 399 permit will be issued with a condition that the MDEQ is provided a copy of the contract between the city and the LOX supplier that specifies the maximum delivery time. The LOX system shall be operated such that a minimum of 5 days

Act 399 Permit Applications:

WTP Rehabilitation:

Part 6 (Facilities Description) needs to discuss the provisions for the stand-by generator. The description needs to be added in the Phase II – Segment III – Electrical Improvements (@WTP) – (i.e. transfer switch, universal generator connection)

Bray Road (Flint WTP Phase II, Segment II – Lime Residual Disposal)

Please revise Part 6 (Facilities Description) since a berm-liner system will not be used to separate the lime sludge area from the concrete debris area. Eliminate "Berm/liner" from the statement: "Berm/liner or Sheet Piling improvements to separate concrete debris from lime sludge."

storage is maintained in the LOX tank at all times.

- Mid – Point Chlorination (Chlorine room) - revise sheets C5-105 and C5-508 to show deletion of the chlorine gas scrubber system.

- Revise the ventilation intake duct detail (Sheet C5-508) to as described in your response.

- Add panic hardware to chlorinator room door (east and west exits).

- The existing door between P.S. 4 and the chlorine gas storage room should be closed off such that the chlorine gas storage room and chlorinator room are only assessable from the outside. Although an improved door sweep is proposed, door sweeps are not failsafe in a catastrophic gas release and such an event could jeopardize the entire P.S. #4.

- Raw Water Piping – the proposed 54X42 cross provides minimal vertical separation (approximately 6-inches). A pair concrete cradles installed on each side of the 54-inch concrete main will mitigate the force of the 42-inch main installed above at the crossing. A condition will be added to the Act 399 permit to field adjust the 42-inch main installation to maximize the vertical separation at the crossing.

Please provide 2 full-sized sets of WTP Rehabilitation Plans that include the requested information and revisions.

Phase II – Segment 2 - Bray Road Sludge Lagoon

Provide 2 full-sized sets of construction plans for proposed work at the Bray Road sludge lagoon. Separation between the concrete disposal area the lime sludge disposal area by metal sheet piling, as discussed in our meeting, needs to be depicted.

Prepare final Bray Road Lime Sludge Management Plan. The plan also needs to include establishment of a level working surface in the west portion of the lagoon and removal of the island.

The Act 399 permit will also include a condition requiring the sheet piling to be driven deep enough into native soil to maintain its structural integrity for removal of waste material on the exterior portion of the lagoon.

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
March 19 , 2014

Segment 1 - Cut –in Piping

The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?

Written response needed.....

Segment 1 – WTP Rehab

1. Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102

   54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?

   Air-release manhole – same as Cut-in piping

   Current yard piping diagram?

Written response needed on the first 3 items. Yard piping diagram will be a work in progress.

2. Mid-Point CL2 - Basis of design provided

   - Scale – use existing or proposed? If poposed - type, capacity
   - Scrubber?
   - Room air-exchange rate ?
   - Pipe penetrations – discuss protective seal
   - Floor drains – discuss
   - Door sweep - discuss
   - Scrubber piping – lower intake

810 516 6793

- Check valve/anti-siphon at influent channel - include in final

3. High Service Pump

   Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

   TDH of current pump and proposed pump?
   Conformance of proposed pump TDH with system head curve?

   Written response needed.....

4. LOX/LN Storage

   Piping configuration clarified
   The LN calculation (71 ppd) is not clear. Is there a % concentration or transfer efficiency?

5. Electrical improvements

   Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

   Written response needed.....

Flint WTP Improvements
Phase II
Segments I-III
MDEQ Comments
February 27, 2014

Segment 1 - Cut –in Piping

✓ **The detail shows air-release manholes with corp. stops? How will the air release operation be executed? Means to drain the manhole?**
↳ (Pump em down)

Segment 1 – WTP Rehab

✓ 1. **Raw Water Piping – Maintain back-up supply from Gen Co. during interim operation at C.S. #2. Sheet C5-102**

✓ **54X42 cross (Sheet C5-501 & C5-101) only 6-inches – Support?**

✓ **Air-release manhole – same as Cut-in piping**
↳ Same design

Current yard piping diagram? — Same op. concept

2. **Mid-Point CL2 - Basis of design needed**

- **Application rate (both mid-pt & post for CT)**
- **CL2 gas max dosage LBs/Day**
- **Scale – type, capacity** ✓ 4 new Scaletron Ind.
- **Rotometer (lbs/day)**
- **Vacc reg, injector, educator (size)**
- **Scrubber capacity** – not being installed
- **Room air-exchange rate** 1/3.3 MIN
- **Pipe penetrations – Sheet C-103 – linkseal – gas resistant?** – will inspect & seal
- **Floor drains** – to be plugged
- **Door sweep** – new better sealing sweeps to be provided
- **Safety features – obs window, fan, lights, switches, panic bar**
- **Scrubber piping – lower intake** → will extend to floor w. 90° bend
- **Check valve/anti-siphon at influent channel** – yes

hydraulic "check" will close on system failure/shut-down

3. High Service Pump

Will mechanical ball valve operate like a check valve in event of unexpected pump shut-down?

,185 → will match w. smaller pump

TDH of current pump and proposed pump?

Conformance of proposed pump TDH with system head curve?

4. LOX/LN Storage

LOX & LN piping clarification – Sheet D2-102 & D2-601

BOD for storage

Ozone was designed at 4.0 mg/l max dose @ 36 MGD (Sec. 3.5 WTP BOD)

Ozone max dose at 18.0 MGD is 650 Lbs/day

How many GPD does this equate to?

5. Electrical improvements

Are operation of the pumps being split with the MCC or are multiple MCCs being provided?

ONE switchgear – dual feed

Two breaker – kirk key

Flint WTP Improvements – Phase II, Segments I, II and III

Responses to MDEQ Review Comments dated 3/19/2014

Segment I – Initial Watermain Cut-in

1. Detail 2, Sheet C-504, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.

Segment 1 – Rehabilitation

1. Raw Water Piping
   a. Maintain back up supply from Genesee County during interim operation at C.S. #2. Installation of the 42" raw water piping has been delayed until the KWA project is closer to being ready to supply water to the City. This will allow the City to maintain the backup supply from Genesee County during interim operation.
   b. The crossing of the new 42" steel pipe over the existing 54" concrete pipe is shown in plan on drawing sheet C5-101, with Detail 5, Sheet C5-501 showing how the 42-inch line will be supported. As shown on Detail 5, Sheet C5-501, the new 42-inch line will have concrete pipe cradles constructed on either side of the existing 54" pipe, maintaining a minimum clearance of 12" on either side of the 54" pipe. Pipe loads from the 42" line will then be transferred to the pipe cradles and into the soil, and not the 54" pipe. The 6" clearance between the two pipes will be backfilled with CLSM material as it will be impossible to compact typical granular bedding material under the 42" pipe.
   c. Detail 2, Sheet C5-505, "Air Release & Access Manhole," shows a 2" corp stop for air release. These are intended to be manual air release valves for exhausting air upon initial filling of the pipeline or after maintenance has been performed and refilling the pipeline. The manhole structure will be checked periodically and pumped out with a portable sump pump as part of the normal plant maintenance program.
   d. See attached color coded yard piping diagram.

2. Midpoint Chlorination
   a. Four (4) new scales will be provided for monitoring chlorine usage from ton containers. Scales shall be as manufactured by Scaletron Industries Ltd. with a load range of 0 to 4000 lbs.
   b. The City has not been able to determine that the chlorine scrubber is a requirement of any applicable code. At this time, the City will not be installing the chlorine scrubber shown on the design drawings and will rely on the existing ventilation system to exhaust air from the Chlorine Storage Room.
   c. The existing ventilation in the Chlorine Storage Room was tested to have a capacity of 18.3 air changes per hour, or 0.305 air changes per minute. Therefore, one room volume air

change would take approximately 3.3 minutes with the current ventilation system. See attached test results. Due to the size of the existing Chlorine Storage Room, a ventilation system of 1 air change per minute is not practical. While the existing ventilation system capacity is less than 1 air change per minute, it appears to be in compliance with 10 State Standards as lesser rates may be considered in cases where 1 air change per minute is not appropriate due to the size of the room.

d. WTP staff will identify and inspect all proposed and existing piping and conduit wall penetrations in the Chlorine Storage Room and seal as necessary to prevent gas leakage into other parts of Pump Station No. 4.
e. Existing floor drains in the Chlorine Storage Room were for condensate from the old chlorine evaporator system. These drains will no longer be used and will be plugged by WTP staff.
f. WTP staff will attach new door sweeps with better seals at existing doors as required.
g. WTP staff will extend existing ventilation intake ductwork to finished floor level with 90-degree bends.
h. Per Addendum No. 1, an Anti-siphon / Back Pressure Valve and additional ball valve shall be added just prior to the trough wall penetration. The anti-siphon / back pressure valve shall be PVC and designed for use with chlorine systems. The valve shall be a LMI #35856, Walchem E90422, or engineer approved equivalent. The valve shall be installed between the two ball valves to allow for isolation during servicing. The valve shall be located above the high water level in the trough. The Contractor shall install a 1" drain line from the relief port to the finished floor elevation of the pipe gallery.

3. High Service Pump
   a. The new 16" pump control ball valve for HSP #1 replaces the existing pump control ball valve in kind and will operate in the same manner as the existing valve. The valve will act like a check valve upon emergency shutdown of the pump through the use of a hydraulic cylinder actuator that will automatically close the valve. The cylinder actuator uses hydraulic water system pressure to supply the energy required to close the valve.
   b. The existing HSP #1 is rated for 25 MGD at 185' TDH. The proposed replacement HSP #1 is rated for 15 MGD at 185' TDH, matching the head condition of the existing pump.
   c. Results from the City's hydraulic model were used to develop system curves for max day and average day, which were used to confirm pump selection. The proposed HSP #1 will operate on a VFD which can be adjusted during operation to meet various duty points depending on demand.

4. LOX/LIN Storage
   a. Nitrogen usage is calculated based on 2.5 % of the oxygen usage:

      2,833 ppd O_2 x 0.025 = 71 ppd N_2

5. Electrical Improvements
   a. The operation of the pumps is contained within a single switchgear at Pump Station No. 4. However, there will be a dual feed coming into the main plant switchgear that will supply redundant power to the plant, including Pump Station No. 4.. There will also be two breakers

at the main plant switchgear that feed two different breakers at Pump Station No. 4. Therefore, any one point of failure will not take the system down.

TO OWMA

Proposed Bray Road Lime Sludge Management Plan

1. Introduction

The City of Flint plans to utilize their existing WTP to provide water on a continuous basis. The city plans to treat water from the Flint River until construction of the proposed KWA supply system is complete and the WTP can then be used to treat water from Lake Huron. Until then, The City of Flint will be utilizing the Bray Road Disposal site to pump lime sludge for interim storage with decant water being pumped into the City of Flint sanitary sewer system. The Flint River and consequently the Bray Road facility will be utilized during the KWA Supply System era for emergencies or to supplement water supply demands beyond current max day provided by KWA.

2. Proposed Lime Sludge Management Plan

LAN has been working with the City to evaluate, design and implement a lime residuals disposal plan to handle softening sludge for the interim period and long term operation of using the Flint River as a water source. The most feasible option is the use of Bray Road lagoon which was constructed in 1958. The site has been used intermittently since then during select test runs by the City. However, a concern by the MDEQ about unauthorized discharges into the neighboring stream and disposal of street sweeping, concrete and asphalt chunks has made this site off limits for the time being. Our team is working with City staff to develop a preliminary work plan and schedule that will address the concerns of the MDEQ and allow the use of the site for continued discharges of lime sludge in the interim basis and in the long run when emergencies and supplemental water supply require the use of lime softening at the water treatment plant.

EXISTING SYSTEM

The most common sludge dewatering method is use of lagoons to settle the lime sludge and decant the water. The lime sludge from the water treatment clarifiers is transferred by pipe to a dewatering lagoon, e.g. at the Bray road site. The pipe network for the discharge line into the Bray Road site consists of an 8 " pipe with multiple discharge feeders with valves that distributes the flow of the lime sludge into the dewatering lagoon. This facility has one large dewatering lagoon and one small lagoon for decant water. The two are separated by a dike and a concrete structure with an adjustable stop log system that controls the flows between the two lagoons. The large dewatering lagoon is capable of decanting the water on top of the sludge (supernatant) to the adjacent small lagoon for discharge to the nearby Cornwell Drain via an outlet tower. See Figure 1 - Existing Site Layout. Figure 2 – Decant Lagoon Blow Up.

The site was constructed in the late 1950s and was used on a permanent basis until the City entered into a contract to obtain treated water from the City of Detroit, at which time; the site was used occasionally for test runs as a redundant system. During this period, the City of Flint did not control fully site activities and some unauthorized discharges of illegal debris got placed within the site that has compromised the use of the site. As a result, The MDEQ has, on multiple occasions, requested that the City secure the site and insures that these activities are suspended while addressing the illegal disposal of street sweeping, concrete and asphalt debris within the site. See Figure 3.

PROPOSED SYSTEM

The proposed upgrades associated with the Softening Residuals Disposal have been categorized into Phase II – Segment II and are to be completed as soon as practical so that the WTP can be utilized to treat water from the Flint River in the spring of 2014. However, the use of the Bray Road lagoon for other disposal activities will require that this issue be addressed independently to certain extent as to isolate the problem areas while working with MDEQ to permit its use for lime sludge disposal.

In order to analyze the issues, define the possibility of using the site and address MDEQ concerns, the LAN Team has performed additional survey, geotechnical and environmental testing at the site in order to assess the condition of the lime sludge in the basin and to verify the capacity of the lagoon system. Based on the preliminary findings of this evaluation, proposed improvements will be designed to accommodate the use of the facility in the interim basis (during the use of the Flint river) while addressing some of the MDEQ concerns about the site and any unauthorized discharges into the nearby stream. Permitting for site use will be incorporated as part of the overall design improvements at the WTP and submitted to the MDEQ for their pre-permit review and comments. A final package will be submitted to the MDEQ at the 100% design stage for permit issuance and approval of work plan.

The intended Work plan encompasses the following action items:

1. Evaluate the existing conditions in comparison to the original site design and its intended functionality in order to evaluate required design changes. Figures 1 & 2 highlight the original design and select key elements while Figure 3 shows the changes that may affect proper operation of the system.
2. Site survey of the project site has been completed. Collected data confirms the plan that the site has the required capacity to handle the continuous full time operation of the plant during the next 30 to 36 months until the KWA system is constructed and connection is made at which time, lime softening will not be required. Figure 4 highlights the current

site features and proposed elevation for the required volume and anticipated 2 feet free board.

3. In order to address MDEQ concerns about discharges to the Cornwell Drain, the outlet tower will be capped to terminate any discharges to the stream while lime softening is in use at the WTP.
4. A separation barrier will be constructed to isolate the disposal area from the lime sludge discharge bay as shown in Figure 4.
5. A decant structure and submersible pump station will be constructed in the SE corner of the upper lagoon bay to treat and dispose of flows into the City's sanitary system. This system will be fully operational while the plant is treating river water and lime softening is required. A new storm treatment outlet structure may be reestablished with the approval of MDEQ after the KWA connection is online and lime softening is no longer in use.
6. In order to assess the potential impact of the disposal site on the ground water, two new monitoring wells were installed along the west side of the site in order to analyze the characteristics of the flow entering the site while using the existing monitoring wells to check whether these characteristics have worsened or not. Based on the results of the well data collected, it does not seem that the debris area is a cause for contamination to the site; However, The City will have to develop a more definitive environmental work plan to further evaluate and insure that the debris will not cause any detrimental effect on the groundwater system.

PROPOSED MANAGEMENT PLAN

Drying and selling lime sludge for agricultural lime is a desirable solution to the disposal problem, since the money made by the sale offsets the disposal cost paid by the water treatment plant: if the lime sludge were not sold as a product, no value for the material could be recovered. However, The City of Flint has not had the time to research this option and find a suitable consumer(s) for such a transaction. But this option will be pursued and the plan will be modified for approval by the MDEQ when such option becomes viable.

Lime sludge could be disposed of in municipal solid waste (MSW) landfills. However, it is Safe to assume that MSW landfills would prefer stockpiled lime sludge to be somewhat dry, because landfills need to minimize the amount of leachate they generate. Furthermore, if lime sludge were sent to a MSW landfill, the producer of the sludge may have to pay for the costs of drying, loading, and transporting the sludge, plus tipping fees.

Since the sludge may need to be retained in the lagoon for an average 10 -12 months before it is excavated from the dewatering lagoon with a backhoe and isolated to be dried in the sun during the summer in a month or two depending on air temperature, sun exposure, and humidity. Therefore The City of Flint is proposing the following approach to their lime sludge management plan:

1. The City is committed to removing all new lime sludge to be generated during the operation of the plant using Flint River water in addition to 10% of the lime sludge already in place at the site.
2. The equivalent of 10% of existing lime sludge and all future accumulations will be disposed of site either at the landfill or using approved land application sites.
3. Existing lime sludge on site will be manipulated and stored in two semi isolated bays along the north side of the lagoon in order to allow the City to start removing it from site for disposal at the landfill until land application sites are determined and approved by MDEQ.
4. The four available orifices, on site, will be utilized to discharge lime sludge into the lagoon system based on a quarterly or semi-annual rotating schedule as to allow for proper distribution of the lime sludge within the lagoon.
5. No flows will be permitted into the decant lagoon until the pump station is fully operational. However, the plan is to maintain the level working surface within the sludge lagoon at 738.5' while the pump station and decant system is operational.

3. Implementation Schedule

The majority of the work associated with the operation of the WTP will need to be accomplished and completed by April 15, 2014 so the plant can be operational by April 17, 2014. All work associated with the Bray road site may not be complete but the following activities will be completed in order to allow for the successful operation of the Plant with MDEQ approval. The activities to be completed immediately are as follows:

1. Suitable Barrier of clay berm will be constructed to isolate the disposal area from the dewatering lagoon and will be completed as agreed to with MDEQ.
2. Outlet Tower will be bulk headed out of the decant lagoon as to insure no outflow to the stream nearby (Cornwell Drain).
3. New orifice will be installed near the SE corner of the site to replace the two damaged that will be abandoned.
4. Stop logs will be in place to isolate the dewatering lagoon from the decant lagoon until the pump station is operational.
5. Existing lime sludge will be manipulated along the edges as to excavate and store dry lime sludge in the upper two semi isolated bays for regular removal and disposal at the landfill until land application options are available for permitted use.

The City is committed to provide the appropriate improvements for the proper use of the site as a lime sludge disposal facility while addressing the issues associated with the unauthorized disposal areas so the site can be closed suitably and allow it to function as initially intended.

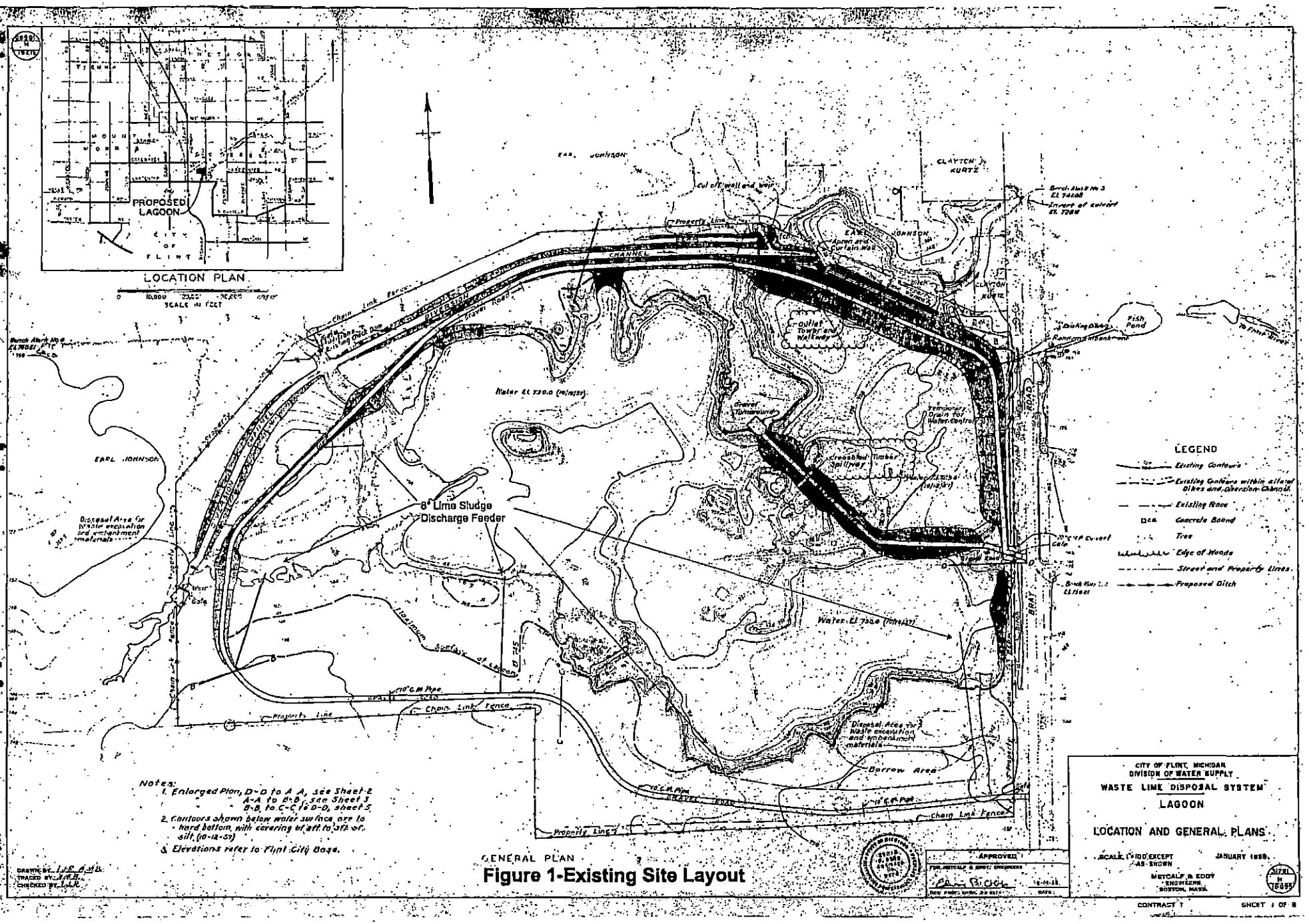


Figure 1-Existing Site Layout

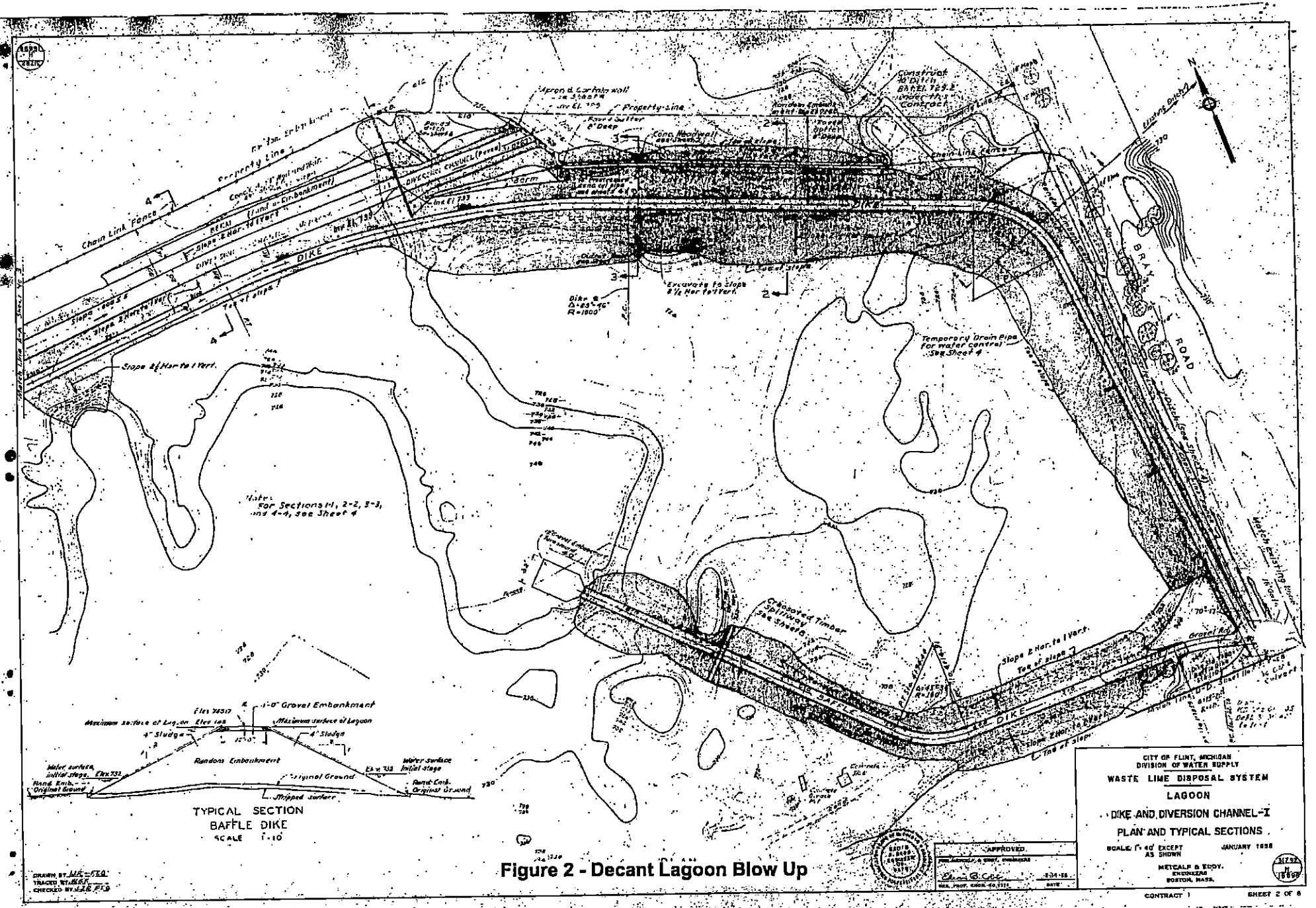


Figure 2 - Decant Lagoon Blow Up

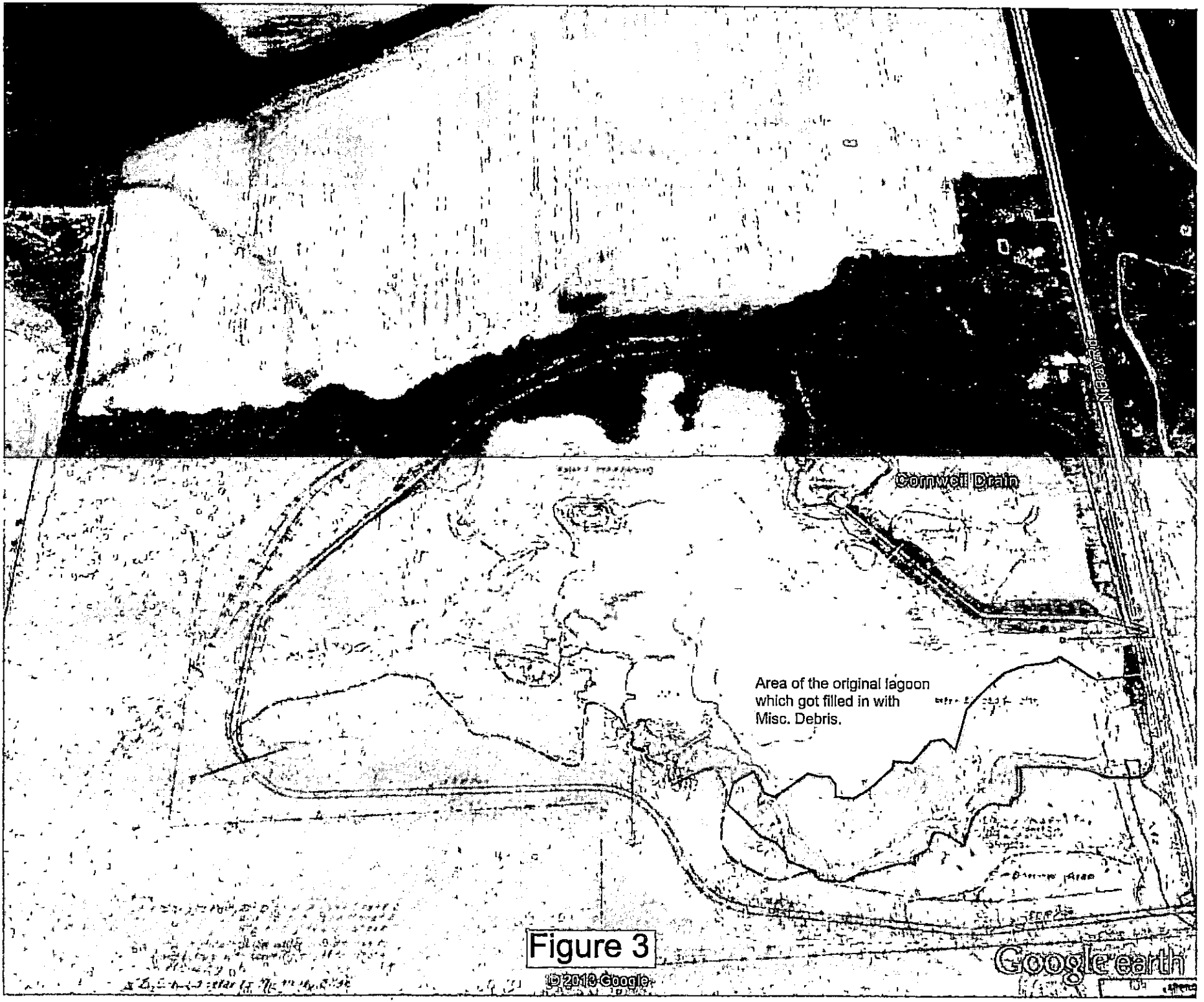

Cornwell Drain
Area of the original lagoon which got filled in with Misc. Debris.
© 2018 Google
Google earth

Figure 3

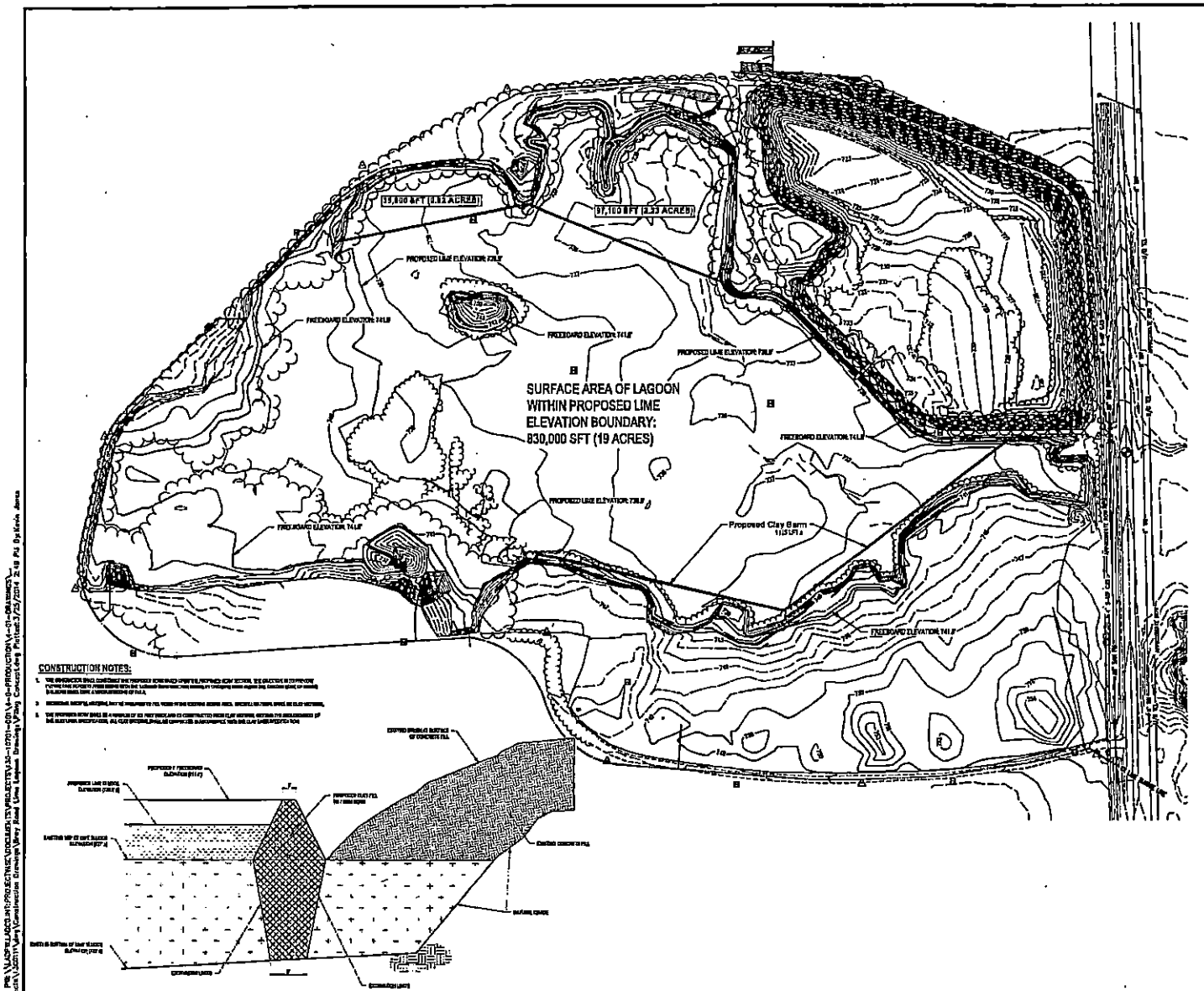


Figure 4

Flint WTP
Phase II, Segment II
Lime Residual Disposal
Flint MI, 48503

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
1311 South Linden Road, Suite B
Flint, MI 48532
Tel 810-820-2842 Fax 810-820-2701

ROWE PROFESSIONAL SERVICES COMPANY

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

Project No. 130-10701-001
Date: February 28, 2014

Prysby, Mike (DEQ)

From:	Matta, Samir <SFMatta@lan-inc.com>
Sent:	Wednesday, March 26, 2014 2:22 PM
To:	Prysby, Mike (DEQ); Busch, Stephen (DEQ); Arduin, Jim (DEQ)
Cc:	Daugherty Johnson; Brent Wright (bwright@cityofflint.com)
Subject:	Bray Road Alternative Separation Concepts.
Attachments:	Piling Concept 3-24-14 (2).pdf - Adobe Acrobat.pdf; MC-3500 Chamber from ADS StormTech System.pdf

Hi All,

As requested, the following two concepts are being discussed with the City and ultimately with the contractor to see which one is more in line with the project budget and can be accomplished in a timely matter. The attached concept shows sheet piling being proposed which will be terminated at the designated height needed to achieve a 2' freeboard along the alignment highlighted in RED.

The other concept which we discussed on the phone will entail using a light weight storm chamber (see attachment) fastened to a 4x8 plywood sheeting, attached together, with a geotextile fabric along the back side to follow the same alignment as the sheet piling option. It will be placed directly on the existing lime sludge in front of the disposal area for separation.

Please review, let me know if you have any questions and we can further discuss on Monday.

Thanks.

Samir F. Matta, PE
Senior Project Manager

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
2121 University Park Dr, Suite 100 • Okemos, MI 48864-6901
T 517.203.5437 **D** 517.203.5437 **C** 517.819.2367
www.lan-inc.com • SFMatta@lan-inc.com

Flint WTP Improvements
Bray Road Lime Sludge Lagoon
MDEQ Comments
March 21, 2014

1. The placement of the proposed liner and berm fails to establish physical separation between the lime sludge collection area and concrete fill area. For complete separation of these areas, the berm needs to be constructed down to native soil.

   As proposed, this appears to constitute the first step towards a "cap-in-place" of the existing materials. If waste is left in place within the berm, the city will be required to construct the berm to meet Part 115 cap requirements. In addition, long term groundwater monitoring, financial assurance, closure and post closure plans will be required.

2. Please provide a residuals management plan for the lime sludge collection area. In additional to removal of new lime sludge produced, the plan must also include the gradual removal of existing lime sludge.

3. The working depth of the lime sludge collection area does not appear to meet 10-States Standard's minimum depth of 5 feet. The available volume appears to be 60,000 cubic yards based on 2.6 feet of working depth. Please confirm this. What is the surface area of the lagoon? Please provide a basis of design that includes the amount of lime sludge produced at average day demand and the available days of storage at this production rate. These parameters will need to be used towards developing the residuals management plan. Finally, an acceptable residuals management plan is needed for us to consider a deviation from the 10-State Standards guidelines.

4. An effluent sampling point needs to be provided for decant water.

Total Hardness 292 mg/l use 300 mg/l as $CaCO_3$ 9/13/13 LAN Report

Total ; 100 mg/l as $CaCO_3$

~~250~~ mg/l removed

10 stacks .7 Acres/1 MGAL/100 mg/l removed

Size;

.7A * 10 MGD * 200 mg/l removed / 100 = 14A

Based on 5 Ft depth.

we have 2.6 Ft depth — 19 A

SA = 830,000 Ft^2 = 19 A

Rem 150 mg/l

.7A * 10MGD * 150/100 =

LAN Report

@ 14MGD

@ 12% solids → 73,924 gpd
= 366 yd^3/DAY

@ 25% → 183 yd^3/DAY

25% @ 10 mgd → 131 yd^3/DAY
12 Mgd → 157 yd^3/DAY

60000 yd^3 / 131 yd^3/DAY = 458 DAYS @ 10MGD 1.25 yrs
382 DAY @ 12 Mgd 1 yr

3 Months = 50,000 yd^3 3%
@ 10 MGD wo. dilution

455 yd^3

@ 10 mgd 60000 yd^3 / 55 yd^3/DAY = 1091 DAYS
3.0 yrs

@ 12 Mgd 60,000 yd^3 / 66 yd^3/DAY = 909 DAYS
2.5 yrs

BASIS OF DESIGN
BRAY ROAD LIME SLUDGE DECANT WATER TREATMENT SYSTEM
CITY OF FLINT

1. GENERAL DATA

The City of Flint (City) proposes to use the existing lime sludge storage lagoon facility at Bray Road for the next 2.5 years on a continuous basis while the Karegnondi Water Authority (KWA) water system is being constructed. After which, the facility will only be used should the Flint WTP have to treat Flint River water on an emergency basis. In order to maximize storage volume of the facility, the City proposes to construct a decant tower structure, pump station and forcemain to transport the decanted water from the lagoon to a nearby sanitary sewer for final disposal. A CO_2 feed system is also proposed to neutralize the high pH decant waste stream prior to pumping to the sanitary sewer.

The existing lime sludge storage lagoon facility at Bray Road does not have multiple cells; therefore, the sludge will be continuously wetted and will only consolidate to approximately 25% solids. The lime sludge and decant waste stream flows are summarized in the table below:

Lime Sludge Quantities Summary

	WTP Flow [MGD]	Sludge Produced (3% Solids) [gpd]	Sludge Stored (25% Solids) [cy/day]	Decant Waste to Sewer [gpd]	Decant Waste to Sewer [gpm]
Average Day	10 (10 MGD)	92,000	55 (66 yd³/DAY)	80,700	56
Current Max Day	18	165,000	98	145,200	100
Prop. Max Day	24	220,000	131	193,600	135

2. CO_2 FEED SYSTEM

a. Process Description

A gaseous carbon dioxide feed system will be installed on the Bray Road site near the decant pump station. The system will include a liquid storage tank, vaporizer, vapor heater, pressure regulator, pH control panel and a gas diffuser. Liquid CO_2 will be stored in a 6-ton tank and regulated through a vaporizer. The gaseous CO_2 will be sent through diffuser piping and released into the decant tower through two (2) 7" diameter disk ceramic diffusers. A pH probe will be located in the decant tower to monitor pH downstream of the CO_2 injection point. The pH probe will transmit the pH reading to the pH control panel, which will regulate the CO_2 feed rate for set point control of the pH in the decant water waste stream.

b. Design Criteria

- Max CO_2 feed – 200 mg/L
- Max decant flow rate – 140 gpm

- CO_2 feed system capacity @ Max Day (140 gpm)

$$\frac{140 gpm}{694.4\frac{gpm}{MGD}} * 200 ppm\ CO_2 * \frac{8.34 lb}{gal} = 336\ lb/day$$

- CO_2 feed system capacity @ Average Day (60 gpm)

$$\frac{60 gpm}{694.4\frac{gpm}{MGD}} * 200 ppm\ CO_2 * \frac{8.34 lb}{gal} = 144\ lb/day$$

- CO_2 storage for minimum 30 days at Average Day per 10 States Standards

$$144\frac{lb}{day} * 30\ days = 4{,}320\ lbs = 2.16\ tons$$

c. Equipment

- One (1) 6 ton capacity Liquid Carbon Dioxide storage tank system complete with refrigeration unit (6 ton is minimum for CO_2 delivery by tanker truck)
- One (1) 12 kW electric vaporizer
- One (1) vapor heater
- One (1) First stage CO_2 pressure regulator
- One (1) Carbon Dioxide pH control panel
- One (1) Carbon Dioxide gas diffuser assembly
- One (1) pH Transducer
- Two (2) 7" Diameter Ceramic Disk-type diffusers

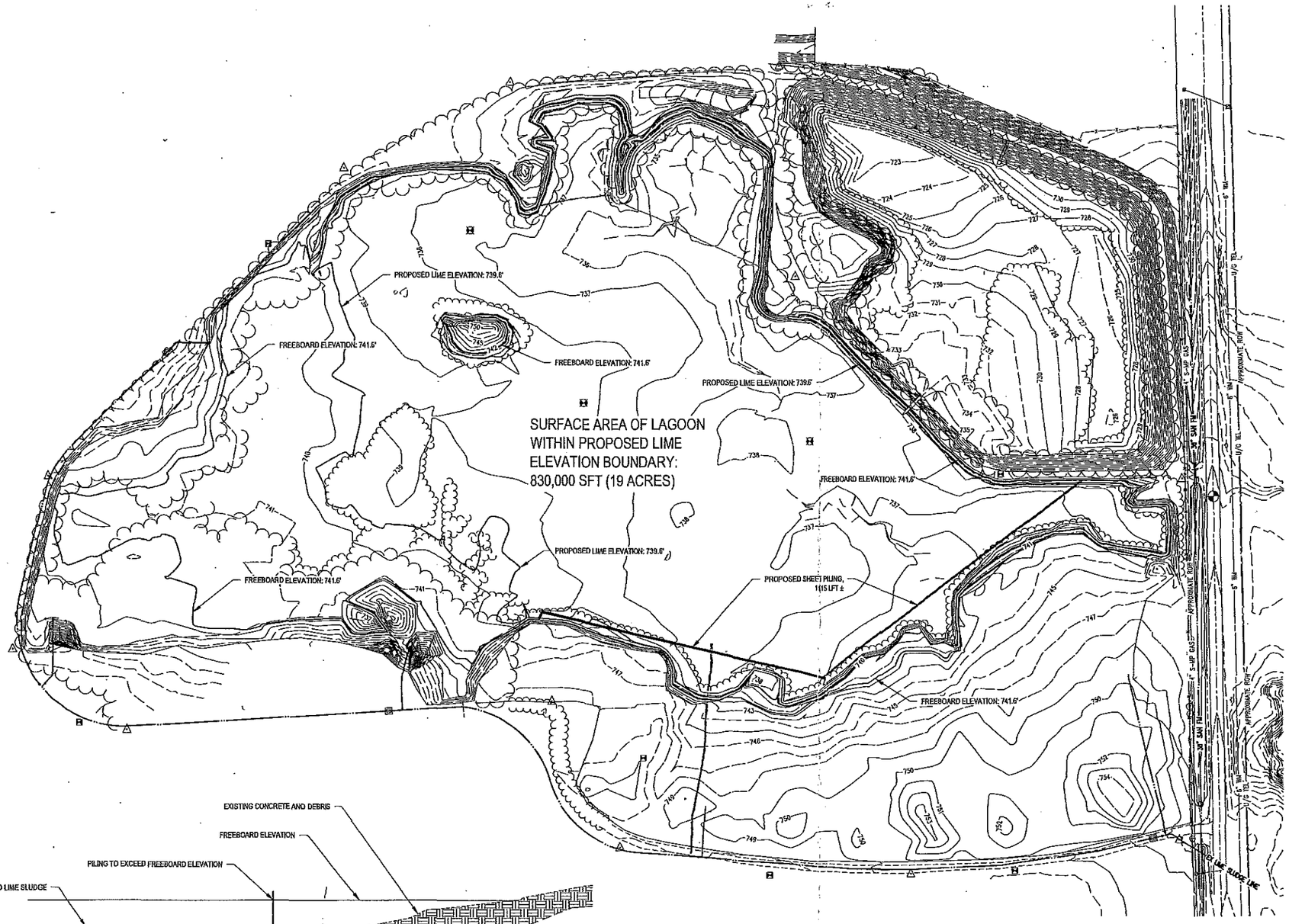
3. DECANT TOWER

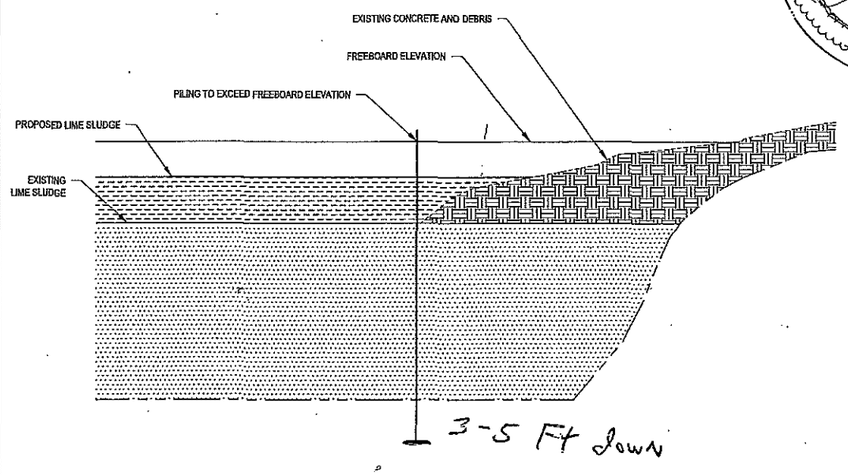
a. Process Description

The decant tower is a 6'x6' precast manhole with three (3) 12"W x 36"H staggered openings that will provide 9' of total operating depth for decanting. Each opening has an interior wall-mounted inverted slide gate with a manual operator and an external stoplog channel to allow maintenance on the slide gate when necessary. An under-flow baffle wall will be installed to promote CO_2 transfer into the decant waste stream and prevent short circuiting. A pH probe will be installed just below the invert of the 8" gravity pipe to the decant pump station.

b. Design Criteria

- Average day flow rate = 60 gpm
- Peak day flow rate = 140 gpm





Flint WTP
Phase II, Segment II
Lime Residual Disposal
Flint MI, 48505

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
PLANNING
ENGINEERING
PROGRAM MANAGEMENT
1311 South Linden Road, Suite B
Flint, MI 48532
Tel 810-820-2682 Fax 810-820-2703

ROWE PROFESSIONAL SERVICES COMPANY
The Rowe Building
540 S. Saginaw St., Ste. 200;
PO Box 3745
Flint, MI 48502
O: (810) 341-7500
F: (810) 341-7573
www.rowepsc.com

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

Manager	SFM
Design	SFM
Draw	XPJ
Check	DAS

STAMP

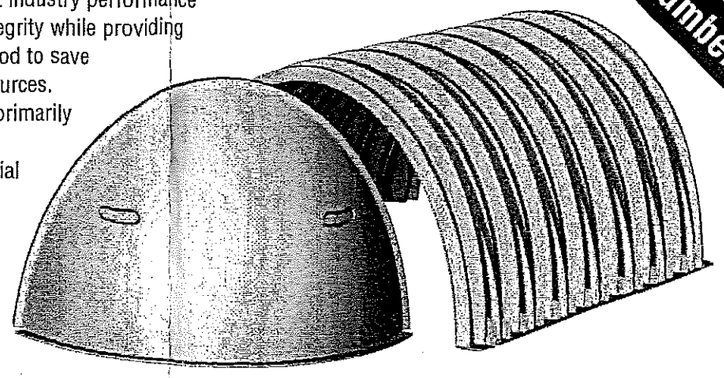
Project No. 130-10701-001
Date: February 28, 2014

ProjectWise: PW:\\LADPW.LAGOO.INT:PROJECTWISE\DOCUMENTS\PROJECTS\130-10701-001\4-D-PRODUCTION\4-01-DRAWINGS\
File:R:\Projects\JOB11\Dwg Construction Drawings\Gray Road Lime Lagoon Drawings\Piling Concept.dwg Plotted: 3/25/2014 2:49 PM By: Kevin Jones

StormTech MC-3500 Chamber

MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.



StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90" (2286 mm) x 77" (1956 mm) x 45" (1143 mm)
Chamber Storage	109.9 ft³ (3.11 m³)
Min. Installed Storage*	178.9 ft³ (5.06 m³)
Weight	134 lbs (60.8 kg)

* This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below chambers, 9" (229 mm) of stone between chambers/end caps and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

Size (L x W x H)	26.5" (673 mm) x 71" (1803 mm) x 45.1" (1145 mm)
End Cap Storage	15.6 ft³ (0.44 m³)
Min. Installed Storage*	46.9 ft³ (1.33 m³)
Weight	43 lbs (19.5 kg)

*This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below, 6" (152 mm) of stone perimeter, 9" (229 mm) of stone between chambers/end caps and 40% stone porosity.

Shipping

15 chambers/pallet

16 end caps/pallet

7 pallets/truck